

CUMBRIA CLEAN ENERGY STRATEGY

CONSULTATION
DRAFT

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MAY 2022



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FOREWORD



Cumbria's vision is to be "The place to live, work, visit and invest sustainably - where exceptional industry and innovation meets a breathtakingly beautiful and productive landscape" with this vision underpinned by three strategic touchstones – net zero, productivity, and inclusive growth. This Clean Energy Strategy supports the delivery of this vision and our three strategic touchstones being a key component of delivering net zero in Cumbria; fostering productivity improvements through new technology development and providing long term high quality jobs to support inclusive growth.

Importantly, in developing this strategy, we were clear that it needed to be based on the unique competitive advantages that Cumbria has, to ensure that the strategy is both ambitious and deliverable and will support the drive to net zero. We all recognise that achieving net zero is a global challenge and one that all of us need to work together to address, that is why at Cumbria LEP, working with all of our partners, we have identified twin priorities on which we will demonstrate leadership, namely clean energy generation and business decarbonisation. This strategy is focused on clean energy generation with the business decarbonisation aspects addressed through the CLEP Business Decarbonisation 10 Point Plan, which we are currently implementing.

The focus on the twin priorities is not where our role stops as we will be strong supportive partners on both transport decarbonisation and natural capital, recognising the importance of both of these priorities in delivering Cumbria's overall net zero ambitions. It is particularly important that Cumbria's exceptional natural capital effectively supports the journey to net zero in a way that benefits our economy, businesses and communities. These important priorities are being taken forward through complementary strategies and work streams.

Cumbria starts in a very strong position, with its natural assets and industrial heritage making it uniquely placed to be a net clean energy generator, given that it already provides three times more clean energy generation than that consumed in electricity, through offshore wind and other renewable sources.

UK Government set out its pathway to net zero in a series of strategy documents issued over the last 18 months, from the 10 Point Plan for a Green Revolution, the Net Zero Strategy and most recently the Energy Security Strategy. That is in addition to the overall target established by the 6th Carbon budget from the independent Climate Change Committee to achieve a 78% reduction in CO₂ from 1990 levels by 2034 and then net zero by 2050. This document outlines how Cumbria will effectively support the achievement of this national ambition.

Our ambition is across all energy technologies from being at the forefront of a new nuclear renaissance; expanding our offshore wind capability establishing hydrogen and Carbon Storage infrastructure that can help decarbonise our energy intensive industries. Cumbria also has the potential to be the test bed for a wide range of renewable energy schemes that can be deployed at rural and community level. Integration with the Borderlands Energy Masterplan will help lead the way on a diverse range of renewable schemes spanning onshore wind, bio-energy, solar, hydro and other new technologies as these emerge. Delivery across these technologies could provide an additional 9GW of clean energy - the equivalent of removing 25 million tonnes of CO₂ per year. This is expected to provide at least 9,000 long-term skilled jobs in the county.

In setting out our ambition we have established principles that ensure clean energy development must not be at the detriment of Cumbria's natural environment and historic assets and that developments should place the community at the heart of decision making.

In summary, we have a clear vision, one that builds on Cumbria's unique natural assets and industrial heritage, but importantly moves this to the next level, providing an exciting next chapter in which Cumbria is as a major contributor to UK clean energy generation, delivering on our net zero and levelling up ambitions through sustained investment and economic growth.



Lord Inglewood
Chair, Cumbria Local Enterprise Partnership

INTRODUCTION

Cumbria has played an important and long-standing role in generating conventional energy to meet UK demand through higher carbon sources such as gas and through lower carbon sources such as nuclear, wind, solar and biomass.

Cumbria is at the forefront of the UK's commitment to Net Zero maximising our unique historic and natural assets and capabilities to drive investment in clean energy sources and to power a sustainable future that balances environmental considerations with business productivity and levelling up ambitions. It can make a powerful contribution to the decarbonisation of the UK through delivering opportunities in the clean energy sector and reducing emissions.

The achievement of net zero will be influenced by a number of policy influences including the decarbonisation of heat, buildings and transport, alongside energy transition.

The focus of this strategy is on clean energy generation as part of the overall achievement of net zero. The decarbonisation of buildings, transport, industry and the national environment is being taken forward through aligned strategies.

OUR VISION

Our strategic priorities reflect our thematic areas of focus:

- Becoming a significant provider and UK centre of excellence for new nuclear fission and fusion power
- Expanding offshore wind capacity and ensuring that Cumbrian ports become Operations & Maintenance Hubs for new developments
- Establishing Cumbria as a priority for the next phase of UK hydrogen industrial cluster development
- Positioning Cumbria as a test bed for renewable energy technologies and community led developments
- Supporting energy resilience and security through delivering storage solutions.

CLEAN ENERGY GENERATION

- Offshore Wind
- Nuclear
- Hydrogen / CCUS
- Renewables



NET ZERO
in
CUMBRIA



DECARBONISATION

- Domestic
- Public Sector
- Transport
- Business
- Natural Environment



“Cumbria’s unique natural assets and industrial heritage will provide the platform to become a major contributor to UK clean energy generation, delivering on our net zero and levelling up ambitions through securing investment to support sustainable economic growth”

CONTRIBUTION TO UK RENEWABLE ENERGY GENERATION

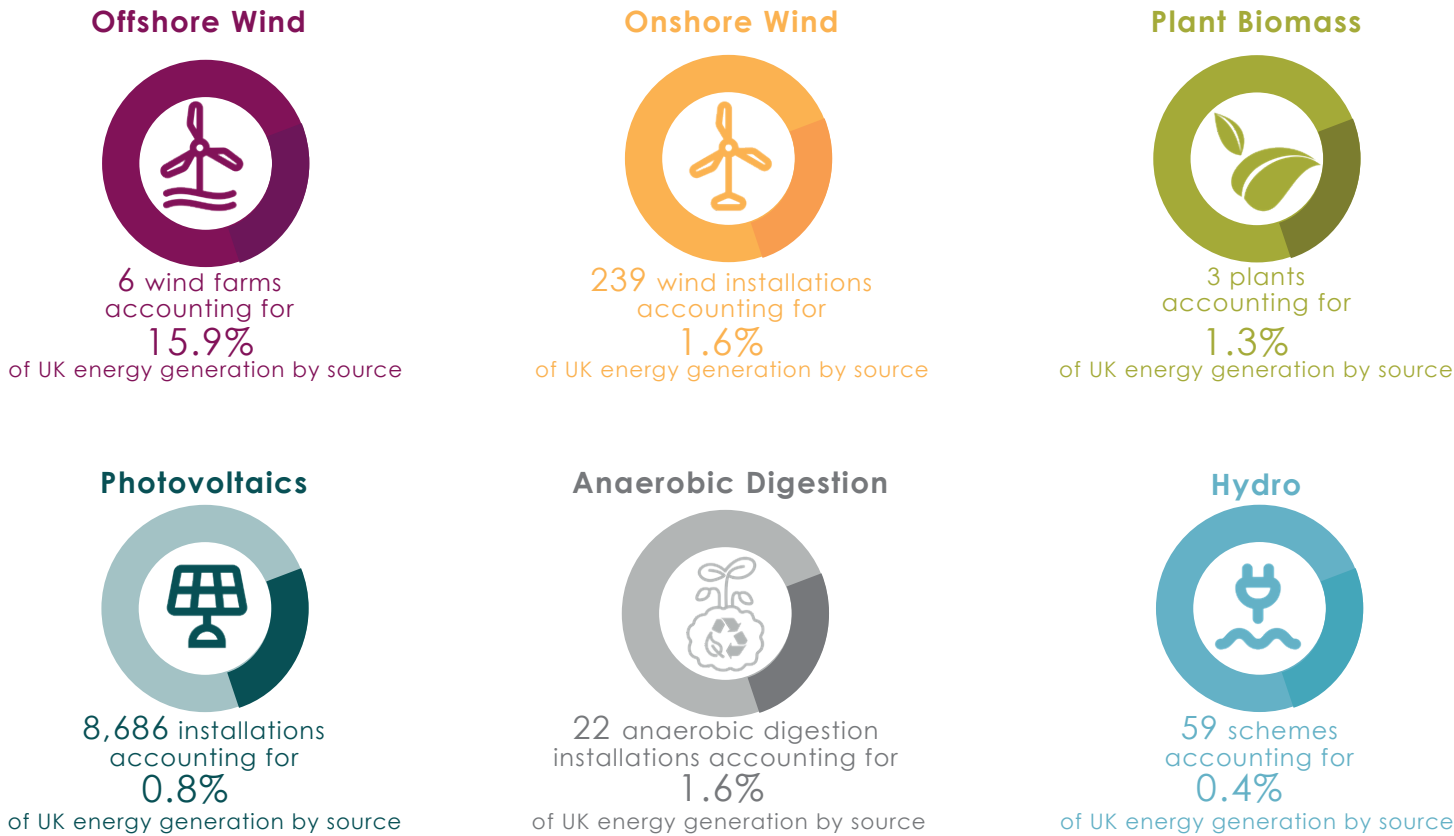
National Position

Across the UK there has been strong growth in renewable energy generation and capacity. Over the period 2009 to 2021, total generation capacity increased sixfold from 8,000 MW to 49,400 MW and the total amount of renewable electricity generated rose from 25,200 GWh to peak at 134,60 GWh in 2020 (a fivefold increase). By 2020 renewables accounted for 43% of all electricity generation, although that fell to 39% in 2021 due to less favourable weather conditions.

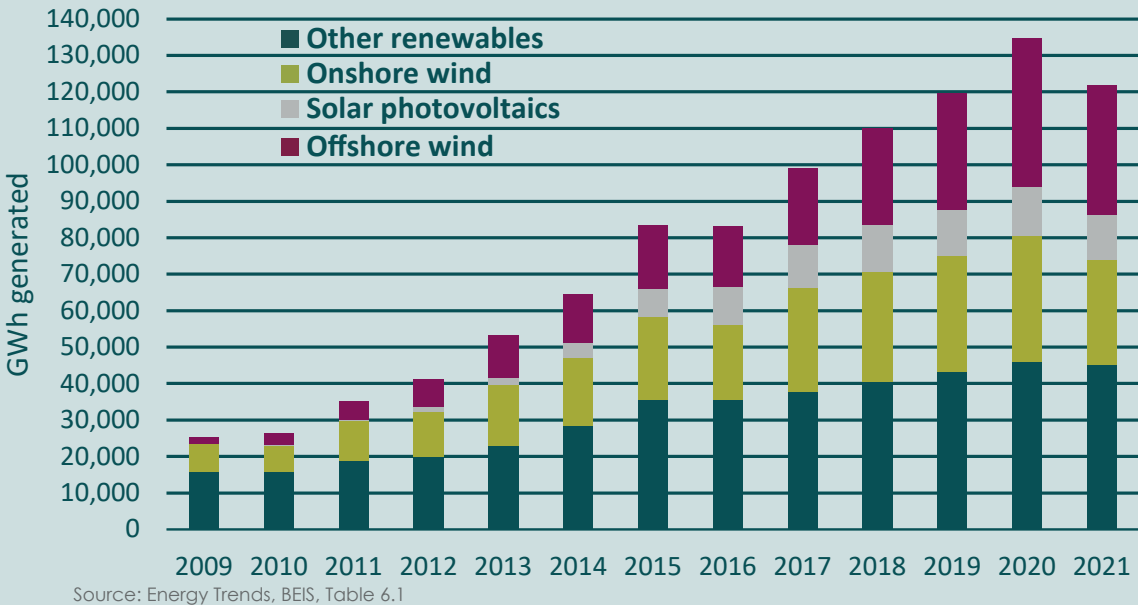
Cumbria's Contribution

Cumbria makes a substantial contribution to UK renewable generation and capacity. It is estimated that Cumbria accounted for 4.3% of all installed UK capacity in 2020 (MW) and 5.6% of all UK electricity generation (GWh). This is well ahead of its share of UK population (0.7%) and land mass (2.8% of UK total). Clean energy generation in Cumbria is relatively widespread but typically small scale with the notable exception of offshore wind energy renewables.

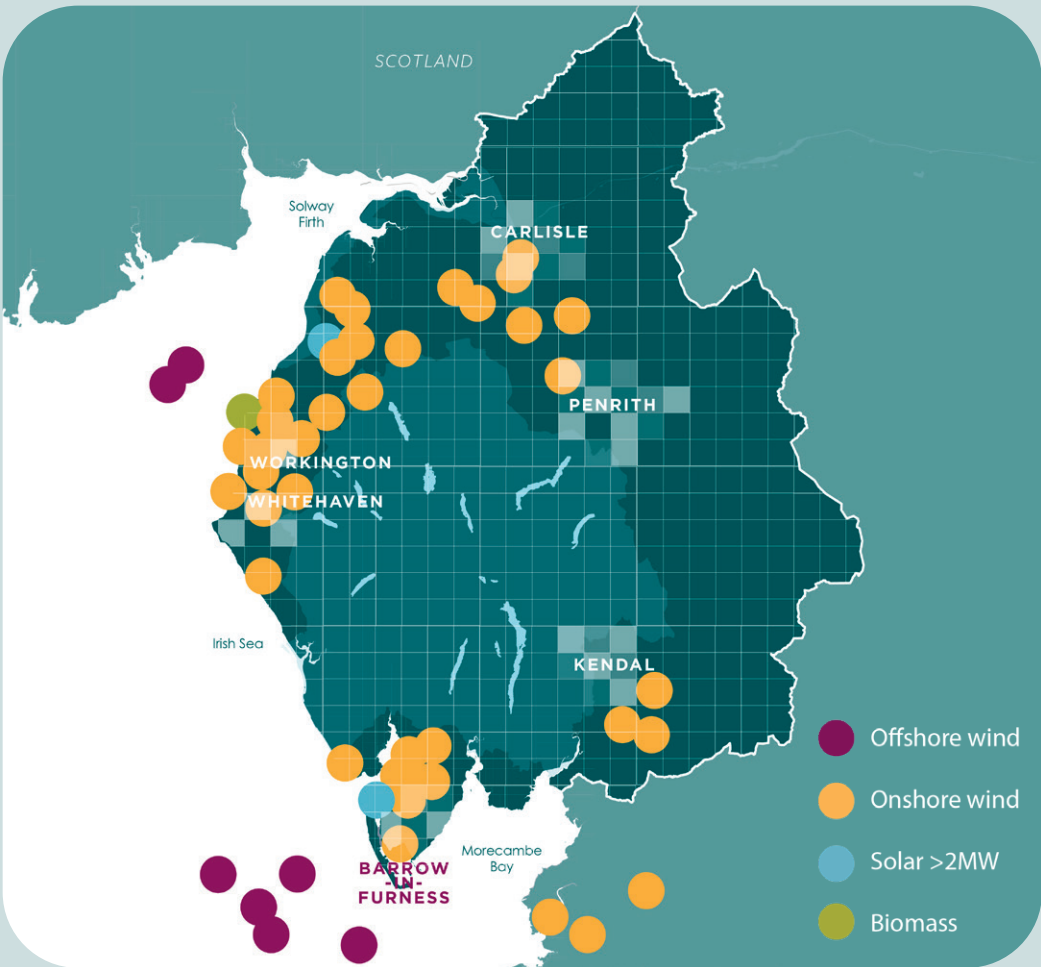
SOURCES OF RENEWABLE ENERGY IN CUMBRIA



Growth in UK renewable energy generation



Current Clean Energy Production in Cumbria



Source: NP11 Energy & Clean Growth Report & CLEP

NET EXPORTER TO THE NATIONAL GRID

The official data for offshore wind generation allocates installed capacity to where the supply 'lands'. This allocates a substantial proportion of capacity to Lancashire. In reality, the six wind farms in the Morecambe Bay/Irish Sea area off Barrow are part of the Cumbria renewable energy supply, accounting for 1,656 MW capacity and 16% of the UK total in 2020. In contrast, Robin Rigg wind farm in the Solway Firth is in Scottish waters but 'lands' at Workington.

Cumbria consumed 2,848 GWh of electricity in 2020. If all the wind energy produced in the Walney wind farms were included in Cumbria's renewable generation then Cumbria is a significant exporter to the national grid, with renewables production accounting for 305% of consumption.

| Renewables generation capacity and actual electricity generation 2020 | | | | | | |
|---|-----------------------------------|--------|---------------|--------------------------------------|---------|---------------|
| Source | Installed capacity MW end of 2020 | | | Electricity Generation in 2020 (GWh) | | |
| | Cumbria | UK | Cumbria share | Cumbria | UK | Cumbria share |
| Photovoltaics | 111 | 3,462 | 0.8% | 104 | 13,158 | 0.8% |
| Offshore wind* | 329 | 10,383 | 3.2% | 1,289 | 40,681 | 3.2% |
| Onshore wind | 214 | 4,102 | 1.5% | 549 | 34,688 | 1.6% |
| Hydro | 7 | 1,876 | 0.4% | 24 | 6,754 | 0.4% |
| Anaerobic Digestion | 9 | 38 | 1.6% | 47 | 2,904 | 1.6% |
| Plant Biomass | 52 | 4,553 | 1.1% | 344 | 26,845 | 1.3% |
| Other | 8 | 2,900 | 0.3% | 16 | 9,573 | 0.2% |
| *Total | 730 | 47,813 | 1.5% | 2,373 | 134,681 | 1.8% |
| **All offshore wind allocated to Cumbria | 1,656 | 10,383 | 15.9% | 6,488 | 40,681 | 15.9% |
| Revised total renewables | 2,057 | 47,813 | 4.3% | 7,572 | 134,603 | 5.6% |

Source: Renewable electricity by local authority 2014 - 2020. Note Cumbria offshore wind share for generation adjusted by applying share of capacity to total UK offshore wind generation in 2020. *The share is based on the wind capacity allocated to Barrow (329MW) and excludes the share allocated to Lancaster (1,327 MW) **This share includes the proportion allocated to Lancaster on recognition that the six wind farms in Morecombe Bay (Irish Sea) are part of the Cumbria renewable energy supply

STRATEGIC FOCUS ON CLEAN ENERGY GENERATION

Cumbria Local Enterprise Partnership (CLEP) has identified twin priorities in relation to Net Zero – Clean Energy Generation and Business Decarbonisation - to meet Government's target of 2050 and to support Cumbria's aspiration to achieve this as soon as possible. CLEP is fully committed to transport decarbonisation and maximising the benefits from Natural Capital but recognises that other partners are best placed to lead on these priorities. This strategy outlines Cumbria's assets and capabilities in delivering clean energy generation, leveraging in investment in this and thereby supporting the transition to a low carbon economy.

It recognises Cumbria's long established nuclear and energy excellence, and the natural resources Cumbria has to lever as a major player and contributor to UK renewable energy generation. The sector supports high value supply chain clusters, which in turn support jobs, skills and education, innovation and technology.

The strategy focuses on the commercial and business-led clean energy opportunities, which will make the most significant contribution to meeting the UK's energy requirements as defined by energy capacity and generation and will drive diversification and productivity in Cumbria's economy as defined by jobs, exports and GVA.

It:

- Establishes Cumbria's clean energy credentials and prospects for growth
- Sets out a pathway for developing clean energy generation in Cumbria
- Creates a shared vision for clean energy in Cumbria

- Encourages public and private sector investment in clean energy generation to support economic growth and the levelling up agenda.

Delivery of the Cumbria Clean Energy Strategy will yield positive economic, social and environmental outcomes for Cumbria, including:

- Diverse low carbon economy
- More resilient energy supply facilitating affordable power
- Reduction in CO² emissions and improved air quality
- Enhanced productivity and increased exports
- Creation of green job opportunities
- New products and services driving benefits for local businesses and boosting competitiveness.

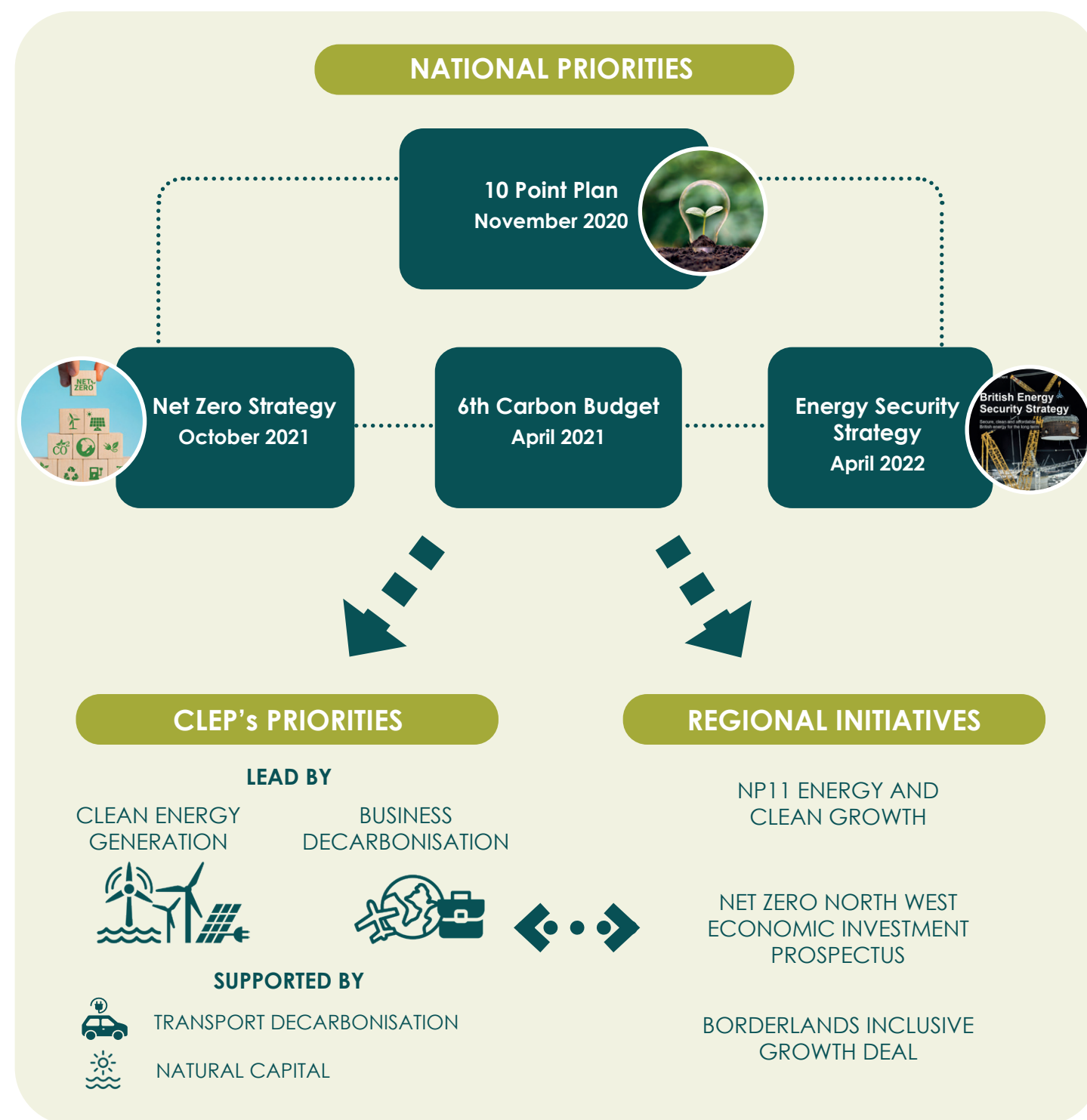
The Clean Energy Strategy aligns with complementary strategies which will deliver the enabling infrastructure to realise the benefits of clean energy generation and deliver impact in our communities. Aligned strategies such as the Local Skills Report 2022 and Cumbria Transport Infrastructure Plan 2022-2037 will be taken forward in parallel to deliver the enabling infrastructure and necessary skills. In addition, active engagement with National Grid, Network Operators and other statutory bodies will facilitate vital connections.

The delivery of the Clean Energy Strategy will be led by Cumbria Local Enterprise Partnership and overseen by the Clean Energy Sector Panel, working in partnership with investors, developers and operators to drive positive economic, social and environmental outcomes.

RESPONDING TO THE NET ZERO IMPERATIVE

The UK played a key role in shaping the Paris Agreement to combat climate change and in 2019 enshrined a commitment into law to reduce its contribution to global warming by 2050 through net zero emissions. In April 2021 this included an obligation to secure

a 78% reduction by 2035. The Ten Point Plan for a Green Industrial Revolution details the UK's approach to meeting this commitment, including advancing investment in low carbon power and growing employment within low carbon industries.



Cumbria can make a significant contribution to delivering the Ten Point Plan. This Clean Energy Strategy directly aligns with the ambition to deliver:



Point 1: Advancing Offshore Wind



Point 2: Driving the Growth of Low Carbon Hydrogen



Point 3: Delivering New and Advanced Nuclear Power



Point 8: Investing in Carbon Capture, Usage and Storage

The **Net Zero Strategy: Build Back Greener** seeks to build on this progress, setting out plans for reducing emissions from each sector of the economy. The Net Zero Strategy sets out the ambition to full decarbonise the British power system by 2035:

“Our power system will consist of abundant, cheap British renewables, cutting edge new nuclear power stations, and be underpinned by flexibility including storage, gas with CCS, hydrogen and ensure reliable power is always there at the flick of a switch”

The **British Energy Security Strategy** sets out the ambition to deliver secure, clean and affordable British energy for the long term. This builds on the ambitions set out in the ‘Ten Point Plan’ and ‘Net Zero Strategy’ and provides a strategic response to rising global energy prices and the need to boost and diversify sources of homegrown energy that is affordable, clean and secure.

The strategy includes a commitment to the significant acceleration of nuclear investment, with the ambition of up to 24GW to come from nuclear power by 2050. The strategy sets out plans to set up a new Government body, Great British Nuclear, and to bring forward new projects, including large scale new nuclear power plants and smaller scale Small Modular Reactors (SMRs) and Advanced Modular Reactors (AMRs), using new technologies. A decision is also set to be taken in 2022 on the location for a prototype nuclear fusion plant, a first-of-kind Spherical Tokamak for Energy Production (STEP) facility. The Moorside site in West Cumbria is one of the final five shortlisted locations.

The role of gas in the transition to clean energy, including utilising the empty caverns for CO₂ storage and delivering on the commitment to four Carbon Capture Usage and Storage (CCUS) clusters by 2030 is outlined. Hydrogen provides an alternative to natural gas, and the strategy sets out the intention to double the UK ambition for hydrogen production to up to 10GW by 2030. This includes a target of 1GW of CCUS-enabled hydrogen by 2025.

The UK is a global leader in offshore wind and a pioneer in floating wind. The strategy articulates the ambition to deliver up to 50GW by 2030, including up to 5GW of floating wind.

The **Net Zero North West Economic Investment Prospectus** sets out an ambition to transition the North West as the UK's first decarbonised region and industrial cluster to meet the net zero goal by 2040. The North West of England currently produces approximately 38 mega-tonnes of carbon dioxide. The Prospectus sets out how the Net Zero target will be achieved through the delivery of 3 key objectives:

- Delivery of a fully integrated decarbonised industrial cluster driving a sustainable economy
- Securing clean energy as a platform for all decarbonisation activities across the North West
- Creating the eco-system and market for hydrogen to support decarbonisation.

The Prospectus sets out 18 investment cases to deliver this ambition, which collectively would unlock £206.9bn of planned spending, securing or creating 660,000 jobs, and growing the economy by £285bn in GVA.

The **CLEP Local Industrial Strategy** (LIS) sets out a vision for Cumbria as:

“The place to live, work, visit and invest sustainably – where exceptional industry and innovation meets a breathtakingly beautiful and productive landscape”

A key priority of the LIS includes identification of the opportunities for innovation in clean growth. CLEP is committed to supporting Cumbria's ambition to reach Net Zero ahead of the current Government commitment and has agreed two priorities for the organisation to focus on:

- Supporting Clean Energy Generation
- Supporting Cumbria's Businesses to Decarbonise.

The **Restart, Reboot, Rethink – A Plan for Cumbria's Economic Recovery** established a focus on six 'rethink' themes, including 'Clean Energy Production – a world-recognised heritage and expertise, which provides the platform for significant future investment in energy generation'.

The **CLEP Futures Framework** identifies 'Sustainable Cumbria' as a key objective to retaining and attracting young people: addressing the climate and environmental crisis by greening the economy, capitalising on Cumbria's strategic position as a pioneer in the clean energy sector; and provide much needed employment opportunities to support diversification and growth.

The **Cumbria Nuclear Prospectus** sets out an ambition for the growth of a Cumbrian energy cluster, with nuclear as a key component of a low carbon, clean growth economy. The Prospectus articulates the strengths of Cumbria as a Centre of Nuclear Excellence which can support diversification and export, and development of nuclear new build and advanced nuclear technologies.

The **Borderlands Energy Masterplan** is part of the £450m Borderlands Inclusive Growth Deal which was signed in March 2021 and includes encouraging green growth through investment in energy transition as one of four key investment themes with provision of £53.1m to stimulate growth. The Energy Masterplan establishes an energy baseline to enable investment through Local Area Energy Investment Plans. This CLEP Clean Energy Strategy aligns with the Borderlands Energy Masterplan and it is believed that the Growth Deal can facilitate a significant contribution from renewable energy generation in the more rural areas of the region.

This **Clean Energy Strategy** sets out our plan to deliver against these policy ambitions and position Cumbria as a key contributor to clean energy generation in the UK.

This strategy focuses on Clean Energy generation. Business decarbonisation is addressed in the separate CLEP 10 Point Business Decarbonisation Plan that sets out a way forward spanning large carbon emitting industries through to SMEs across every sector. There are links between clean energy generation with decarbonisation and these links are picked up in the thematic areas of focus notably in the Hydrogen chapter.



OUR CLEAN ENERGY CREDENTIALS

LONGSTANDING CONTRIBUTION TO UK ENERGY REQUIREMENTS

Cumbria has a longstanding history in the generation of nuclear power, as a pioneer in nuclear energy through the Windscale Pile reactors, Calder Hall and Windscale Advanced Gas-cooled Reactor prototype, which were the seeds of the UK's nuclear programme. The Sellafield site has built generations of globally recognised experts in nuclear plant operations, construction management, material science, decommissioning, and research and development. Furthermore, the nuclear technology underpinning the nuclear submarine industry in Barrow supports diversification into the civil nuclear market.

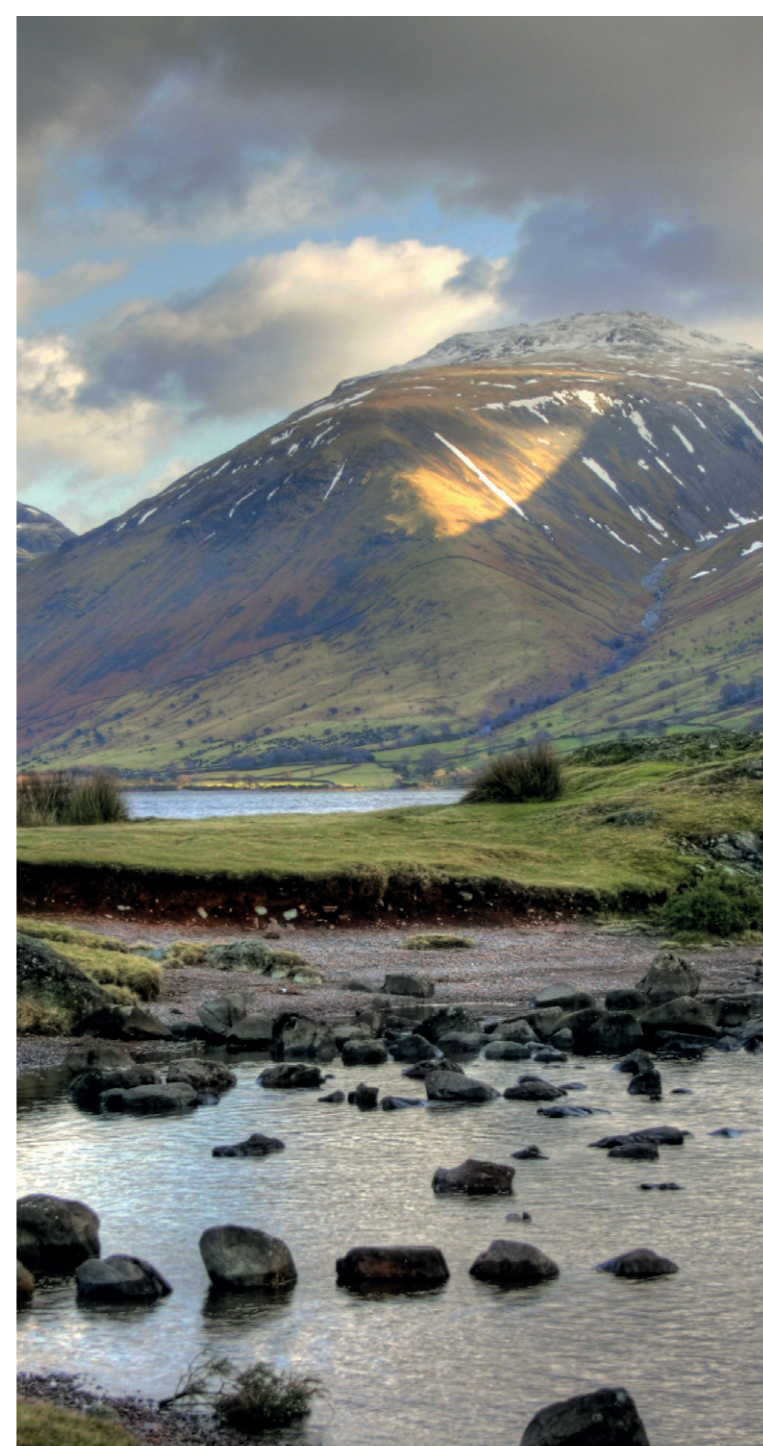
Since 1985 more than 6.5 trillion cubic feet of gas from the east Irish Sea has been landed and processed at the Barrow Gas Terminals operated by Spirit Energy. At its peak, the Morecambe Bay gas hub supplied 10% of domestic gas demand and played a big part in the UK's conversion from coal to gas. Today, the hub is contributing enough energy to heat 1 million homes but is expected to reach the end of its gas production life in the mid-to-late 2020s. As part of Spirit Energy's refocused business, the company is maturing plans for the conversion of its Morecambe Bay gas hub into a net zero cluster of national scale and importance focused on hydrogen and carbon capture usage and storage.

There are currently six offshore windfarms off the Cumbria Coastline, and the towns of Barrow and Workington have strong capabilities as operation and maintenance hubs servicing these requirements.

This longstanding energy experience has developed a strong ecosystem of professional and technical expertise which can fuel growth in clean energy in the future.

RICH NATURAL CAPITAL

Cumbria is rich in natural capital, which will play a vital role in helping the area achieve net zero carbon emissions through carbon sequestration and low carbon energy generation. The Clean Energy Strategy will connect clean energy generation opportunities to the assets we have to lever, including the coast line and river systems, geothermal potential, and the sea bed, disused mines and salt caverns.



SKILLED AND INNOVATIVE TALENT POOL

The ambitions set out in this strategy require effective collaboration between investors and providers to strengthen Cumbria's skills base to support the clean energy sector to expand by investing in the workforce of the future and enabling local residents to access the new jobs being created.

The University of Cumbria is investing heavily in new campuses in Carlisle and Barrow which will be a key driver for the further development of higher level skills. In addition, there are strong linkages to the University of Lancaster and the University of Central Lancashire, alongside four strong performing Further Education colleges and an extensive network of training organisations, which provides a strong base for enabling the provision of future skills to meet demand. Cumbria has specific nuclear, manufacturing and offshore academic and training facilities including the University of Manchester Dalton Facility, Energus, National College for Nuclear, Gen 2, the Energy Coast UTC and the Advanced Manufacturing Technology Centre at Furness College.

The Local Skills Report 2022 identifies the need to look to the future and the skill needs of a green, low carbon economy. The Skills Advisory Panel will work with the Clean Energy Sector Panel to identify the skills and support required for this transition and will facilitate opportunities to develop the future talent pipeline to serve clean energy investments.

SUPPLY CHAIN STRENGTHS

Cumbria has exceptional manufacturing and engineering capability, with one of the most important concentrations in the UK accounting for 21% of total GVA. The manufacturing sector has strength and depth with expertise in nuclear in addition to advanced manufacturing specialisms such as marine engineering and sub-sea technologies which provides significant scope for diversification to support clean energy sectoral growth.

There is significant depth to the professional and technical services supporting the delivery of major projects in Cumbria, which provides a key strength. This includes civil engineering construction and architectural/engineering skills linked to specialist construction, especially nuclear activity, that takes place.

Growth in the clean energy sector will present local SMEs in Cumbria with major supply chain and value adding opportunities, building on our strengths to grow opportunities for diversification and export.



ENABLING INFRASTRUCTURE

Cumbria has the enabling infrastructure to support growth and secure investment in clean energy generation.

Strategically Connected

Cumbria sits at the heart of the UK on a vital cross roads between England and Scotland, supporting critical north/south (M6/West Coast Mainline) and east/west links (A66 and A69). Strategic connections include the Port of Barrow and Port of Workington,

and Carlisle Airport enable supply chain development and trade with trade with Scotland, Northern Ireland and the Republic of Ireland. Rail infrastructure includes the West Coast Main Line, Furness Line providing connections to Manchester Airport and London, and the Cumbria Coast Line connecting Barrow to Carlisle via the west coast, including Whitehaven, Sellafield and Workington.

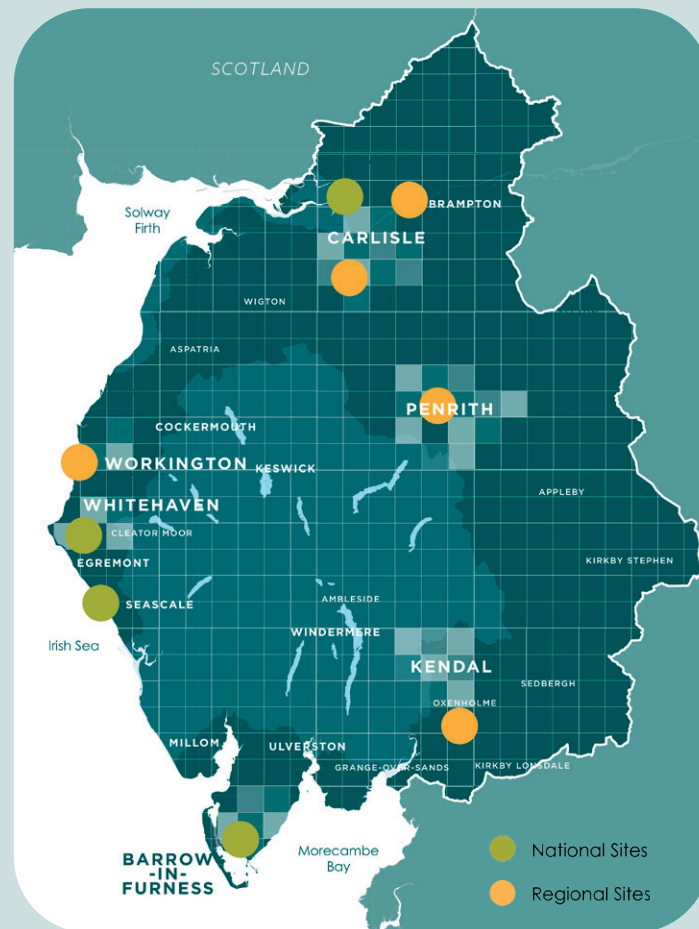
Critical Transmission And Storage Networks

Cumbria's energy assets are connected to the National Grid through large scale gas storage transmission assets, and power transmission assets:

- The National Gas Transmission Network that supplies Cumbria is fed from the Barrow Gas Terminal. Cumbria's gas network is managed by two Gas Network Providers: Cadent in the South, and Northern Gas Networks in the North. This means that the county is connected to the North East and the Pennines via the NGN network; and Liverpool, Manchester and the Midlands via Cadent
- National Grid is responsible for the 400kv UK double circuit transmission line that runs down the M6 corridor with Cumbria connections at Harker in the north and Hutton in the south. At these two points the voltage is reduced to 132kv and distributed by Electricity North West Limited, forming the Cumbria Ring around the west coast and central spine of Cumbria
- Two Battery Energy Storage Systems (BESS) exist in Cumbria that provide service to the National Grid. The Roosecote Battery Energy Storage System site based at Barrow in Cumbria is a 49MW Battery Energy Storage Site and the Cleator battery storage project is a 10MW Low Carbon Battery Park. These storage systems provide electricity to the grid on an on-demand basis.

Sites And Premises

There are a range of commercial sites and premises in Cumbria that are well suited to supporting growth in the clean energy sector. These sites can meet the requirements of clean energy producers and consumers to facilitate business growth and job creation.



THE ECONOMIC SCALE AND CONTRIBUTION OF CLEAN ENERGY

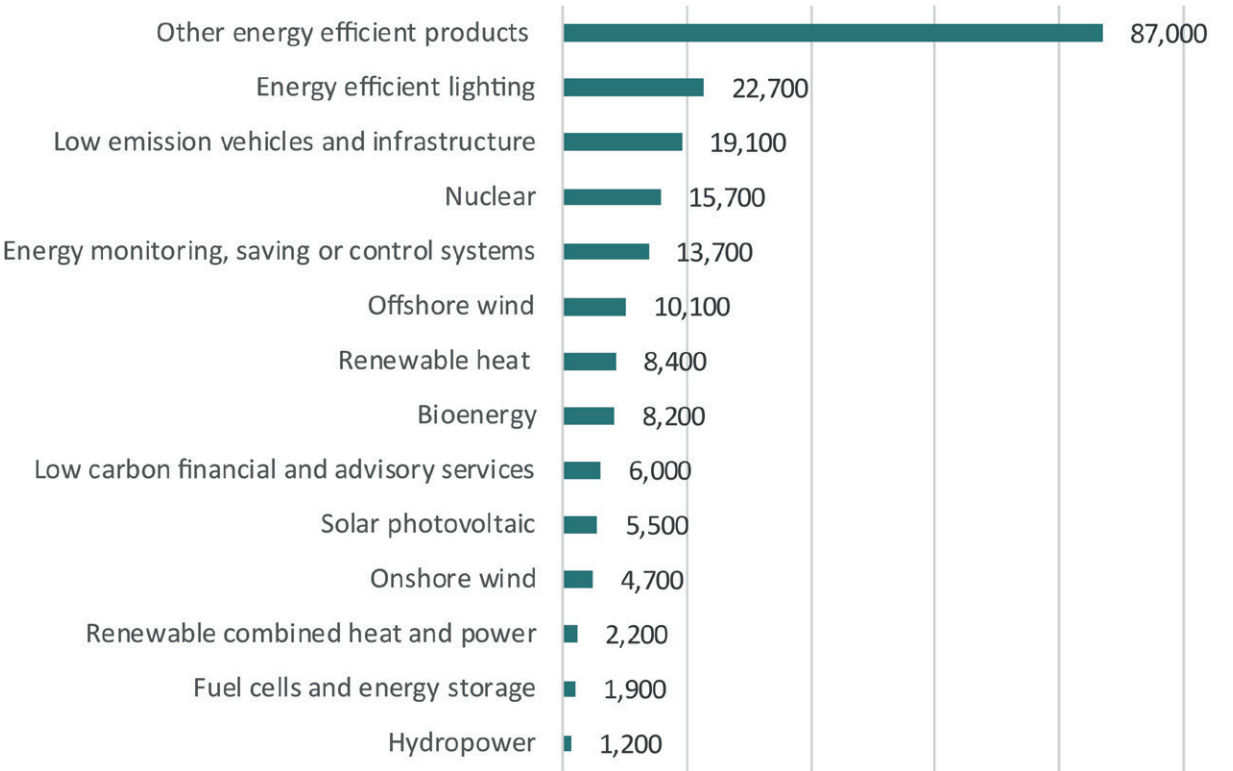
The Clean Energy sector makes a substantial and increasingly important contribution to the economy.

QUANTIFYING AND CHARACTERISING THE CLEAN ENERGY SECTOR IN CUMBRIA

There are a variety of ways of defining and measuring the current scale of the clean energy sector. The Low Carbon and Renewable Energy Economy (LCREE) definition by ONS considers firms directly

producing renewable energy or low carbon products and does not include the supply chain for these firms. Nationally, the LCREE sector generated £41.2bn in turnover, with employment of 207,800 full-time equivalent (FTE) employees.

FTE jobs in LCREE, by sector 2020 in the UK



Source: ONS, Low Carbon and Renewable Energy Economy (LCREE) survey estimates, UK, 2014 to 2020

Main EGSS sectors in the UK in terms of output, 2019



Note: "other" comprises energy saving and sustainable energy systems, environmental consultancy engineering, environmental-related education, in-house environmental activities, insulation activities, management of forest ecosystems, managerial activities of government bodies, organic agriculture, production of industrial environmental equipment, production of renewable energy, and waste water.
Source: ONS, UK environmental goods and services sector (EGSS), 2019

LCREE sectors and businesses are primarily found in the manufacturing, energy, construction and professional/scientific services sectors (91% of jobs and turnover). It is important to note that these estimates have limitations: they are based on a survey and the definitions do not necessarily accord with other definitions for example the nuclear estimates exclude all decommissioning activity and are considerably smaller than the UK Nuclear

Industries Association estimate of 61,000 jobs across the UK that includes the supply chain and decommissioning.

Alternative estimates for the UK environmental goods and services sector (EGSS) estimates the size of the sector as having an output of £89bn, with GVA of £45.2bn and employment of 394,900 FTE employees in 2019. This takes a much broader definition.

There are a variety of businesses which are linked to the clean energy sector in Cumbria, however establishing robust data on the current scale of economic activity linked to the sector is difficult as:

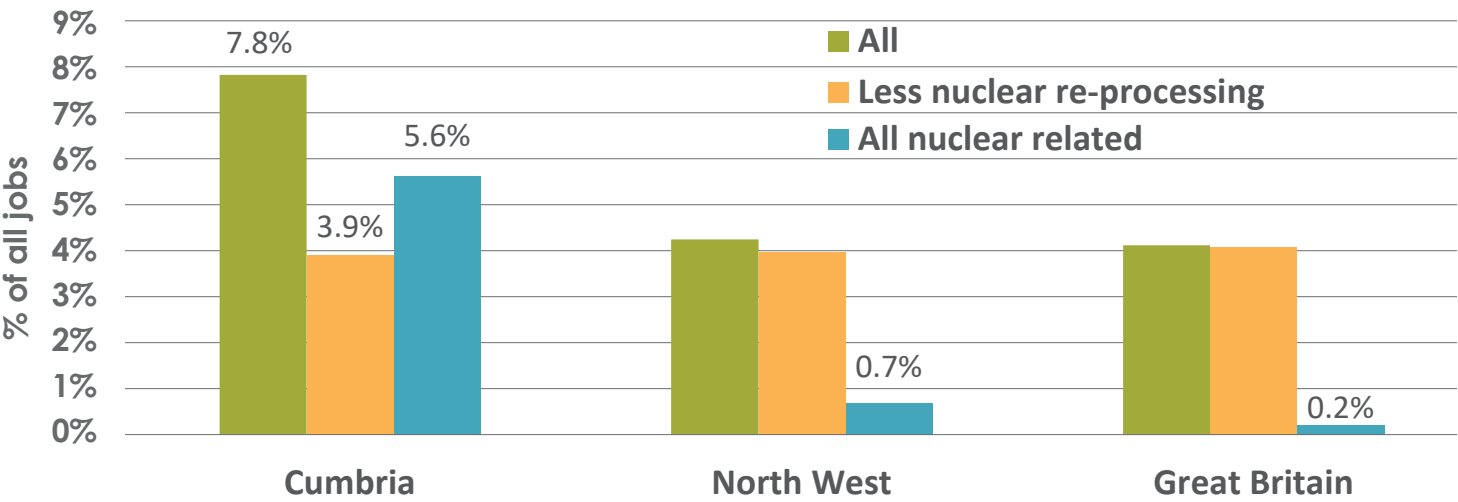
- Firstly, the SIC definitions of economic data for Cumbria and its degree of disaggregation (for GVA for instance) does not lend itself to applying to the sector
- Secondly, many firms are involved in only partly delivering goods and services to the clean energy or renewables sector (which is why the ONS surveys businesses). For instance there are firms in Cumbria in the engineering/manufacturing sector which serve the offshore oil and gas sector (not renewable) but also the nuclear and offshore wind sectors

- Thirdly, much of the interest and opportunity is in the supply chain.

Two definitions, based on SICs, have been applied to estimate the proportion of jobs in Cumbria, which are potentially related to clean energy and low carbon (LCE) in its broadest sense. It is important to note that this approach cannot, and does not, capture the **actual footprint** of the clean energy or low carbon economy, but is indicative of its scale and distribution.

The estimates suggests that some 20,000 jobs (8% of Cumbria's total) could be in the Low Carbon Economy. This is a higher share than the North West or Great Britain (both 4%). A slightly tighter definition suggests around 18,000 jobs (7% of Cumbria's total) and 3% regionally and nationally.

Low Carbon economy jobs



Source: Nicol Economics analysis. Note: nuclear related is data provided by the NIA for civil nuclear activity and its supply chain

The reason for the much larger share in Cumbria is almost entirely down to the inclusion of nuclear decommissioning (c. 10,000 jobs). If this is excluded, then the share of employment in the LCE is very similar to the regional and national level at 4%.

To put these figures into context, data provided by the Nuclear Industries Association suggest that in 2021 the total number of jobs related to the civil nuclear sector in Cumbria was around 14,300 (or 5.6% of all jobs in Cumbria, compared to 0.7% in the North West and just 0.2% nationally). Therefore the number of jobs associated with non-nuclear activity is relatively small.

FUTURE GROWTH PROSPECTS AND OPPORTUNITIES

Research for the Local Government Association² estimates that renewable and low carbon technologies could support around 1.4 million jobs across the UK by 2050. This compares to the most recent ONS estimate of 202,000 green economy jobs under the LCREE definition, implying an average growth rate of 6.4% per year. The research estimates assume that much of the job creation could be concentrated in the short term: approximately 600,000 green jobs by 2030.

An earlier paper by Ricardo Energy and Environment for the Climate Change Commission suggested that the number of jobs supported in the LCREE could be substantially greater at around 2.5 million by 2050.

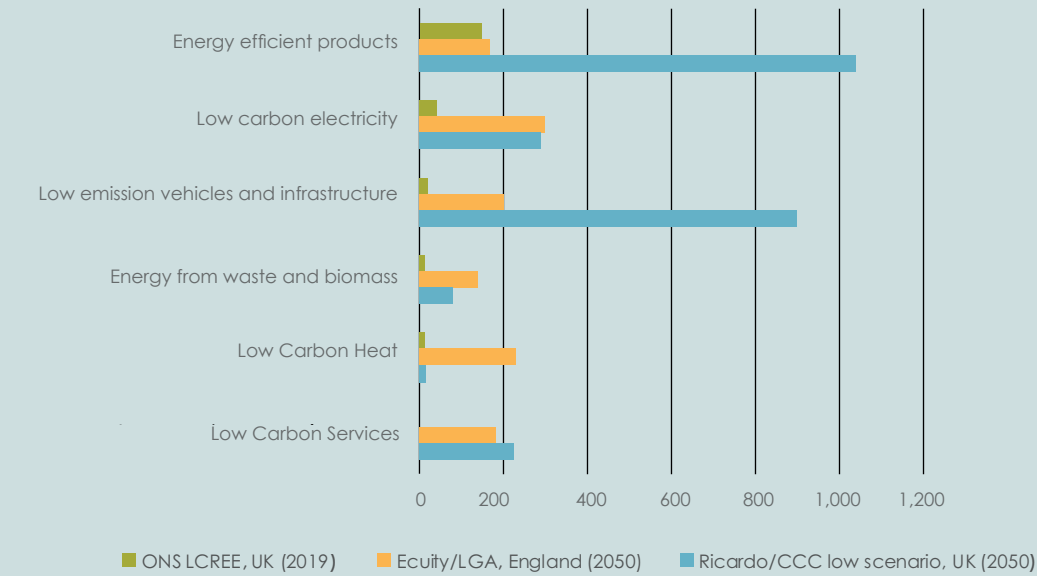
² Local green jobs – accelerating a sustainable economic recovery, Ecui-ty Consulting report for the Local Government Association (LGA)



The UK Government's latest Net Zero Transition Plan suggested that there could be around 200,000 jobs supported by the transition by 2024/5 and a further 250,000 so rising to 444,000 by 2030. This is of the same order of magnitudes as the LGA estimates.

| Estimate of jobs supported by Net Zero Strategy pathways, by sector and date | | | |
|--|--------------------------|----------------------|------------------------------------|
| Sector | Jobs supported by 2024/5 | Extra 2024/5 to 2030 | Total extra jobs supported by 2030 |
| Power | 59,000 | 61,000 | 120,000 |
| Fuel Supply | N/A | 10,000 | 10,000 |
| Industry (carbon capture, usage and storage only) | 5,000 | 49,000 | 54,000 |
| Heat and buildings | 100,000 | 75,000 | 175,000 |
| Transport | 22,000 | 52,000 | 74,000 |
| Natural resources, waste and F-gases | 2,000 | 0 | 2,000 |
| Greenhouse gas removals | N/A | | N/A |
| Total | 190,000 | 250,000 | 440,000 |
| Source: Net Zero Strategy: Build Back Greener, October 2021, BEIS Table 12 | | | |

Future jobs potential from LCREE considering current and future forecasts to 2050



Source: Green Growth: Opportunities for the UK, A Report for Lloyds Banking Group, Oxford Economics, July 2021

An Energy Innovation Needs Assessment (EINA) carried out by the UK Government in 2019 developed estimates of the economic potential of 11 technology areas. The largest source of potential employment identified related to the deployment of new nuclear fission technology in power generation. The next largest sectors relate to road transport, which includes both the design and manufacture of electric vehicles, and other developments in road transport such as smart logistics, and “building fabric” which includes work to improve the construction and design of buildings, and retrofit existing building.

There is a very high degree of uncertainty about the scale of the opportunities at a UK level from the future clean energy or low carbon economy. This reflects the following:

- Firstly, the current position and importance of the sector which is far from clear
- Secondly, the difficulties of defining where the opportunities are and how the UK policy and economy will adopt to its own needs

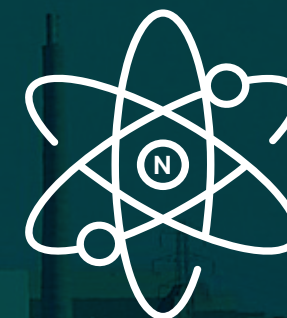
- Thirdly, the extent to which UK firms will meet the needs in the UK and globally for new or adopted goods and services linked to the clean energy economy.

These uncertainties are exemplified in the following figure. Nevertheless, the figures show the massive scale of the opportunities over the next 2 to 3 decades.

Cumbria's ability to take a share in these future opportunities will depend on a variety of factors including Cumbria's role in the direct generation of clean energy (construction and operation) and the role of Cumbrian firms in supplying the sector. The areas where Cumbria has a unique position are explored in subsequent chapters of the strategy and include:

- New nuclear
- Fusion and innovation
- Offshore wind
- Hydrogen & CCUS
- Renewable Energy Technologies
- Networks Storage & Flexibility

FOCUS ON NEW NUCLEAR



NATIONAL POSITION

Government's vision is for Nuclear Fission to play a key role in UK Clean Energy generation has been laid out progressively in the 10 Point Plan, Net Zero Strategy and most recently the Energy Security Strategy published in April 2022. There is a clear ambition to embrace the safe, clean and affordable new generation of nuclear reactors taking the UK back to a pre-eminence in a field where we once led the world. Currently, nuclear provides about 15% of UK electricity demand and without further investment this will rapidly diminish as existing stations reach end of life. EDF is currently constructing the 3.2GW Hinkley Point C nuclear power station in Somerset that is expected to come on line in 2026 and the Energy Security Strategy recognises the Moorside area adjacent to Sellafield as one of 8 sites currently designated in the UK for new nuclear facilities and sets out the following ambitions:

- Increase nuclear generation capacity to 24GW by 2050 to contribute up to 25% of UK's electricity demand
- Take 1 new facility to Final Investment Decision in the 2022 parliament session with 2 further facilities in the next 2023 session leading to a potential of approximately 8 further facilities
- Establish a "Great British Nuclear Vehicle" to accelerate the delivery of nuclear projects to meet the challenging timescales without any compromise to safety.

REACTOR TYPOLOGY:

Large 'GigaWatt' Nuclear Facilities

These are GigaWatt scale stations each with multiple reactors. Hinkley Point C is a EDF developed European Pressurised Water Reactor. EDF is in advanced negotiation with Government to deliver a second project at Sizewell C and are part of a consortium that has expressed strong interest beyond that at Moorside. In addition to providing electricity to the national grid they offer opportunities for direct CO2 capture from air and uses for co-generation of hydrogen for industry. A Bechtel led consortium is in active discussion with Government over a similar scale Westinghouse "AP1000" reactor site at Wylfa in North Wales. These gigawatt reactors offer the highest clean energy generation capacity, make use of proven technology but have the highest capital cost and the longest timescale for delivery.

Small Modular Reactors (SMRs)

Small Modular Reactors (SMRs) have thermal power output typically less than 1GW and are designed to be manufactured at factories for installation on site. These offer potential cost and schedule advantages, if sufficient repeat orders are obtained and have passive safety features. RR-SMR is a Rolls Royce led consortium that has attracted £490m of public/private backing to develop a Light Water ~500MW reactor. A number of manufacturing facilities will be built to enable the delivery of a first phase of up to 6 reactors and then to expand further as a wholly commercial venture in UK and worldwide. RR-SMR recognise the Sellafield

area as a potential site for first phase deployment and Cumbria can offer the manufacturing capability and sites for the factories needed.

There are a wide range of other SMR types that are being developed world-wide and developers are actively seeking suitable sites in the UK. They potentially can be delivered without Government support but will need designs to be approved through the UK regulatory process.

Advanced Modular Reactors (AMRs)

Advanced Modular Reactors (AMRs) would be a new generation of nuclear reactors that use novel fuels and coolants. They would use a similar modular build approach to SMR but offer potential for operation at higher temperature that could be utilised for direct hydrogen and synthetic fuel manufacture. A recent Government consultation has identified High Temperature Gas Reactors as the preferred technology and a BEIS procurement process has commenced to develop the concept.

CURRENT STATUS IN CUMBRIA

In 1956 Calder Hall was the first nuclear power station in the world to export electricity to a national grid and the Windscale Advanced Gas-cooled Reactor (AGR) facility paved the way for the deployment of AGR reactors across the UK, which has formed the backbone of the current UK nuclear power capability. Nuclear power generation in Cumbria ceased in 2003 with the closure of Calder Hall after 47 years of service.

NDA owns approximately 1100 hectares of land to the north and south of the Sellafield Site that is collectively termed Moorside. Part of this land ("the Moorside site") is designated in National Policy Statement EN-6 as suitable for new nuclear development. Some of this land is reserved for Sellafield related activity and Waste Management development but still leaves significant potential for a range of nuclear power developments that need to be considered in conjunction with nuclear fusion and the STEP prototype bid that is addressed separately in the following section. This designated land is a valuable asset for the UK to achieve its stated ambition for new nuclear development.

Through the nuclear decommissioning programme at Sellafield, waste management at the Low Level Waste Repository and the Nuclear Submarine programme at Barrow, Cumbria has built an extensive nuclear capability with a supportive supply chain and skills development infrastructure. The National Nuclear Laboratory's nuclear technology development capability together with other research facilities such as Manchester University's Dalton Cumbria Facility and RAICO robotics development facility mean that Cumbria has the full infrastructure in place to support the development of nuclear power. This applies at both county level and in supporting development across the UK.

The potential to deliver new nuclear power in conjunction with wider nuclear decommissioning excellence is outlined in the Cumbria Nuclear Prospectus.

AMBITION

Cumbria can build on its vast experience and capability to be the preferred siting for “First of a Kind” nuclear development through fission and fusion to become a significant generator of clean nuclear energy to realise government energy security ambition.

New nuclear power can draw on synergies with major project delivery at Sellafield and BAE Systems sites to successfully deliver large infrastructure projects and through these to deliver long term socio-economic development for Cumbria.

New nuclear power has the potential to link to wider industrial decarbonisation and utilisation of hydrogen and synthetic fuels. In particular it could play a key role in the decarbonisation of the adjacent Sellafield nuclear sites. This is a concept to develop with Moorside as a Clean Energy Hub.

With Moorside identified as land designated for future nuclear expansion the forward path is to proceed with SMR delivery in the shortest possible timescale. Two reactors would deliver nearly 1GW of clean electricity generation and could be delivered by 2030. NDA and RR-SMR are in advanced discussions on a collaboration agreement to put a delivery plan in place.

Further expansion depends on the outcome of the STEP siting competition and completion of a full assessment of the NDA land availability.

There are a range of new nuclear power options and Sellafield/Moorside should be at the heart of these and support the delivery of the Government’s Energy Security Strategy, be a driver for socio-economic growth and a hub for decarbonisation of Cumbria.

New nuclear development will bring manufacturing and service opportunities for the Cumbria wider supply chain. RR-SMR is looking for sites for a number of manufacturing facilities that will support their forward programme. Potential sites in Carlisle, Barrow and Workington areas have been put forward. The wider nuclear power expansion across the UK also offers significant supply chain opportunities. A Memorandum of Understanding has been established for the north of England to deliver £2.5 billion procurements in support of the Sizewell C project with negotiations ongoing with Government and a final investment decision is expected by summer 2022.

The wider North West region including North Wales has been at the heart of the UK’s nuclear capability spanning the entire nuclear fuel cycle as well as universities and Engineering/Design capability. Through membership of the North West Nuclear Arc, we will build on synergies for the wider region to deliver the overall government ambition for new nuclear clean energy generation.

Capacity of the Electricity distribution system is a key factor for nuclear power generation in Cumbria. The engagement with the National Grid and the regional District Network Operator (DNO) Electricity North West is outlined in ...the Networks Storage and Flexibility section of the strategy.

FORWARD PLAN

| Action | Lead / Support | Timeframe |
|--|----------------|---------------------------------------|
| Deliver New Nuclear Fission Generation at Sellafield | | |
| • Put in place collaboration arrangement to deliver new SMR facility in Sellafield vicinity. | NDA/CLEP | Summer 2022 |
| • Engage with Moorside Consortium (including EDF) to re-affirm ambition for large gigawatt deployment in Cumbria and its interaction with other developments. | CLEP/NDA/SZC | Summer 2022 |
| • Maintain dialogue with AMR developers for potential deployment in Sellafield vicinity. | CLEP | Ongoing |
| Enabling Actions | | |
| • Establish an effective relationship with the new Great British Nuclear Vehicle to deliver best use of nuclear designated land and to accelerate delivery of capability | CLEP/NDA/CBC | Agree Cumbria approach by Summer 2022 |
| • Complete assessment of nuclear designated land in Sellafield vicinity to determine overall development capacity in recognition of other NDA missions. | NDA | Autumn 2022 |
| • Grow Cumbria Supply Chain opportunities for SMR manufacturing, Sizewell C and other UK new nuclear projects. | CLEP | Ongoing |



FOCUS ON FUSION AND INNOVATION

NATIONAL POSITION

Government's 10 Point Plan established a £1billion net zero innovation portfolio to accelerate low carbon technologies, business systems and business models across the net zero spectrum. BEIS has run a series of competitions across areas such as industrial hydrogen applications and CCUS, which are addressed in other chapters of this strategy.

A key Government ambition is for the UK to be the first country to commercialise fusion energy technology that has the potential to transform low carbon clean energy production on a global scale into the future beyond the short term net zero targets. Government have provided £222m funding to advance a Spherical Tokamak for Energy Production (STEP) programme that is being led by the UK Atomic Energy Authority (UKAEA).



This aims to build the first prototype facility to demonstrate commercial viability by 2040 alongside a further £184m to support wider fusion facilities, infrastructure and apprenticeships to lay the foundations of a global hub for fusion innovation in the UK.

CURRENT STATUS IN CUMBRIA

The Moorside site, adjacent to Sellafield, has been put forward as Cumbria's site in UKAEA's competition to host the STEP facility and supporting infrastructure and is one of the five sites that have been shortlisted for final assessment.

UKAEA will complete their assessment of potential sites by May 2022, with the final decision made by the BEIS Secretary of State by the end of December 2022.

Calder Hall was the first commercial fission plant and Moorside can be the first for fusion. STEP would bring a billion-pound long term investment programme to Cumbria and the North West region. STEP would also bring wider growth for fusion technology development in fields such as Cryogenics, Robotics and specialist manufacturing. It would also pave the way for fusion skills development complementing the nuclear skills training already in place in Cumbria and act as a catalyst for wider innovation delivery in Cumbria.



The comprehensive case for Socio Economic improvement in Cumbria and wider North West has been made in the application as well as demonstrating that the capability exists to deliver this long term transformational clean energy generation project at Moorside. This will build upon existing research expertise such as the Manchester University Dalton Cumbria Facility and the National Nuclear Laboratory facilities at Sellafield and Workington.

AMBITION

Moorside can be the first of a kind commercial fusion Spherical Tokamak for Energy Production (STEP) prototype to build on our 'first of a kind' delivery capability and to drive innovation, productivity and levelling up in Cumbria.

FORWARD PLAN

| Action | Lead / Support | Timeframe |
|---|----------------|-----------|
| UKAEA/BEIS to complete siting assessment for STEP Fusion (see section 6) to confirm whether Moorside is preferred site. | UKAEA/CLEP/CBC | Ongoing |
| Engage with wider fusion developers to seek prototype deployment opportunities at Moorside. | CLEP | Ongoing |
| Establish Cumbria as an innovation test bed for wide range of renewable technologies and business deployment models. | CLEP | Ongoing |

In addition to the STEP programme with UKAEA there are a number of other complementary but independent fusion developments being pursued in the UK, CLEP will explore these opportunities as they reach a stage of deployment at a commercial level.

At a wider level, Clean Energy can act as a catalyst for innovation development in Cumbria and CLEP will continue to coordinate requests from the Net Zero Innovation programme to specific opportunities in Cumbria. CLEP will act as an enabler for technology development across the entire clean energy opportunities. Examples range from advancements in tidal/wave/hydro technologies, bio-energy and other agricultural schemes to larger scale hydrogen and nuclear opportunities. Cumbria has the potential to lead the way in demonstrating the commercial viability of a wide range of clean opportunities relating to our natural renewable resources. This is further outlined in the Renewable Energy Technologies section.

FOCUS ON OFFSHORE WIND

NATIONAL POSITION

Offshore wind has formed the backbone of the UK's drive to clean energy generation with over 11GW capacity already in operation and a target of 50GW to be achieved by 2030. Costs have reduced by two thirds in the last decade and the UK is now a world leader in this field with associated high skilled job growth. The recently published Energy Security Strategy highlights the need to increase the pace of deployment that is constrained through planning and to further deploy floating wind in deeper further offshore locations in Celtic and Irish Seas.

The Crown Estate offered new leasing developments through a competitive leasing process and leasing Round 4 awards were made in Morecambe Bay but in the Scotwind auction announced in early 2022 there were no awards in the Solway Firth area. The current floating wind bidding process is focused on the Celtic Sea in the South West of the UK.

| Current Offshore Wind Farms off the Cumbrian Coast | | | |
|--|-------------|---------------------|--------------------|
| | Operational | Overall Capacity MW | Number of Turbines |
| Barrow | 2006 | 90 | 30 |
| Robin Rigg | 2010 | 180 | 60 |
| Ormonde | 2011 | 150 | 30 |
| Walney 1 and 2 | 2012 | 367 | 102 |
| West of Duddon Sands | 2014 | 389 | 108 |
| Walney Extension | 2018 | 659 | 87 |
| Total | | 1,835 | 417 |

CUMBRIA CURRENT STATUS

There is currently over 1.8GW clean energy generation capacity developed over the last 15 years around the Cumbrian coast focused around the Barrow/Morecambe Bay area and the Solway Firth. Barrow and Workington have established Maintenance & Operations hubs to support these developments, which directly employ over 400 people.



- Existing**
 - 1 Robin Rigg
 - 2 Walney Extension
 - 3 Walney Phase 2
 - 4 Walney Phase 1
 - 5 West of Duddon Sands
 - 6 Ormonde
 - 7 Barrow
- In Development**
 - 8 Morgan
 - 9 Mona
 - 10 Morecambe
- On Shore Facilities**
 - A O&M base Workington
 - B On-shore sub station at Seaton
 - C On-shore sub station at Thorton
 - D On-shore sub station at Heysham
 - E O&M base Barrow

The Crown Estate Round 4 leasing process in 2020 awarded two large developments in Morecambe Bay south of Cumbria with the 3.1 GW Mona and Morgan fields being developed by BP/ENBW and the 0.5GW Morecambe Bay field being developed by Cobra/Floatation Energy. Cumbrian ports are well placed to support longer term maintenance & operations support.

The connection points for the national grid are yet to confirmed but will not be in Cumbria. These developments are expected to be operational by 2028.

CLEP is an active participant in the Offshore Energy Alliance that works across the North West of England and Wales to support the development in the region.



AMBITION

Cumbria ports will provide the operation and maintenance hub of a growing regional offshore wind capacity making a significant contribution to UK clean energy requirements. This is further supported by growing Cumbria’s specialist manufacturing capability and a world wide reputation for offshore operations skills development.

Cumbria's north west coastal location make it a prime candidate for the further development of offshore wind. Whilst recent and current bidding rounds have focused on other areas and further offshore there is still strong potential to expand the current developments that already form over 10% of the UK’s offshore capacity.

Deep water port facilities in either Merseyside or Belfast are needed for the major installation/construction for new Irish Sea developments but there is still a significant role that can be played by Barrow and Workington to both support construction and importantly to provide the maintenance and operations bases for the northern Irish Sea sector.

The Green Investment Plan published in 2022 by a group of potential investors in green growth in Cumbria identified the potential for a ‘Colette’ offshore development off West Cumbria. This would be a community scheme linked to co-generation of hydrogen and decarbonisation of the Sellafield site. This remains at a very early feasibility stage with significant work needed to address all aspects of viability.



FORWARD PLAN

| Action | Lead / Support | Timeframe |
|--|-----------------------------|-----------|
| Extend the life and use of existing developments and identify plans for de or re-commissioning. | Wind Operators | Ongoing |
| Maximise Cumbria manufacturing opportunities from the UK wide and export expansion of offshore wind. | CLEP / BEIS / Growth Hub | Ongoing |
| Continue to work with Port Operators to establish Cumbrian ports as the Operations & Maintenance Hub for Round 4 Lease developments. | ABP / CCC / CLEP | 2022-2023 |
| Lobby Crown Estates for future Round 5 Lease and co-production/off-grid solutions. | CLEP | 2022 |
| Maximise synergies with the nuclear sector with expertise in management of assets in challenging environments (e.g .robotics/remote inspection/data analysis/safety systems) | CLEP / NDA / Wind Operators | Ongoing |

FOCUS ON HYDROGEN & CCUS

HYDROGEN TYPOLOGY:

Hydrogen is the most abundant chemical element in the universe and has high potential as a clean energy source. However it needs to be released from water through a process that requires energy. This can be done in a range of ways depicted by a colour code.

Blue Hydrogen is produced from Natural Gas in a long established process used worldwide for industrial uses of Hydrogen. Carbon Dioxide is produced as a bi-product so Blue Hydrogen needs to be accompanied with Carbon Capture and Underground Storage. (CCUS).

Green Hydrogen is produced through electrolysis of water that needs a clean energy source of electricity. It offers flexibility to offshore wind to use as a form of energy storage when offshore wind provides more energy than the national grid requires at a given time.

Pink Hydrogen is similar to green hydrogen where the clean energy source is from nuclear power through electrolysis. Advanced Modular Reactors working at high temperature offer the opportunity to produce hydrogen directly without the secondary electrolysis step.

Whatever the route, deployment of hydrogen requires an integrated approach for generation, storage and transmission with end use.

NATIONAL POSITION

Whilst hydrogen has been produced at an industrial level for over 100 years, the distribution of hydrogen for energy at a commercial scale is a nascent industry. The Government issued its Hydrogen Strategy in September 2021 outlining the ambition for hydrogen to play a key role in areas such as decarbonising heavy industry, Heavy Goods Vehicles and as a potential for domestic heating fuel, commencing with a 20% blend with natural gas prior to full replacement. It could also be used as a means to provide energy storage flexibility with variable renewable energy sources. The Energy Security Strategy establishes a target to achieve 10GW of hydrogen energy production by 2030 with half coming through the electrolytic sources.

In 2021 two industrial clusters were announced that will combine hydrogen generation, carbon capture and industry decarbonisation, with "HyNet" in Cheshire/Merseyside and "East of England" for Teeside and Humberside. These clusters are expected to come on line by 2026. Four more clusters are expected to be selected in Round 2 of the process.

The Government have recently announced a Hydrogen Investor Roadmap that sets out the full integration of its Net Zero Hydrogen Fund to provide up to £250m for development and capital costs to establish a viable infrastructure as well as a £50m accelerator fund to develop commercially viable electrolytic hydrogen generation capability.

A national "HyDeploy" programme of work involving the gas networks (Cadent and Northern Gas Networks for Cumbria) aims to deliver the evidence to demonstrate that a 20% hydrogen blend with natural gas could be used for domestic heating without retrofit. A progressive series of hydrogen villages to towns will then demonstrate the viability of 100% hydrogen. These trials will be centred around the HyNet and East of England Clusters. By 2026 this will provide evidence to government on the role Hydrogen can play in domestic heating. A further programme of work termed "Project Union" has been initiated by National Grid to upgrade the gas transmission system between hydrogen production centres, industrial users and consumers across the nation. This work is expected to be completed in the early 2030's.

CCUS provides carbon storage to enable Hydrogen to be generated through the steam reformation of natural gas that is the current major industrial process for hydrogen generation. It also offers the potential to capture carbon dioxide from energy intensive industries as well as capture of CO₂ from direct air capture & storage (DACs) and from Bioenergy with Carbon Capture and Storage. (BECCS) The Government's Net Zero Strategy sets out a target for 30 million tonnes of CO₂ storage by 2030.

CUMBRIA CURRENT STATUS

Whilst there is no significant current generation or use of hydrogen energy in Cumbria, the county is well placed to establish a hydrogen infrastructure based on the following assets:

- Blue Hydrogen /CCUS – The Morecambe Bay Gas Field with the Barrow Gas Terminal operated by Spirit Energy offers the potential to commence a hydrogen energy cluster. Morecambe Bay has a carbon storage potential of 5 times that of the recently announced HyNet and East of England Clusters combined.
- Green Hydrogen – There is significant potential for electrolytic hydrogen generation from offshore wind in the Irish Sea as well as from on shore wind in Cumbria and South West Scotland. Of particular interest is use of hydrogen generation as means of providing storage flexibility.
- Pink Hydrogen – Development of new nuclear capability at Moorside offers potential for large scale hydrogen generation either through electrolysis or directly from high temperature reactors. This will become essential if hydrogen is to play a substantial role in industrial and domestic heating in the UK.

Whilst not at the same scale as large industrial clusters in Merseyside, Teeside and Humberside, Cumbria has a large number of industrial facilities that could make use of Hydrogen as well as the potential for transport hubs associated with the M6 and West Coast Rail Mainline.

In addition to the potential assets for hydrogen generation, a research facility operated by DNV (a global leading quality assurance and risk management company) at Spadeadam in north Cumbria plays a key role in demonstrating the safety and viability of use of hydrogen in the existing gas transmission network and in domestic homes. This work will contribute to key



Government decisions on options to use hydrogen as a 20% blend with natural gas for domestic fuels and then full 100% hydrogen. The gas network operated by Northern Gas Networks, Cadent with National Grid offers potential to link hydrogen schemes in Cumbria to wider schemes at HyNet and East of England.

AMBITION FOR CUMBRIA

Through transition of the Morecambe Bay gas industry, and proposed investments in offshore wind and new nuclear Cumbria has a unique opportunity to develop the UK's next hydrogen industrial cluster.

Cumbria is well placed to play a leading role in the delivery of the UK Hydrogen strategy across all types of generation. This can be developed through the following emerging schemes:

- **Morecambe Bay Hydrogen/CCUS:** as well as hydrogen generation, there is the potential for much wider utilisation of CO² “non-pipeline” storage through import from UK heavy industry by ship or rail transfer prior to processing through the Barrow Gas Terminal for permanent storage in Morecambe Bay depleted gas fields. This will allow the transition of the existing assets and skills base as natural gas production ceases by the end of the decade.

- **Green Hydrogen** production related to offshore wind generation at Robin Rigg as well as at the national grid substation at Harker north of Carlisle, which receives electricity generated from onshore wind in southern Scotland. There are a range of other potential green hydrogen developments across the county and linked to individual industries for decarbonisation.

All of the schemes depend on assessing the overall business model for generation, storage/transmission and downstream use that need to be assessed through viability studies.

The overall potential has been set out in a comprehensive report “Hydrogen in Cumbria – A Vision for the Future” by Progressive Energy.

The ambition is that early delivery of these schemes can pave the way for larger scale hydrogen generation either through nuclear power capability or from new large offshore wind development in 2030s. Through the CLEP Clean Energy Strategy these potential developments can be delivered in an integrated manner.

FORWARD PLAN

| Action | Lead / Support | Timeframe |
|--|---------------------|----------------|
| Support Spirit Energy with proposal for Morecambe Bay Blue Hydrogen/CCUS Scheme to target the “Track 2” industrial cluster funding round by the end of 2022 | Spirit Energy/ CLEP | By end of 2022 |
| Engagement with interested parties (ARUP, RWE, Northern Gas Networks, National Grid) to target acceleration funding to complete viability studies in North Cumbria for green energy hydrogen schemes | Arup/CLEP | Summer 2022 |
| Work with Cumbria large industries to establish potential for deployment of Hydrogen. | CLEP | By end of 2022 |
| Work with Gas Networks to establish distribution of either blended or 100% hydrogen | Cadent/CLEP | By end of 2022 |



FOCUS ON RENEWABLE ENERGY TECHNOLOGIES

There are a wide range of renewable energy technologies that Cumbria can develop making use of geography, natural assets and working for the diverse range of communities within the county. Delivering on the clean energy ambition for Cumbria needs to be at all levels from the large-scale developments outlined in previous chapters to the diverse range of renewable opportunities with some at a small community level as described below.

NATIONAL POSITION

Whilst the Government's 10 Point Plan focused on larger scale clean energy areas, the recently published Energy Security Strategy paper stated that the UK should aggressively explore renewable opportunities afforded by our geography and geology. The Net Zero Innovation Portfolio discussed earlier provides a potential route to develop schemes that are most appropriate for Cumbria.

The Energy Security Strategy outlines the importance of onshore wind in being able to provide affordable clean energy but recognises the range of public views and promotes putting local communities

in control where hosting a site will return benefits including lower energy bills.

Solar energy is also recognised whilst highlighting the need to balance land use and seek ground-based developments on non-protected lands and ensure communities continue to have a say and environmental protections remain in place.

CUMBRIA CURRENT STATUS

Onshore Wind

With an abundant prevailing south westerly wind, Cumbria currently has 239 installations around the county generating 464 GWh of clean energy. Local authority plans in Cumbria identify areas that could be suitable to host onshore wind but recent national policy has curtailed new developments in the county.

Solar PV

Despite northern latitude and weather pattern, Cumbria has a reasonable potential for solar energy with areas in the west of the county with same potential as areas in South and Midlands of the UK. (Insert Map). Solar has been utilised in Cumbria in a range of roof top and ground based systems for both domestic and commercial use. Schemes at Cropper Paper Mill at Kendal and Kingmoor Industrial Park show how solar can play a key role in business decarbonisation.

Tidal/Hydro

The tidal range of the Irish Sea coast and estuaries and running water in rivers offer potential for Cumbria to develop schemes in these areas. They also offer the benefit of incorporating flood defence requirements

and improvement to transport links. However, high civil engineering costs and negative environmental impacts have prevented significant progress. Variable river levels limit the potential for hydro power for Cumbria rivers.

Feasibility studies into major tidal schemes for both Morecambe Bay and the Solway have been completed but are not currently being actively progressed by developers.

However, technology is improving and there is potential to deliver schemes that address the high civil costs and environmental concerns. For example, a scheme utilising a novel venturi turbine application has been developed by VerdErg that could offer both tidal and hydro applications in Cumbria as well as turbine manufacturing opportunities.

The Mersey Tidal Power Project is being pursued in Liverpool City Region which has the potential to provide energy for 1 million homes. It is at a concept design stage and through the Offshore Energy Alliance, CLEP will retain a keen interest to assess opportunities for similar undertaking in Cumbria.

Bio-Energy

Cumbria's strong agricultural and forestry sectors mean that there are a wide range of bio-energy developments in the county and opportunities to expand these further. Examples include:

- Anaerobic Digestion of agricultural residues or dedicated grown grass offers the opportunity to produce bio-methane as a fuel. First Milk has installed this capability at Aspatria Creamery to support their own energy needs and to export to the gas

national grid. Further schemes are being considered in areas such as bracken removal.

- Biomass - Iggesund have installed a biomass combined heat and power plant at their Flimby paperboard mill. In a circular sustainable model, local farmers are supported to grow short rotation coppice willow that is used in the paperboard manufacture and the waste material is used in the biomass facility, which provides the factory heat and power needs as well as providing net export to the national grid.

For both Anaerobic Digestion and Biomass, CO₂ is still generated and as discussed in chapter 8 opportunities for carbon capture (BECCS) need to be developed.

Heat Networks

HeatHeat networks that could utilise heat recovered from industry or urban infrastructure and it is recognised will need to play a key role for the UK to meet its carbon targets cost effectively. For Cumbria this could be from retrofit to existing facilities or to be incorporated into new clean energy sources such as nuclear.

Rural Community Energy Fund

The Rural Community Energy Fund (RCEF) is a £10m BEIS scheme which supports communities in England to develop renewable energy projects. A number of local schemes are being supported in Cumbria to conduct feasibility studies. Examples include Buttermere Valley and Lickle River hydro schemes. Whilst the scheme is now closed to new applications, CLEP will support the completion of the feasibility studies and potential forward delivery in a programme administered through the North West Net Zero Hub.



AMBITION

Cumbria should actively pursue all potential renewable sources suited to our geography and communities and establish itself as a national leader in implementing rural and community clean energy schemes.

For this diverse range of renewable opportunities, this strategy focuses on applications for bulk clean energy generation schemes. Domestic and individual industry decarbonisation schemes are important and addressed in wider net zero plans.

Whatever the renewable clean energy source, whether from those described above or from any other source such as

Geo-thermal or disused mines, the path to successful implementation needs the following:

- A lead developer to bring forward the proposed development
- A willing community to accept and receive benefit from the development
- A business model drawing on public and private funding to deliver sustainable clean energy outcome.

CLEP will play a key facilitation role to promote the development and address the key factors above. Such renewable schemes lend themselves to be community run and CLEP will work together with partners such as Zero Carbon Cumbria Partnership/Cumbria Action for Sustainability and the Lake District Foundation for delivery. It is also envisioned that the Borderland Energy Masterplan will be a stimulus for rural community clean energy schemes.

FORWARD PLAN

| Action | Lead / Support | Timeframe |
|---|----------------|----------------|
| To continue to engage with clean energy developers to put in place viable business models and community and stakeholder engagement. | CLEP | Ongoing |
| To continue as an active partner in the Zero Carbon Cumbria Partnership and Borderlands Energy Masterplan Board to support the delivery of community energy schemes. | CLEP | Ongoing |
| Actively engage with industry groups such as the Offshore Energy Alliance, North West Net Zero Hub and BEIS directly to identify new developments that could be delivered in Cumbria. | CLEP | Ongoing |
| Carry out a review to assess Heat Network potential for Cumbria. | CLEP | By end of 2022 |



FOCUS ON NETWORK STORAGE AND FLEXIBILITY

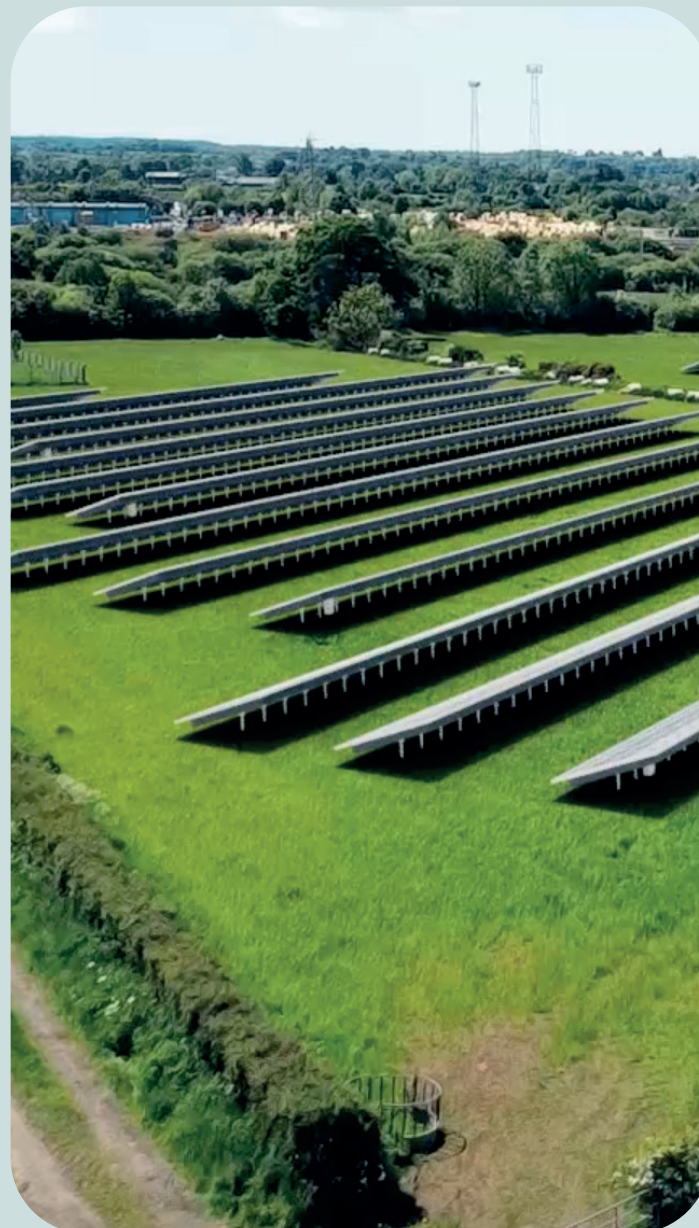
This chapter focuses on the ability of our Electricity and Gas Networks to support clean energy generation in Cumbria. Wider aspects of electrification to achieve net zero are addressed in other strategy documents, for example the provision of electrical vehicle charging points is covered in the Cumbria Transport Infrastructure Plan.

NATIONAL POSITION

The Energy Security Strategy lays out two key challenges to ensure that the UK has an electricity network both large enough to meet the anticipated increased demand from electrification of energy supply as well as the flexibility to manage supply and demand with variable renewable sources to ensure availability and reduce wastage. It sets out the requirement for an Energy Networks Commissioner and a Holistic Network Design (HND) by the end of 2022.

As well as the electricity network this also includes the natural gas mains network and the potential to transition to blended and then pure hydrogen is described in chapter 8.

Storage of renewable energy is therefore important, and this can be achieved either through battery storage or via an intermediate product such as hydrogen or other alternatives such as bio-fuels or ammonia.



CUMBRIA CURRENT STATUS

The regional electricity distribution grid was originally built from the early 1930s to the 1960s and has been periodically replaced and upgraded at various times since its construction.

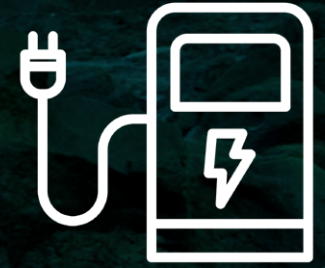
Electricity North West continues to assess demand and capacity of the network and a number of improvements are either proceeding or are outlined in the “ED2” business plan for 2023 -2038 that will deliver over £1.8 billion investment to enable the northwest region achieve net zero and to improve reliability, where recent storms have challenged the supply across the county. One example of this is the re-string a major regional power line that will deliver a further 300MW to the 132kV supply to Cumbria. National Grid is also investing in improved power control at the Harker Sub Station that will deliver a further 500MW of capacity by the end of 2022.

Whilst the proposed improvements give capacity for new clean energy in the county, for the biggest gigawatt scale large nuclear facility or equivalent offshore wind energy, new distribution capability would be needed. This was evaluated for the NUGEN proposal for Moorside and would have necessitated the installation of major new grid connections via both north and south routes to the grid. The multi-billion pound scheme was factored into the delivery of the overall project.

As stated previously, electricity from the Robin Rigg Offshore development is connected to the grid at Workington but all the offshore developments to the south of the county are connected to the grid in Lancashire. The new offshore wind developments in Morecambe Bay will not be connected through Cumbria.

Two Battery Energy Storage Systems (BESS) exist in Cumbria that provide service to the National Grid. Expansion of battery storage could be considered in support of any new clean energy generation.

For natural gas, Cumbria is served by the national transmission system with Cadent operating the system in the south of the county and Northern Gas Networks in the north. There is a dedicated line to the Sellafield Combined Heat and Power plant from the Barrow Gas Terminal.



AMBITION

To collaborate and secure investment from Network Operators to deliver Cumbria’s Clean Energy Ambition.

The overall ambition is that Clean Energy Generation for Cumbria is not constrained by the electricity and gas networks. CLEP’s Transport and Infrastructure Strategy Group has excellent engagement with the Electricity and Gas distribution companies and ongoing dialogue to ensure distribution and capacity requirements are established for any new clean energy development for Cumbria.

Delivering the opportunities outlined in this strategy will provide clean energy sources that will in turn provide the potential to attract industries that could make direct use to decarbonise. This could be done at a large industrial scale through combination of the nuclear, offshore. Hydrogen/ CCUS schemes. Such schemes are being developed in the HyNet and East of England Industrial clusters. A number of sites have been identified in Cumbria where clean energy parks have been identified. It could also be achieved at a rural community level through the range of renewable options.

FORWARD PLAN

| Action | Lead / Support | Timeframe |
|--|---------------------|------------|
| Electricity North West and National Grid deliver on the planned investments to improve grid capacity and reliability through published business plans up until 2038. | ENW / National Grid | Ongoing |
| Put in place a plan to develop clean energy parks in Cumbria to attract new industry to utilise clean energy. | CLEP | March 2023 |



DELIVERING OUR AMBITIONS

SECURING INVESTMENT AND DELIVERING IMPACT

Cumbria has a unique opportunity to be a major contributor to generating clean energy through leveraging its natural assets and industrial heritage.

The Scale Of Future Clean Energy Jobs In Cumbria

A broad top-down approach to estimating the scale of growth in clean energy sector jobs takes into account the generation of electricity and heat and the production of alternative fuels plus fuel cells and storage. In the UK in 2020 there were an estimated 59,000 FTE jobs supported by these sectors and in England 45,000 FTE jobs (around 75% of the UK figure) primarily in nuclear, offshore wind, renewable heat and bioenergy.

One set of reputable forecasts is that the total jobs in clean energy will grow by of the order of 350,000 to reach around 400,000 by 2030 and then a further 430,000 to reach of the order of 830,000 by 2050. However, it must

be stressed that these forecasts are subject to considerable uncertainty they suggest potentially a faster pace than implied by the government estimates of jobs supported by 2030 in the pathway to net zero by 2050. These estimates were produced in 2020 and so could not have taken into account the recent energy generation strategy and greater focus on new nuclear.

Cumbria's share of future clean energy jobs will depend on a variety of factors including Cumbria's role in direct generation of clean energy (construction and operation) and then the role of Cumbrian firms in supplying the sector.

We have developed two scenarios: one based broadly on existing shares of all jobs; the other based on an increased share of the future prize reflecting Cumbria potential advantages as a location for clean energy generation and also the expertise of some of our firms in supply parts of the sector and our strong manufacturing and specialised construction base.

Potential scale of extra jobs in clean energy sector based on applying different shares of potential national growth

| 000s of jobs | Scenario 1: Base Cumbria - applying existing share of all jobs in England | Scenario 2: Ambitious Cumbria - applying existing share of manufacturing GVA in England |
|--|---|---|
| Shared used | 0.95% | 1.62% |
| All jobs 2019 (all sectors of the economy) | 255.0 | 255.0 |
| Growth to 2030 | 3.34 | 5.70 |
| Growth 2030 to 2050 | 4.14 | 7.05 |
| Total Growth | 7.48 | 12.75 |
| Compared to all jobs in 2019 (%) | 2.9% | 5.0% |

Source: Nicol Economic estimates Note: excludes jobs in nuclear decommissioning

By 2030 these estimates suggest extra employment of 7,500 to 13,000 FTE jobs supported by the clean energy sector in Cumbria or 3% to 5% of all (current) employment.

Cumbria Action For Sustainability commissioned a 'Potential for Green Jobs in Cumbria' study in 2021 and estimated 9,000 net green jobs could be created over

a 15-year transition period to 2037, taking a broader view to include jobs in the decarbonisation of transport, industry and buildings, as well as clean energy. Whilst there is uncertainty on precise numbers the overall scale for high quality jobs is clear.

The map overleaf summarises the spatial opportunities for the Cumbria Clean Energy Cluster.

1. Carlisle Energy Hub

- Transport hydrogen hub
- Hydrogen generation
- North / South / East / West Road and Rail
- Regional hydrogen bus hub
- Carlisle Airport

2. Workington Energy Hub

- Hydrogen generation
- Offshore Wind

3. Moorside and Sellafield Energy Hub

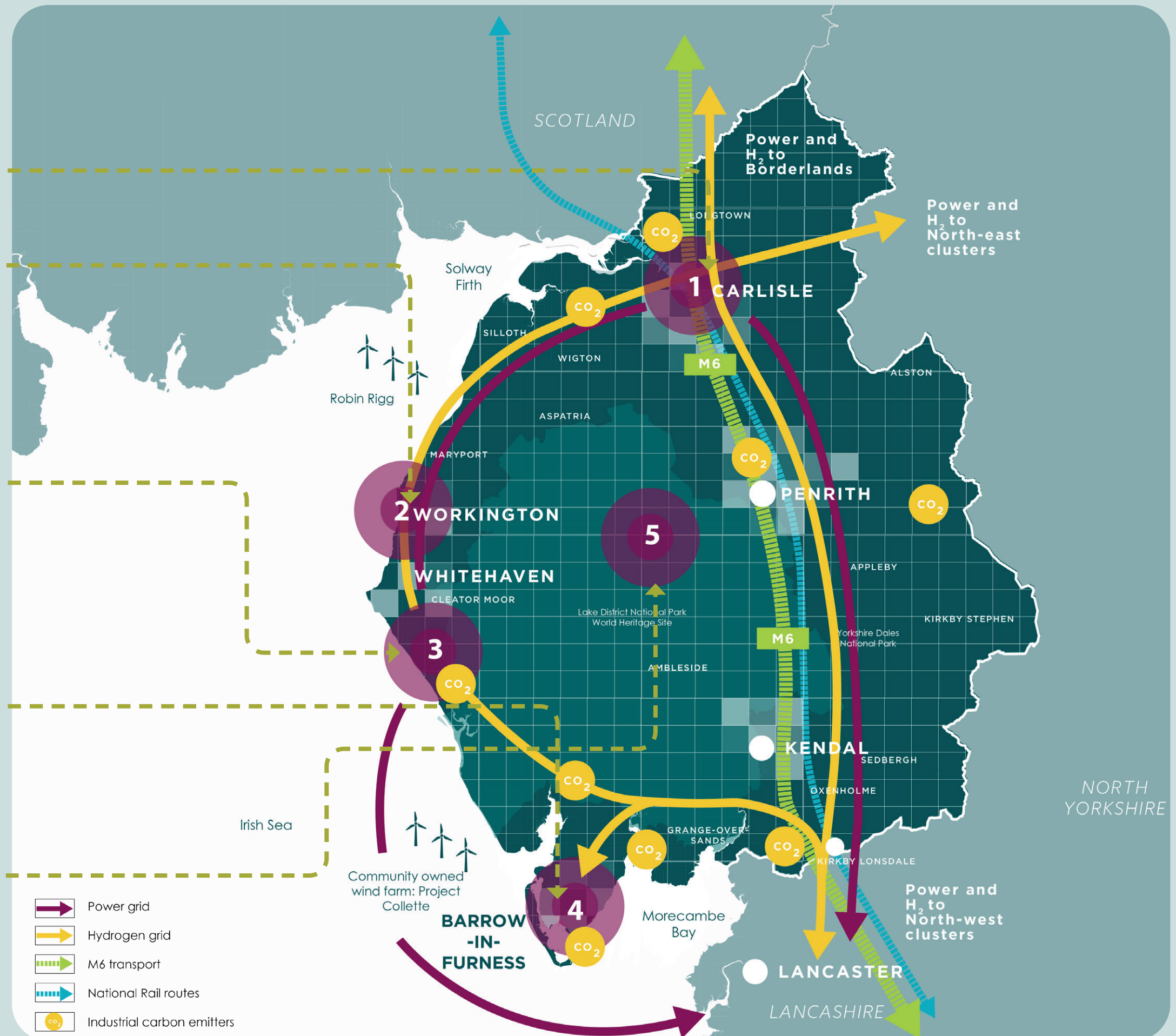
- STEP fusion
- EPR large new build
- Hydrogen generation
- Offshore and onshore win
- Solar power
- Direct air capture
- Synthetic fuels
- Low carbon Sellafield Ltd.

4. Barrow Green Energy Hub

- Hydrogen generation
- Carbon Storage
- Offshore Wind
- Low carbon BAE Systems

5. Cumbria Wide Rural Test Bed

- Hydro / Tidal
- Onshore Wind
- Bio Energy
- Solar
- Geothermal / Heat Networks



ENABLING INVESTMENT

The realisation of these clean energy generation opportunities in Cumbria requires enabling investment to be secured. These will be pursued through aligned strategies and funding submissions, including:

| Enabling Investment | Route / Status |
|---|---|
| Investment in the existing and future workforce to meet sector requirements | <ul style="list-style-type: none">Local Skills Report 2022 (underway) |
| Upgrade to Cumbria Coast Rail Line to support Energy Coast ambitions | <ul style="list-style-type: none">Outline Business Case to the Department for Transport (submitted)Full Business Case (next stage) |
| A595 Grizebeck improvement | <ul style="list-style-type: none">Funding secured and scheme forecast to open in 2024 (in progress) |
| A595 Bothel improvement | <ul style="list-style-type: none">LEP funding secured for the reconstruction of the Greyhound/Torpenhow Junction (in progress)A business case for wider A595 Bothel Strategic Improvements has been submitted to DfT for match funding (pending) |
| A595 Whitehaven Relief Road | <ul style="list-style-type: none">A range of improvement options for the A595 including a Whitehaven Relief Road have been identified and promoted as part of the National Highways Route Strategy with consultation held between October-December 2021The Route Strategy will be used to inform National Highways future investment decisions for the 2025-2030 period. The Interim Route Strategy report will be published in July 2022. |
| A590 improvements including a Ulverston Bypass | <ul style="list-style-type: none">A range of improvement options for the A590 including a Ulverston Bypass have been identified and promoted as part of the National Highways Route Strategy with consultation held between October-December 2021The Route Strategy will be used to inform National Highways future investment decisions for the 2025-2030 period. The Interim Route Strategy report will be published in July 2022 |
| ENWL Grid reinforcement | <ul style="list-style-type: none">Assessment of current grid capacity and requirements to support new clean energy options (identified)£2bn investment across the ENW region (approved)New funding model required to support large scale clean energy investment (discussions in progress) |

| | |
|----------------------|--|
| Sites and premises | <ul style="list-style-type: none">Cumbria Employment Sites and Premises Study assesses current and future employment needs, including priority sites for employment (complete)CLEP and local authorities to facilitate delivery of priority sites to meet demand (underway) |
| Digital connectivity | <ul style="list-style-type: none">Cumbria Digital Infrastructure Strategy (2021-2022 update complete)CCC delivery of UK Gigabit Programme and Shared Rural NetworkPartnership working with the Borderlands Partnership to support investment in digital infrastructure through the Borderlands Inclusive Growth Deal |
| Port of Workington | <ul style="list-style-type: none">Port Masterplan (complete) |
| Port of Barrow | <ul style="list-style-type: none">Refreshed masterplan (in development) |
| Housing Strategy | <ul style="list-style-type: none">Local PlansThe Cumbria LEP Housing Delivery Strategy and Action Plan (underway) |

KEY DELIVERY PRINCIPLES

There are a number of key principles which underpin the approach to delivering the Cumbria Clean Energy Strategy:

- Strategic Focus:** Ensuring that clean energy generation plays a leading contribution in the decarbonisation of Cumbria and realisation of net zero ambitions
- Competitive Positioning:** coalescing around a shared vision for Clean Energy in Cumbria to competitively position Cumbria, influence investment decisions, and unlock funding opportunities
- Targeting enabling investment:** securing investment in enabling infrastructure to facilitate Clean Energy ambitions through aligned strategies including skills development, business support and capital infrastructure
- Joined up Approach:** connecting to regional and national investments and initiatives to ensure a holistic approach and the ability to maximise scale and opportunity
- Working in Partnership:** collaborating with key stakeholders to secure investment and deliver impact including putting the community at the centre of engagement to secure support and facilitate a just transition to net zero
- Securing Sustainable Outcomes:** balancing triple bottom line outcomes (environmental, social and economic) through investment in Clean Energy.

GOVERNANCE & RELATIONSHIP MANAGEMENT

This document outlines a comprehensive strategy spanning a wide range of low carbon energy sources from new nuclear at Moorside, offshore wind deployment off our Irish Sea coast, industrial hydrogen and carbon storage to the north of the county and Morecambe Bay to the south as well as delivering on a wide range of rural and community schemes across the entire county. These schemes can be delivered in a range of delivery models through public, private and community level financing.

This can only be delivered through a wide range of stakeholders as outlined in the table below.

This strategy outlines a series of actions in each of the sections with clear action owners and timescales identified. Governance to oversee the delivery of this strategy will be performed through the

| Type of Stakeholder | Examples |
|---------------------|--|
| National Level | <ul style="list-style-type: none">Local Skills Report 2022 (underway) |
| Regional Level | <ul style="list-style-type: none">Northern Powerhouse LEPs, Net Zero North West, North West Business Leaders, North West Nuclear Arc, Offshore Energy Alliance for the North West, Net Zero North West Hub, Borderlands. |
| Local Government | <ul style="list-style-type: none">MPs, Cumbria County Council and the 6 district councils through the transition to the Cumberland and Westmorland & Furness authorities. |

CLEP governance structure. At the working level this will be performed through the Clean Energy Panel with representation spanning business, local government and independent representatives. This will be overseen by the LEP Board with annual reporting to provide open communication of progress made.

Delivering the Clean Energy Strategy touches all aspects of the LEP governance arrangements:

- People, Employment & Skills Group
- Ideas & Innovation Group
- Transport & Infrastructure Group
- Business Support
- Places
- LEP sector panels including Rural, Advanced Manufacturing, Construction as well as Clean Energy.

The LEP Futures Forum provides the opportunity to incorporate views of the generation that will need to see this strategy through to realise the full decarbonisation benefit.

Through representation in Cumbria wide groups such as the Zero Carbon Cumbria Partnership and Nature Leaders forum this strategy will receive wider scrutiny, challenge and support to ensure it plays a key role in Cumbria achieving net zero. Wider public engagement on the strategy is delivered through LEP communication strategy and through such forums as Climate Change Jurys across the county.

KEY MILESTONES

Delivery of this strategy will lead to clean energy outcomes by the following timescales:

Nuclear

- New nuclear power generation at Sellafield vicinity of approximately 1GW by 2030 by being one of the first deployments of Small Modular Reactors
- Further development through combination of development of a UK fusion industry in Cumbria and large giga watt scale power station that could deliver a further 3.2 GW by 2040. First of a kind development could lead to deployment of Advanced Modular Reactors also by 2040.

Offshore

- Cumbria builds on its current 1.8GW of clean energy generation to increase to at least 5GW through future leasing rounds as well as to be the Maintenance & Operations Hub for the expanding Morecambe Bay developments.

Hydrogen

- By 2030 Cumbria can have implemented a Morecambe Bay Hydrogen Generation and Carbon storage capability as well as a hydrogen hub in north Cumbria powered by wind energy. Overall over 1GW of clean energy could be produced to play key role in decarbonisation of Cumbrian industry and decarbonisation of transportation

- In combination with hydrogen generation from Nuclear, Cumbria can be a net contributor of hydrogen into the gas distribution system by mid 2030's to decarbonise domestic heating.

Renewables

- By 2030, Cumbria has delivered a portfolio of renewable energy schemes appropriate for Cumbria that will complement the larger schemes and will offer decarbonisation for isolated rural communities.

Networks, Storage and Flexibility

- By 2038, Cumbria will have modernised electricity grid system that supports the net zero mission for Cumbria
- By 2030, Cumbria has at least one large scale industrial clean energy park and a demonstrable number of rural industries supplied from direct renewable energy sources.

IN CONCLUSION

Overall, this strategy outlines an ambitious but achievable plan for Cumbria to achieve the following:

1. **Clean Energy Generation:** an overall potential of up to 9GW of clean energy generation by 2040 establishing Cumbria as a key clean energy producer for the UK as well as being a leader of developing rural community renewable energy schemes.
2. **Economic Development:** delivery of this strategy will drive economic growth with up to 13000 new jobs from clean energy deployment.
3. **Innovation:** Selection of the Moorside site for fusion energy will place Cumbria at the heart of the UK and global race for abundant long term affordable clean energy.

Clear actions are identified to underpin the delivery of this strategy and these will be monitored by the LEP Clean Energy Panel.

Putting in place a comprehensive clean energy strategy for Cumbria is a challenging undertaking. There is a wide range of stakeholders with knowledge, vision and views that need to be harnessed to deliver a fair and deliverable outcome. This consultation draft strategy will be consulted on 31st May – 24th June prior to finalisation in July 2022.

The time is now, government has set out its ambition, there is widespread recognition of the need for clean energy within the overall drive for net zero. Delivery of this strategy will play a key role in Cumbria achieving its ambitions to lead the way.



