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ENERGY & CLEAN GROWTH STRATEGY

Cheshire and Warrington Local Enterprise Partnership

DELIVERY PLAN

INTRODUCTION

The refreshed Strategic Economic Plan (SEP) sets out our ambition to drive the economy forward, capitalising on our unique strengths and opportunities. It is a strategy to support growth and economic development over the next 20 years, doubling the size of the economy and setting out the key economic, environmental and social strengths on which growth will be founded.

The SEP is a high-level, 'living document' that will be updated to reflect and respond to key changes in national and local policy as and when they happen. The LEP is planning an early review of the SEP in 2018 and regular reviews after that.

The high-level SEP is underpinned by a robust evidence base and a series of more detailed plans for transport, skills and education, science and innovation, quality of place, digital, housing and place marketing.

This document is the LEP's Energy and Clean Growth Strategy. Developed with support from the Department for Business Energy and Industrial Strategy (BEIS) it sets out the energy challenges facing the LEP area (non-domestic, transport and domestic) and how, in collaboration with industry and key public-sector partners, we can rise to the challenge of delivering 'affordable energy and clean growth'.

Stakeholder Engagement

This strategy is supported by a detailed study undertaken for the LEP by Mickledore and Bizcat during late 2017 and early 2018; this study can be found in the resources section of the LEP website. During the development of the study a series of stakeholder meetings (group and 1-2-1), discussions and conversations were undertaken with key companies and groups across the sub-region.

National Context

The Government published its 'Clean Growth Strategy'[1] in October 2017. This set out the long-term national challenge of meeting our climate change obligations and proposes a series of potential 'pathways' to ensure that, by 2050, we have reduced our carbon emissions to 80% of their 1990 levels.

The principle of "Affordable Energy and Clean Growth" was further reinforced in the Industrial Strategy White Paper[2] published in November 2017 which identified 'maximising the advantages for UK industry from the global shift to low carbon growth' as one of its four Grand Challenges.

The challenge of adapting to low carbon forms of energy production, whilst keeping costs affordable for both commercial and domestic users and reducing our reliance on energy from overseas (energy security) is known as the "Energy Trilemma". In an area with significant levels of industrial energy use, like Cheshire and Warrington, this is a particular challenge. The national strategy also highlights the economic opportunities that could be capitalised on through innovation and new technologies.

These national strategies also recognise that research and innovation by academia and industry will be essential in addressing future energy challenges.

[1] *https://www.gov.uk/government/publications/clean-growth-strategy*

[2] *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf*

Energy in the SEP

Our Strategic Economic Plan (SEP) highlights Energy and Environment as one of six key sectors in Cheshire and Warrington. We have: -

- *Over 7,000 businesses in the wider Energy and Environment sector, employing over 31,000 people*
- *A nationally significant energy cluster, with particular expertise in nuclear (fuels, new build and decommissioning), energy systems and the impact of low carbon vehicles on local energy networks.*
- *An expanding academic research base including the LEP-funded Intelligent Energy Systems Demonstrator at the University of Chester's Thornton Science Park and the British Geological Survey's 'Earth Observatory' also underdevelopment at Thornton.*
- *One of the largest groupings of energy-intensive industries in the UK, which consume energy for both power and as a 'feedstock'*
- *A track record of industry-led innovation through the Energy Innovation Centre in Ellesmere Port, and sector development through groups such as the Cheshire Energy Hub and North West Nuclear Forum*

The SEP also sets out a series of high-level objectives linked to Energy: -

- *Ensure that Cheshire and Warrington business locations have access to adequate power, water and waste disposal facilities to meet current and future needs*
- *Supporting initiatives which look to deploy new and innovative technologies aimed at making the power network smarter, more resilient to peaks and falls in demand and less reliant on outside sources of energy (e.g. through locally sourced geothermal energy or district heating networks)*
- *Be at the forefront of research and innovation activity in power and energy systems, including SMART energy systems and energy storage*
- *Support the shift to a low carbon economy and provision of an energy infrastructure that can accommodate future energy demands in an affordable, responsive way*

Our Current Energy Position

Energy use is generally divided into three categories – non-domestic (i.e. industry and business), domestic (households) and transport. Total energy consumption in Cheshire and Warrington in 2015 (the latest year available) was just over 33,000GWh. For a sense of scale, a GWh (Giga Watt Hour) is one million kilowatt hours of energy – enough to power around one million homes for an hour.

Around 30% of our energy use is consumed by transport, and almost 45% by non-domestic users. Our combined domestic and non-domestic energy consumption is 15% higher than the whole of Liverpool City Region and around 70% that of Greater Manchester[3]. Fossil fuels (oil, gas and coal) account for 70% of the total energy consumption in the sub-region, even before the transport sector is considered.

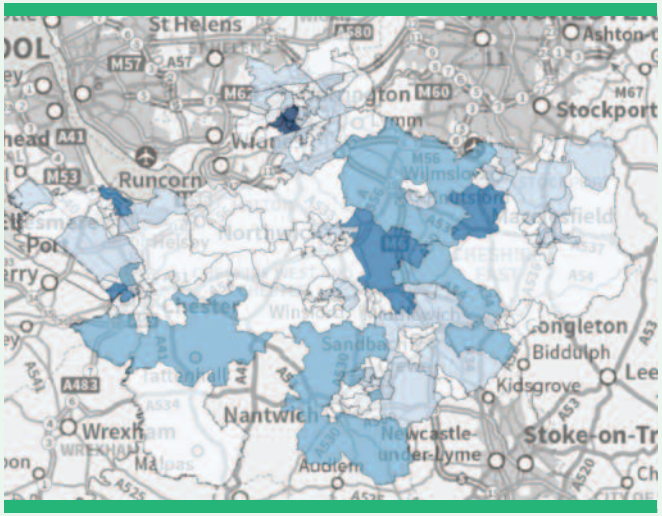
Within the sub-region, Cheshire West and Chester – and in particular the energy-intensive industrial cluster at Ellesmere Port – utilises more energy than Cheshire East and Warrington combined.

Domestically, the majority of energy is used for heating our homes. Gas is the dominant central heating source, accounting for 88% of premises in urban areas and 66% in rural. 5% of heating systems are electric and the remainder is based on heating oil, sold fuels or combinations. Large areas of Cheshire East and some parts of Cheshire West and Chester are not on the gas grid network, posing specific challenges around fuel poverty and decarbonisation.

The figures below give an indication of those areas where non-domestic use of electricity and gas is most concentrated within the sub-region.

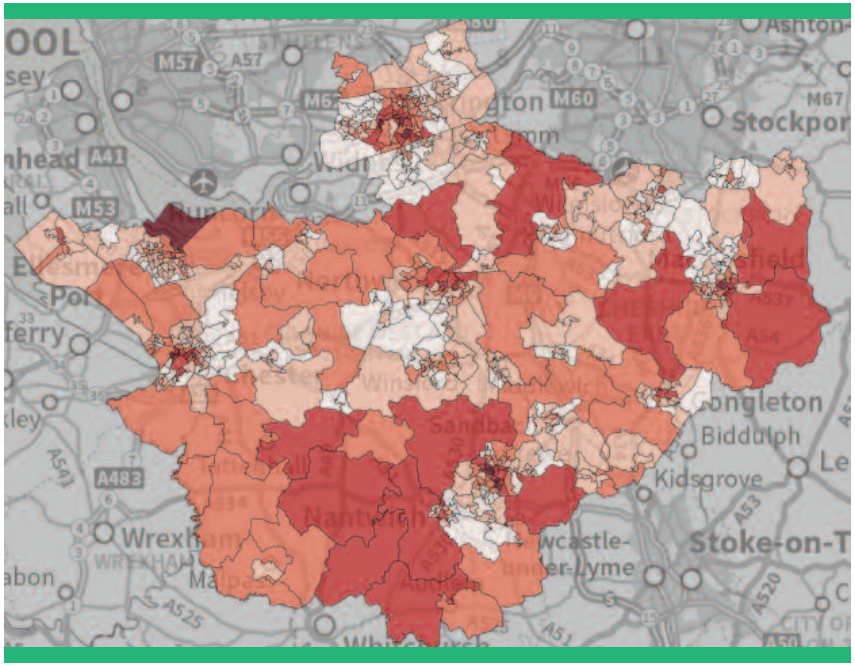
Non-Domestic Electricity Consumption by MSOA 2015

Non-Domestic Gas Consumption by MSOA 2015



[3] *Mickedore (2018), Development of and Energy Strategy and Implementation Plan for Cheshire and Warrington*

Households in Fuel Poverty



Data from BEIS[4] indicates that around 40,000 households in Cheshire and Warrington (around 10%) are experiencing fuel poverty. A fuel poor household is defined as one which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth. In England, this is defined as 21°C in the living room and 18°C in other occupied rooms.

The distribution of fuel poor households is shown graphically in the figure below – the darker the shading the greater the concentration.

Cars account for 60% of the total transport energy consumption in Cheshire and Warrington. Our position at the heart of some of the busiest sections of the motorway network, and the dispersed nature of our key settlements make tackling energy use and emissions from cars and HGVs a challenge too.

As well as using energy to power and heat domestic and industrial premises, there are a number of companies that use significant amounts of energy (including natural gas) as a 'feedstock' in their production processes.

Energy constraints on future growth

The technical report which underpins this strategy considers the extent to which the energy system may be a constraint on future growth in Cheshire and Warrington. To accommodate the area's growth ambitions over the next 25 years, is likely to require a range of reinforcements to the network, as well as a fresh approach to how energy is generated, transmitted and used locally.

The ability of Distribution Network Operators (DNOs) to add to the network 'in advance of need' is restricted by the regulator OFGEM: future capacity can only be created in those locations when specific projects are known, which can introduce significant delays in bringing forward large-scale developments.

[4] BEIS (2017) Sub Regional Fuel Poverty England 2017 (2015 data)

DNO (Electricity or Gas)	Principal Area of Coverage	Status
Electricity North West (Electricity)	Cheshire East	Network reported to have general capacity in identified areas of future development
SP Energy Networks (Electricity)	Cheshire West, Warrington, Crewe	Some capacity constraints particularly Chester and Warrington, with localised constraints in Crewe and Ellesmere Port.
Cadent (gas)	Cheshire east, Cheshire West and Warrington	Principle constraint is that significant areas to the south of the sub-region are not connected to the gas grid.

In addition to energy for industrial and residential development, proposals for increased electrification of key rail routes (e.g. Holyhead-Chester-Warrington) and the increased deployment of Electric Vehicles will increase demand and so stress on the system.

Affordable Energy and Clean Growth

Our future growth ambitions must be underpinned by an energy system that is affordable, clean and secure. In achieving this the LEP believes that energy will increasingly need to be produced closer to where is consumed, and that we must make best use of all of the outputs from energy generation and industrial processes, particularly waste heat. This will require a mix of technologies which are designed to work together and are optimised wherever possible.

Our three local authority partners each have their own responsibilities in terms of carbon reduction targets, and each has developed a comprehensive long-term energy vision and strategy. The LEP's role is to support and add value to these strategies where possible and help create strategic links between areas inside and beyond the LEP boundary, where there is a mutual benefit in doing so.

The LEP also has a role in identifying how our energy sector's expertise can be supported and enabled to innovate, develop solutions to local and national energy challenges and create further jobs and economic value. The switch to clean energy also provides an opportunity to create jobs in the development, production, installation and maintenance of new low carbon technologies.

During 2018 the LEP will develop its Local Industrial Strategy. This will include setting out our response to the four 'Grand Challenges' included in the Industrial Strategy White paper launched in November 2017. Clean Growth is one of these Grand Challenges and our response will be informed by the work undertaken to prepare this strategy and the underpinning study by Mickledore and Bizcat.

"We will maximise the advantages for UK industry from the global shift to clean growth – through leading the world in the development, manufacture and use of low carbon technologies, systems and services that cost less than high carbon alternatives"

Industrial Strategy (2017), p.42

AN ENERGY VISION FOR CHESHIRE AND WARRINGTON

By 2040, Cheshire and Warrington will have a resilient energy system, based on locally integrated low carbon power and heat systems, reducing climate gas emissions by 50%

Cheshire and Warrington has the potential to lead the UK's clean growth and energy system in a number of areas including local energy networks, local heating and small modular reactors, as well as being significantly involved in hydrogen, geothermal energy and electric vehicles. There is a strong industry-led track record of energy innovation in Cheshire and Warrington and an increasing academic network looking at primary research and technology development.

For our vision to be realised, the LEP needs to work with Government, Industry and local partners (including other LEPs) to ensure the facilities and environment are right to develop, test trial and implement new energy system solutions. The LEP has already supported development of the Intelligent Energy Systems Demonstrator at Thornton Science Park, but there is scope to develop further facilities and 'centres of excellence' and create stronger links with national assets such as the Energy Systems Catapult. We also need to look at how industry can be linked up more effectively to universities with energy-related research and development capabilities.

It will also be important to recognise that for maximum benefit and impact, we need to take a 'whole system' approach to energy and clean growth; understanding the relationship between system inputs and outputs and between the system and the wider environment that it supports.

The LEP will work with industry and business to examine and identify potential ways of supporting the transition to a low carbon economy. This will include: -

- *Opportunities for supporting new ways of generating, distributing and storing low carbon power and heat locally. This could include carbon capture use and storage (CCUS)*
- *Identifying barriers to growth resulting from the current regulatory framework for energy*
- *Developing business support programmes to help with information, advice and guidance on adopting new technologies and processes to reduce energy consumption and encourage carbon reduction*
- *Using the LEP's Low Carbon Energy Innovation Fund to stimulate development and roll out of new industry-focussed technologies and processes, and commercial growth opportunities*
- *Working with business to identify new economic opportunities arising from the development and production of new clean energy technologies*

Leadership in tackling domestic energy use and reducing fuel poverty lies principally with national and local government and energy companies themselves. However, the LEP has a role in promoting low carbon technologies as a key factor in making new housing and commercial developments sustainable and should look to use its funding routes as levers to help achieve this.

The LEP also recognises the potential benefits of working collaboratively with other LEPs and areas on projects of common interest. This includes the considerable opportunities for nuclear new build, advanced modular reactors and decommissioning cross-border with north Wales, and hydrogen with Liverpool City Region.

Heat and Power
Local Generation and Storage

Central to demonstrating the benefits of local generation and storage in an industrial setting is the **Energy Innovation District (EID)**. At the heart of the Cheshire Science Corridor (including its Enterprise Zone) it encompasses an existing cluster of energy-related industry, including large-scale energy assets, energy intensive industries, the associated supply chain and a centre for research and development.

CASE STUDY: ENERGY INNOVATION DISTRICT

The Energy Innovation District, launched in September 2017, is an idea driven by business through the Cheshire Energy Hub, with the overarching aim to lower energy costs and increase energy security, enabling increased investment and economic growth. The ambition is to develop a District-wide micro-grid taking advantage of locally generated, low carbon electricity and heat, initially covering a stretch of north Cheshire and Halton running from Ellesmere Port to Runcorn.

The Cheshire Energy Hub is an energy sector support organisation, which has been entirely funded and strategically driven by industry. It works with its member organisations and key stakeholders in promoting collaborative action, advancing the skills agenda and working towards business solutions. It initially established a successful Graduate Recruitment Programme and now provides the conduit for collaboration across various energy initiatives.

This existing cluster represents an area that currently consumes around 5% of the UK's energy and contains some of the UK's most significant and energy intensive infrastructure, including Ineos Chlor, Essar's Stanlow Refinery, CF Fertilisers, Encirc and URENCO.

What sets the Cheshire Energy Innovation District (EID) apart is the breadth of individual opportunities across a range of energy system components ('vectors') and more importantly how they can be brought together to deliver a 'whole place' energy solution for a large industrial area.

The key components of the EID are: -

1. Electricity: significant opportunities for low carbon power generation and distribution through a District-wide micro-grid. Already over £190 million has been invested in delivering three new assets in the last two years – 57MW wind farm, 21MW biomass plant and 20MW gas-fired energy-from-waste facility;

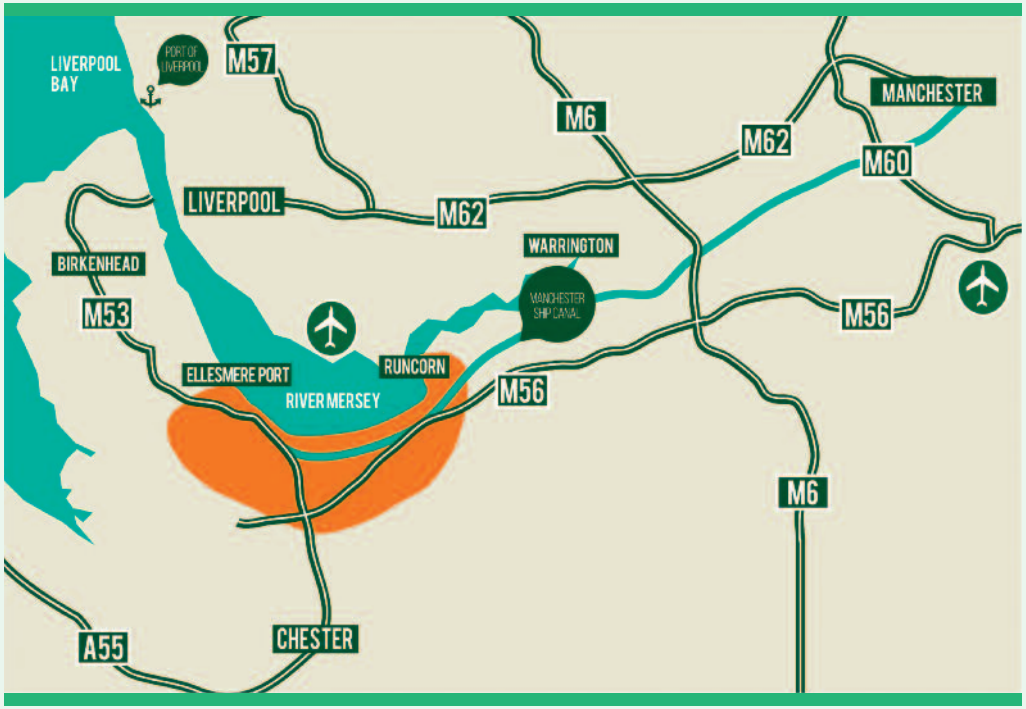
2. Heat: Building on previous and on-going studies funded through the Government's Heat Networks Distribution Unit (HNDU) to capitalise on the significant sources of local heat generation in the Ellesmere Port area. Developing hydrogen and bio-gas as genuine low carbon alternatives to natural gas, though initiatives such as Cadent's 'HyNet' project;

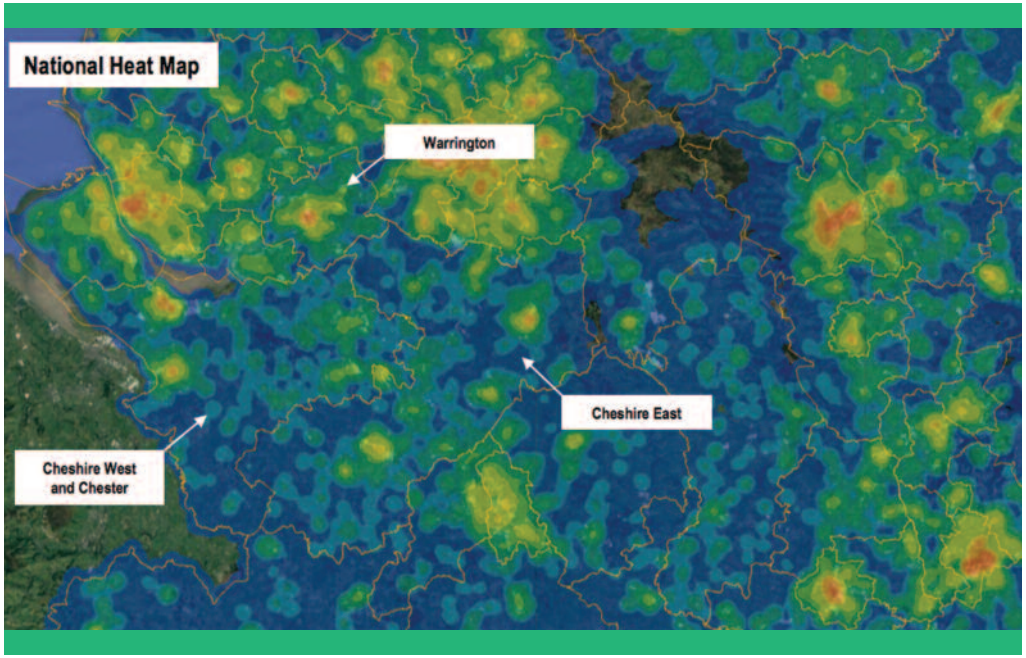
3. Transport: Leading research to understand the impact of electric vehicles (EV's) on the low voltage network through the 'MyElectricAvenue' and 'Electric Nation' projects; research and development work on fuel cell applications for the automotive sector including using hydrogen to fuel HGVs and trains;

4. Innovation: Developing key research and innovation assets such as the Thornton Science Park and URENCO's Sustainable Energy Technology Park at Capenhurst, creating a comprehensive energy innovation ecosystem;

5. Manufacturing: Already home to some of the largest energy users in the country, the EID's objective of affordable, secure low carbon energy will be a key attractor to private sector investment in manufacturing and associated supply chains.

Initial studies are underway to define the scope, infrastructure requirements and likely cost of the energy and heat networks with the objective of developing a series of distinct and compelling propositions for investment by Government and the private sector.





National Heat Map

HEAT NETWORKS

The National Heat Map for Cheshire and Warrington is shown in the figure left.

The decarbonisation of heating is a major plank in the achievement of UK CO2 reduction targets, and the development of heat networks and deployment of heat pump technologies offer the principal technological means of decarbonisation.

Heat networks have been intensively studies around the country, mainly funded by the Heat Networks Delivery Unit (HNDU) which sits within BEIS. HNDU funding has been secured by all three local authorities within Cheshire and Warrington and is supporting initial feasibility studies for heat networks in Ellesmere Port, Crewe Town Centre, Macclesfield (Town centre and Hurdsfield), off-gas grid in Cheshire East, and Alderley Park.

It is estimated by the Climate Change Commission (CCC) that around 18% of UK heat will need to come from heat networks by 2050 if the UK is to meet its carbon targets cost effectively. The industrial nature of parts of Cheshire and Warrington (as reflected in the heat map) plus the potential for geothermal heat in Crewe, make our sub-region ideally placed to adopt heat networks.

The LEP is keen to see the deployment of heat networks within the sub-region: as indicated above a number of initial studies have been funded by HNDU and the next stage will be to encourage development of full business cases and identify potential funding sources for viable projects.

Heat Networks – sometimes called district heating – are systems of insulated pipes used to distribute heat from a central source to a number of domestic or non-domestic buildings. The heat source may be a facility that provides a dedicated supply to the heat network, such as a combined heat and power plant; or heat recovered from industry and urban infrastructure, canals and rivers or energy from waste plants.

Smart Energy Systems

As levels of localised energy generation increase and new technologies such as energy storage become more widespread, so our energy system needs to be more 'agile' and able to manage the peaks and troughs in supply and demand often associated with renewable, low carbon energy. Many homes are now fitted with Smart meters and they should be standard in UK homes by 2020.

A study for the Government estimates the benefits of a smart energy system to be £17-40bn to 2050 . These benefits come from avoided or deferred network reinforcements, avoided generation build, avoided curtailment of low carbon generation, and better operation of the system. The potential for significant benefits was also reiterated in the Committee on Climate Change's recent annual progress report to Parliament[6].

The LEP has supported, through a £6.8 million allocation of Local Growth Fund, development of an 'Intelligent Energy Systems Demonstrator' at the University of Chester's Thornton Science Park. This project offers a flexible space for research, innovation and development, allowing companies to test new equipment in a self-contained environment able to simulate a range of conventional and unconventional energy systems and smart grids. The increased use of Electric Vehicles (covered in more detail in the next section) will also require a much greater adoption of smart technologies to manage the impact of widespread vehicle charging on local, low voltage networks.

The Energy Innovation District, centred on Ellesmere Port, will provide the opportunity for developing a smart grid, focussed on understanding the system needs and operability in an industrial, manufacturing setting. Some of our larger development proposals, such as Warrington New City and the Constellation Partnership area also provide opportunities to develop and deploy smart systems in a commercial and residential setting.

Geothermal

The Cheshire Basin is one of four basins in the UK which have the potential for deep geothermal and has major advantages over other areas. Under Crewe it reaches depths of up to 4.5 km and temperatures reaching 100 °C, giving the potential to produce a high quantity of clean, renewable energy – to power the smart, sustainable and clean growth of Crewe, linked to HS2.

Independent research has reviewed the national and local economic benefits. (Regeneris, 2016). Locally, the single scheme could provide 76GWh powering the equivalent of 6,740 homes and reducing 7-8,000 tonnes of CO2. The overall scheme could support 200 FTE's and £10m GVA in construction, and annual operational and maintenance benefits of 16 FTE's and £0.9m GVA. This benefit could be tripled on the back of growth expected through HS2. There are also wider socio-economic benefits which could impact positively on local supply chains, workforce development, energy affordability, and carbon reduction.

Decarbonising transport...

To meet the Government's 2050[5] emissions targets, almost every car and van will need to be zero emission by that date. In late 2017 the Government announced an end to the sale of all new conventional petrol and diesel engines by 2040. Emissions from Heavy Goods Vehicles will also need to reduce significantly to make a meaningful contribution.

The implications nationally and locally of this decision are still to be fully understood but there is an opportunity for Cheshire and Warrington to work with Government, our neighbouring LEPs and Transport for the North to scope out what our response to this challenge needs to be.

There are opportunities to accelerate decarbonisation of the transport network in Cheshire and Warrington by ensuring that the infrastructure (principally the charging network) is in place to support greater numbers of EVs.

The current distribution of public charging points across Cheshire and Warrington is shown on the map right (credit: ZAP Map).

The LEP is developing a comprehensive Transport Strategy and supporting investment programme to improve and expand public transport options. As a sub-region we have an advantage in this regard. EA Technology, based in Capenhurst, has been leading on a number of pilot studies to understand how the switch to Electric Vehicles (EVs) is likely to impact on local energy networks. Through the 'My Electric Avenue' programme and more recently 'Electric Nation' they are gathering real time data from EV owners and users which will prove invaluable in this transition.

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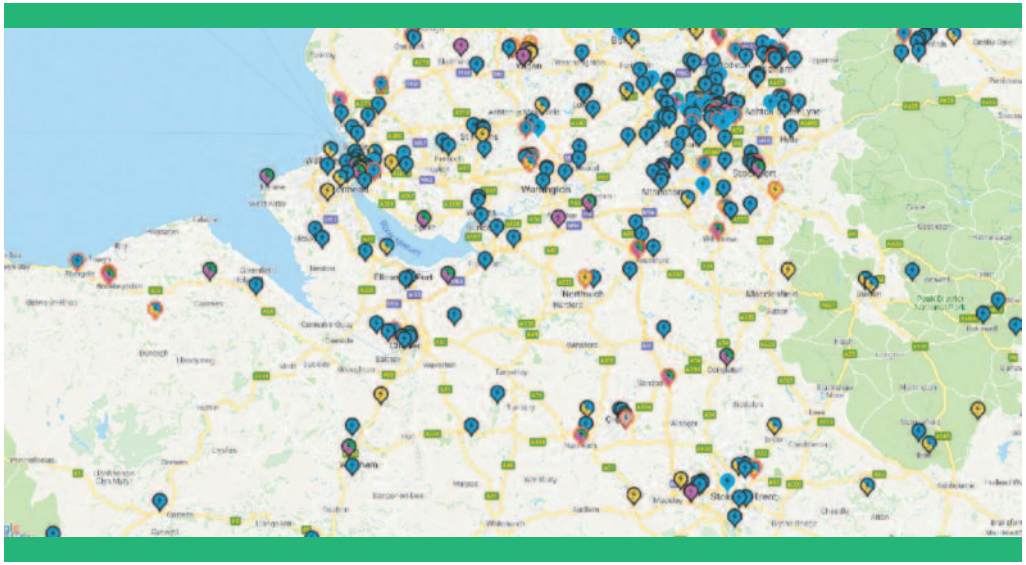
[5]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/568982/An_analsis_of_electricity_flexibility_for_Great_Britain.pdf

[6]https://www.theccc.org.uk/publication/2017-report-to-parliament-meeting-carbon-budgets-closing-the-policy-gap/

Zap-map charge points 2018



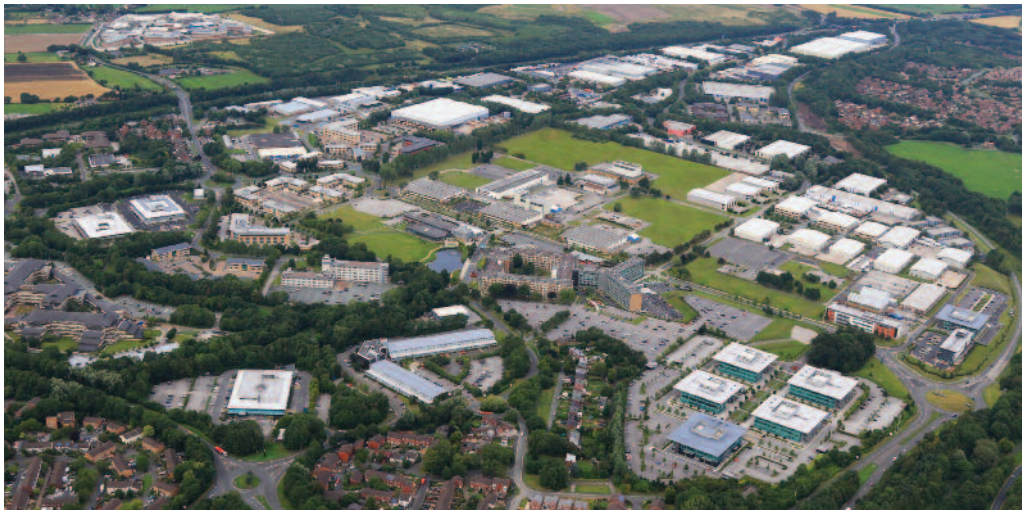
CASE STUDY: ELECTRIC NATION

Electric Nation is seeking to recruit between 500-700 people buying or leasing an electric vehicle (EV) (including pure electric and plug-in hybrids) to take part in the largest trial of its kind. Participants will charge their cars at home using a smart charger which can manage when and how their vehicle battery charges. The findings of the trial will help electricity network operators to manage the effect of the additional load caused by charging EVs on the local electricity network. This is essential for the security of electricity networks in the future and the decarbonisation of the transport sector which is responsible for approximately 21% of the UK's greenhouse gas emissions.

The UK electricity system has sufficient capacity to deliver energy to electric vehicles, however recent research suggests that if clusters of EVs develop in local areas and they're all charged simultaneously then some local electricity networks may require costly reinforcement. Charging vehicles with larger batteries, at faster rates, and over longer periods could exacerbate this pressure.

Electric Nation is the customer-facing brand of CarConnect, a Western Power Distribution (WPD) and Network Innovation Allowance funded project. WPD's collaborative partners in the project are EA Technology, DriveElectric, Lucy Electric GridKey and TRL. The project aims to provide local electricity network operators with the tools to be able to ensure that their networks can cope with this massive new challenge, whilst avoiding replacing cables and substations.

The Electric Nation project is focusing on the local electricity networks that supply homes and small businesses – the low voltage network. Electricity networks are run in a safe, secure, reliable and sustainable way to provide energy to local communities. This trial will help the Distribution Network Operators, who manage these networks, increase their understanding of the impact of EVs on their networks and how this impact could be reduced using smart chargers.



A World Class Nuclear Cluster

Within this the area is recognised as having one of the largest concentrations of nuclear consulting engineering companies in Europe, at the centre of an arc running from Cumbria to north Wales.

From nuclear fuel production by URENCO at Capenhurst, through the engineering cluster at Birchwood to Wood Group's European Clean Energy in Knutsford, over 6,500 people work in the nuclear industry in Cheshire and Warrington. This includes National Nuclear laboratory and the Nuclear Decommissioning Authority at Birchwood.

There are specialist skills covering the whole nuclear life-cycle from design and construction through to decommissioning.

As well as the next generation of large scale nuclear reactors, Small Modular Reactors (SMRs) are an increasing area of focus, with Government seeing the development of commercial systems as a key opportunity for the UK to lead internationally.

Rolls-Royce is the highest profile of a number of companies shortlisted in the recent UK competition for the best value SMR design. The Rolls-Royce consortium research claims that once mature, SMR technology will deliver power at £60 per megawatt hour. This compares with £92.50 per megawatt hour stated for the Hinkley Point power station.

Rolls-Royce Nuclear has its Nuclear Services and Projects Engineering Office in Warrington and Wood Group (incorporating the former Amec Foster Wheeler), a key partner in this consortium is leading the work from their operations based in the LEP area. Nuvia UK is also headquartered in Warrington. Local capabilities will be enhanced further following the award of a £2.9 million contract from government to Wood group to lead a key nuclear research programme to enhance the techniques used to design reactors and optimise their performance. TThis new Digital Reactor Design Partnership includes the University of Liverpool's Virtual Engineering Centre (located at Sci-tech Daresbury), Rolls-Royce, EDF Energy, NNL, the University of Cambridge and Imperial College.

Companies in the LEP area also have the opportunity to build relationships with the new Nuclear Advanced Manufacturing Research Centre (Nuclear AMRC) located at Cammell Laird in Wirral.

Nuclear Sector Deal

Government unveiled a £200 million Nuclear Sector Deal in June 2018, aimed at stimulating innovation and new technologies, and a diverse and highly skilled workforce by 2030. The Deal includes specific commitments around supply chain development, and £44 million for research and development funding to support the development of advanced modular reactors, including small modular reactors (SMRs) and micro modular reactors (MMRs).

CASE STUDY : SMALL MODULAR REACTORS

SMRs are defined by the International Atomic Energy Agency as being advanced reactors producing up to 300MWe of electric power and that can be largely built n factories as modules to minimise costly on-site construction. SMRs are suitable for smaller sites as well as for new applications such as hydrogen production. In 2014, a National Nuclear Laboratory study suggested a market for 7 GWe of SMR power plants could exist in the UK by 2035, with further opportunity beyond this to 2050.

The Government, through innovation funding, has been encouraging development of proposals for advanced modular reactors (AMRs). One local response is the U-Battery, a micro modular reactor which is being developed by URENCO in partnership with Wood, Cammell Laird and Laing O'Rourke.

U-Battery is a 10MWt (4MWe) gas-cooled reactor that can provide heat at 7500C. The concept design was developed by the University of Manchester, Dalton Institute and Technology University of Delft after the project was initiated in 2008 by URENCO. The micro SMR is anticipated to be operating by 2026.

The competition received 32 expressions of interest including from Hitachi/Westinghouse, NuScale, URENCO/U-battery and Rolls-Royce. The latter is a high-profile consortium consisting of Wood (formerly Amec Foster Wheeler), Nuvia, Laing O'Rourke, Arup and the Nuclear Advanced Manufacturing Research Centre. Wood is also in the URENCO consortium. U-Battery (a micro-SMR) is a 10 MWt (4MWe) gas-cooled reactor that can provide heat at 7100C.

The consortium also includes Cammell Laird. The concept design of U-Battery was developed by the University of Manchester and the Technology University of Delft. The consortium has registered its reactor technology for pre-licensing vendor design review with the Canadian Nuclear Safety Commission. The micro SMR is anticipated to take 10 years to become operational.

Rolls-Royce is the highest profile of a number of companies shortlisted in the UK's competition for the best value SMR design. The Rolls-Royce consortium research claims that once mature, SMR technology will deliver power at £60 per megawatt hour. This compares with £92.50 per megawatt hour stated for the Hinkley Point power station.

Rolls-Royces' SMR capabilities are already generating overseas interest. In November 2017 the company signed a MOU with Jordan Atomic Energy Commission to conduct a technical feasibility study for the construction of a Rolls-Royce SMR in Jordan.

Cheshire and Warrington SMR Capabilities

Cheshire and Warrington has a growing base of SMR capability. Rolls-Royce Nuclear has its Nuclear Services and Projects Engineering Office in Warrington and Wood, a key partner in this consortium, is leading the work from their operations based in the LEP area. Nuvia UK is also headquartered in Warrington and the capability in Warrington originated from BNFL placing its headquarters there. Capenhurst (Cheshire West) is the base for the uranium enrichment facility operated by URENCO.

URENCO's subsidiary, URENCO ChemPlants Limited, is responsible for the operation of the Tails Management Facility (TMF), also at Capenhurst. At the TMF, the company will store, process and deconvert depleted uranium hexafluoride (UF6) – tails - to stable uranium oxide (U308). The TMF consists of a number of associated storage, maintenance and residue processing facilities to support URENCO's long term strategy for the management of tails. The TMF project is nearing completion, commissioning has commenced, with commercial operation anticipated to start in 2019.

The wider area holds significant wider expertise including a fuel production facility at Springfields, Preston, the reprocessing plant at Sellafield, power production at Heysham and Wylfa and new power plants earmarked for Wylfa and Moorside, Cumbria. This supports a wider nuclear-enabled supply chain – with companies such as Cammell Laird seeking to enter the large scale nuclear fabrication sector.

Local capabilities will be enhanced further following the award of a £2.9 million contract from the government to Wood to lead a key nuclear research programme to enhance the techniques used to design reactors and optimise their performance. This new Digital Reactor Design Partnership includes the University of Liverpool's Virtual Engineering Centre (located at Sci-tech Daresbury), Rolls-Royce, EDF Energy, NNL, the University of Cambridge and Imperial College..

In early 2017, Cammell Laird established a partnership with the Nuclear Advanced Manufacturing Research Centre (Nuclear AMRC) which will lead to investment in their facilities and workforce to meet the demands of modular new build.

Rolls-Royce has stated that its deployment of a UK-developed SMR could support 40,000 jobs in the next 20 years and add £100bn to the UK economy in the period 2030 – 2050. If the government commits to delivering a coherent SMR strategy, depending on the chosen consortium, this could represent an opportunity for Cheshire and Warrington to further build on its nuclear strengths. Whilst SMRs are less likely to be built locally, particularly given the nearby Cammell Laird NAMRC construction facility, SMR opportunities for Cheshire and Warrington are more likely to arise around R&D, testing, design, licensing, fuel production and the safety case.

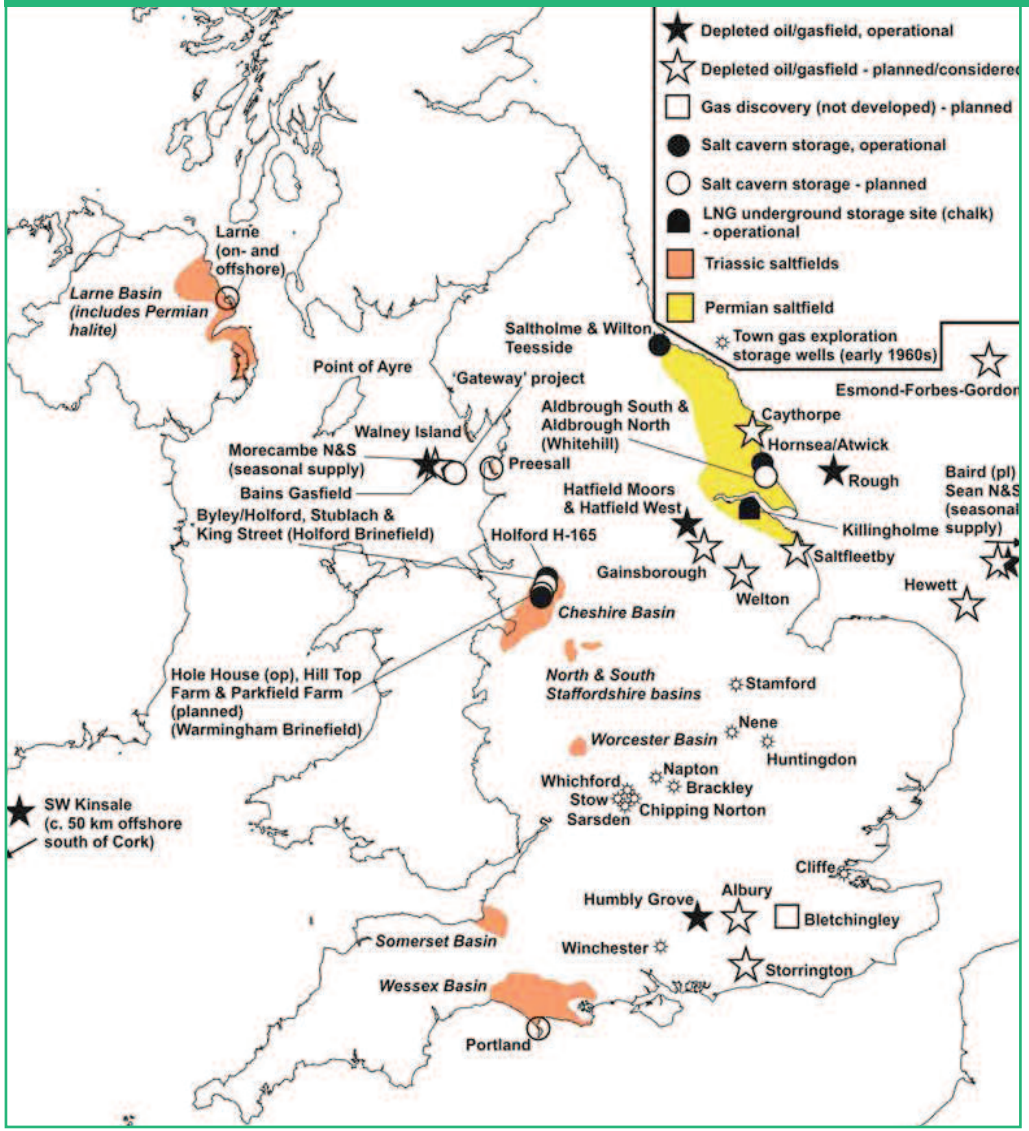
Current Policies and Drivers

The size of the potential global SMR market is approximately 65 – 85GW by 2035, valued at £250bn - £450bn. The domestic market is likely to represent less than 10% of the global demand for SMRs, so export markets will be critical to make a return on investment.

Other countries, particularly China and Canada are making faster headway with SMR technologies and if the UK does not accelerate development to keep pace, the opportunity for a UK-designed and manufactured SMR may be lost.

As well as costs, other issues include the potential delays in regulatory approval and potential locations where SMRs could be sited. The Energy Technology Institute has identified 250 potential sites where SMRs could be deployed, with sites identified based on the need for baseload and load-following generation and for district heating.

The General Design Assessment Process (GDA) for SMRs is likely to take 4 to 5 years. The GDA is the process by which the Office for Nuclear Regulation assess the potential suitability of a nuclear reactor design for development.
The GDA combined with the development period means that SMRs are not likely to be operational until c.2030. For AMRs, the GDA process could take as little as two years.



Gateway to the Earth

Location of current and proposed Underground Gas Storage facilities in the UK (credit: British Geological Survey)

HYDROGEN

Hydrogen and fuel cell (HFC) technologies are increasingly being deployed in public transport vehicles (bus and train) and the LEP has had initial discussions with Liverpool City Region LEP about their ambitions to trial hydrogen-powered trains on the Halton Curve, between Chester and Liverpool. The sub-region has a strong rail heritage and is home to a heavy duty rail engineering and repair facility in Crewe, operated by Bombardier.

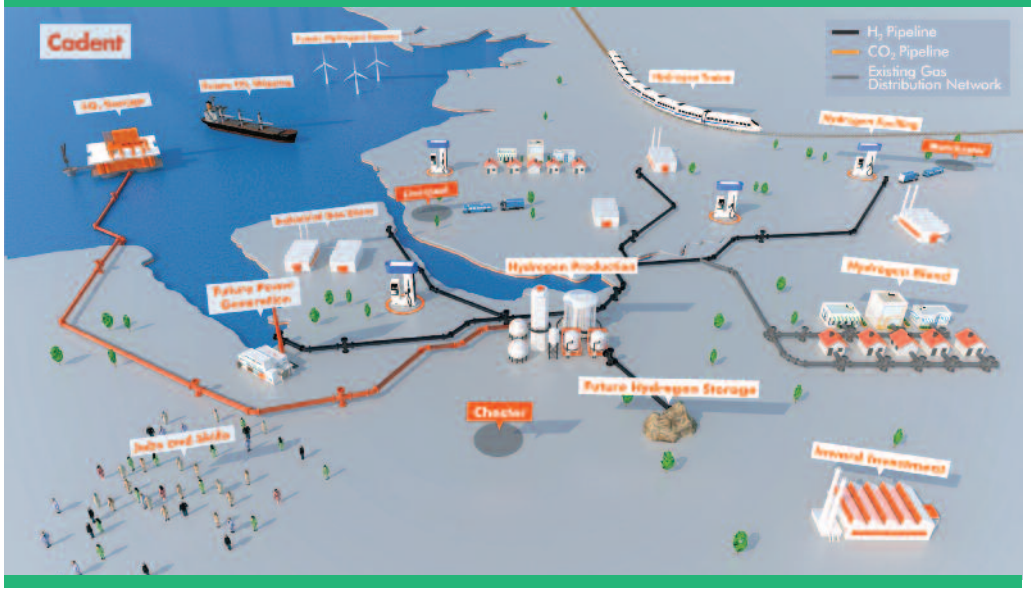
Our geology also makes Cheshire and Warrington a prime location for the development of facilities for underground gas storage (including, potentially hydrogen) as well as potentially carbon capture and storage (CCS).

Carbon Capture and Storage is a method by which over 90% of CO2 emissions from industrial or power plants can be captured and stored permanently in depleted oil and gas fields (such as the Hamilton gas field in the Irish Sea). This can be from capturing industrial and power emissions directly, or through capturing emissions from a hydrogen production plant and then using the hydrogen as a low carbon fuel for industry, homes and transport, or a mixture of the approaches.

CCS is important for all industrial and power clusters, and given the Cheshire and Warrington houses a significant number of energy intensive industries it is a particularly important technology for the area. CCS and hydrogen has the potential to transform the north into a major low carbon fuel supplier for homes, businesses and transport across the UK. It links not only to the UK's industrial strategy but a wider Northern Powerhouse agenda to build on our already world leading energy and industrial assets.

There are currently two project proposals for CCS in the North; Teesside Collective and the Cadent gas 'HyNet' project running through Merseyside, Cheshire and Warrington and in to Greater Manchester See illustration below), and both these projects have the potential to be transformational not just for the surrounding industry but for the UK as a whole through decarbonising the gas supply to towns and cities such as Liverpool.

[7] *Regeneris (2018) Cheshire and Warrington Value Proposition: Energy Proposition*

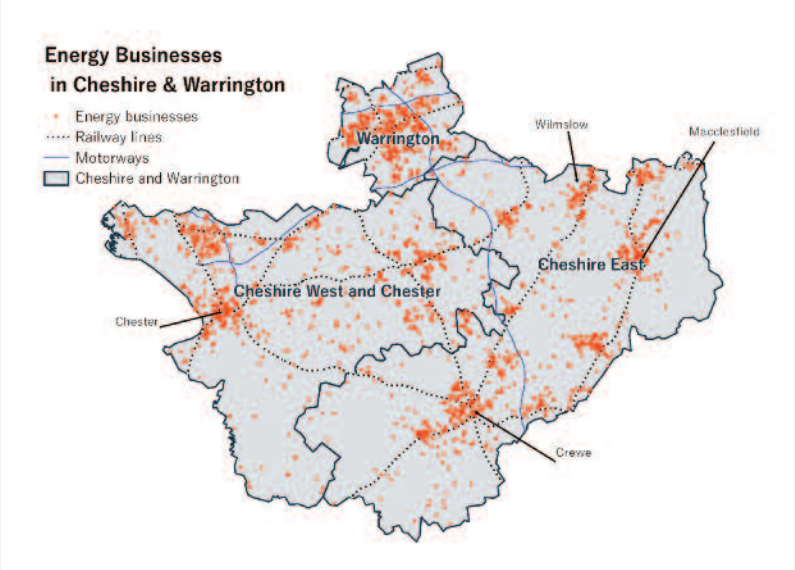


The existing concentration of chemical industries along the north bank of the River Mersey, along with the refining capabilities at Essar's Stanlow plant, present a foundation for hydrogen production, mainly using the Steam Methane Reformation (SMR) process.

Cheshire energy hub

A significant energy sector to drive growth

As highlighted earlier in the Strategy, Cheshire and Warrington is home to a significant cluster of energy-related businesses, as illustrated in the figure below, employing over 31,000 people. The area accommodates 10% of the Energy business base in the Northern Powerhouse .



Collectively these provide a strong foundation for future economic growth from this sector, provided that businesses are willing and able to innovate and provide the solutions that places need to underpin sustainable economic growth.

DELIVERY PLAN TO 2020

To implement this Energy Strategy the LEP has identified an initial series of activities and interventions to progress between now and 2020. Other proposals are included within the Mickeldore report and these will be form the basis of our longer-term plans.

1. Supporting Energy as a Key Sector

I. Support for local implementation of the Nuclear Sector Deal which sets out a secure long-term future for the nuclear industry locally and in the wider area. This will also include identifying potential programmes to support SMEs to enter the nuclear supply chain.

II. The LEP will provide a 'critical friend' role to existing industry forums and encourage greater cooperation and joint working between these groups to develop a strong, consistent narrative on the expertise and potential for the Cheshire and Warrington energy sector to help Government address the challenge of Affordable Energy and Clean Growth. This narrative will also highlight the opportunities and benefits of collaboration across boundaries and borders on key energy projects.

III. Understanding and responding to the key skills needs for the sector. This has identified a collaborative approach that could benefit business to: -

- *Attract and inspire young people to join this sector and develop capability for the future and overview the existing demographic challenges of an aging workforce*
- *Improve the provision of technical education and skills development for this sector available locally*
- *Develop the skills of the existing workforce to confidently use new technology, implement digital solutions and contribute to business improvement*
- *Ensure safety-related training (for top tier COMAH sites) is available locally at competitive rates*

The LEP will work with the sector during 2018/19 to scope out appropriate calls via the ESF route to match fund key skills and training activity.

2. Supporting Affordable Energy for Clean Growth

IV. Support to develop the concept of the Cheshire Energy Innovation District. This includes developing phased proposals for early intervention for energy-intensive industries in Ellesmere Port.

V. Working with colleagues in Liverpool City Region and Greater Manchester LEPs to support development of industry-led proposals for utilisation and distribution of hydrogen as an alternative fuel for industrial and domestic use.

VI. Support for the development of proposals for district heat networks, including the potential for geothermal heating linked to the Crewe Masterplan. It will also work with local authority partners and house builders to promote district heating networks in new housing schemes and look at other opportunities to tackle fuel poverty as part of our inclusive growth agenda.

V.II Support development of cross-border energy sector opportunities including inputting to the development of an Energy Prospectus in conjunction with the Mersey Dee Alliance and North Wales Economic Ambition Board.

3. Supporting Energy Innovation

VII. Champion Cheshire and Warrington as a potential location for development of advanced modular reactor technology (including small and micro reactors), capitalising on the nationally-significant nuclear engineering cluster within the Cheshire Science Corridor.

VIII. The LEP will develop and promote the Cheshire Science Corridor as a premier location for energy-related investment, and as part of this examine opportunities to improve the pathways linking industry and academia.

IX. The LEP will launch its Low Carbon Energy Innovation Fund to stimulate development and adoption of low carbon technologies by and for industry. Where possible we will look to align the fund with remaining ERDF Low Carbon monies and Innovate UK funding for maximum impact.

X. The LEP will look to increase its engagement with key national energy innovation assets including the Energy Systems Catapult, Nuclear Advanced Manufacturing Research Centre and the Advanced Propulsion Centre. We will also explore with Government opportunities to establish further centres of energy-related excellence within Cheshire and Warrington.

XI. The LEP will support the establishment and activities of a North West Energy Hub, utilising funding from BEIS to identify and progress key energy-related projects at a sub-regional and pan-regional level.

4. Demonstrating Leadership in the Transition to a Low Carbon Economy

XII. The LEP will engage key partners to evaluate options for developing an Electric Vehicle charging point network, centred initially on the Cheshire Science Corridor. Where feasible and viable, projects developed using LEP funds will be expected to achieve an above average level of energy efficiency and sustainability.

Measuring Impact, Evaluation and Review

Measures of success will be developed in conjunction with key delivery partners.

Evaluation and Review

Monitoring and evaluation protocols will be agreed with the LEP's Strategy and Performance and Investment Committees. The Plan will be kept under regular review to ensure that it remains current and properly aligned to national priorities and local needs.

Governance

The action plan will be overseen by the LEP's Strategy Committee, which reports to the main LEP Board.

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