

DELIVERING THE VISION

THE HUMBER'S ROADMAP
FOR INDUSTRIAL DECARBONISATION





Foreword, Richard Gwilliam, HEB Chair



Plans to transform the Humber industrial cluster are at a crucial juncture. Two years have passed since the launch of the Humber 2030 Vision – a vision that would set the region on the path to long term, sustainable economic growth – and progress towards its realisation has been limited.

Whilst business in the Humber is working hard to retain credible plans to deliver 2030 decarbonisation targets, delays in decision making have cost the region valuable time. Intervention is needed now to shore up investor confidence in the major projects that will be catalytic in transforming the region's economy and ensure the Humber can help deliver critical national climate targets.

Through the Humber Energy Board, industry is making the case for urgent action if we are to play our part in meeting the 5th and 6th Carbon Budgets, as well as the new government's mission to make Britain a clean energy superpower delivering zero-carbon electricity by 2030; all whilst driving growth across the Humber and protecting and creating jobs.

This report sets out the short, medium and long term action needed to ignite the Vision. Whether that's on the carbon capture and storage pipeline that will underpin our journey to a decarbonised industrial cluster, on creating the markets for hydrogen production, use and storage to power our growth whilst decarbonising our vital industries, through to the much needed upgrades to the electricity grid to allow our thriving offshore wind industries to grow.

A core theme running through this report is the need to see the Humber Industrial Cluster as an ecosystem. The decarbonisation projects promoted by each business that make up the Vision rely on shared infrastructure in order to successfully deliver their objectives; but the relationship between projects is deeper. The Humber has the scope to be one of largest circular economies in the world and the application of innovative decarbonisation technologies has the potential to spur a more symbiotic relationship between businesses and projects maximising efficiencies and delivering sustainable economic growth.

The realisation of this opportunity and the delivery of the Vision can only be achieved through partnership. At its core, the Humber Energy Board represents partnership; it unites businesses with the public and academic sectors in the region to provide a shared voice to Government. But the last two years have taught us that a partnership in the region is not enough to deliver the world leading opportunity. Central government must play a role alongside the Humber Energy Board to bring these plans to fruition.

Through a broader partnership we can unlock at least £15 billion of private investment in the Humber, create over 20,000 new jobs across the region, achieve carbon targets and turn the Humber into a global exemplar of how the pursuit of industrial decarbonisation can drive economic growth. We look forward to developing a new partnership with government to deliver on our shared ambitions of growth, jobs and decarbonisation.

Richard Gwilliam

RICHARD GWILLIAM
HEB CHAIR

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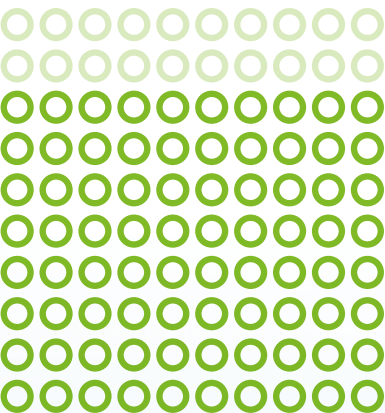
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80%
OF HUMBER
CO₂ EMISSIONS
ELIMINATED VIA
DECARBONISATION
PROJECTS

THE HUMBER IS THE LARGEST INDUSTRIAL DECARBONISATION OPPORTUNITY IN THE UK



THE HUMBER CAN MEET
50% OF THE UK'S
RENEWABLE POWER NEEDS

'IT IS ESTIMATED THAT DOMESTIC CAPTURE PROJECTS USING SHIPPING AND OTHER NON-PIPELINE TRANSPORT (NPT) INFRASTRUCTURE COULD HELP CAPTURE A FURTHER ~15MT CO₂/YR BY 2034'

30% of UK Government H₂ production targets can be met by the Humber

66% The Humber is perfectly placed to take advantage of up to 2/3rds of the UK's Carbon Storage licences



The Humber has hydrogen storage capacity to power
2million
UK homes for 1 year

 **1 IN 10 REGIONAL JOBS WILL BE SAFEGUARDED AND THOUSANDS OF NEW JOBS CREATED BY DECARBONISING THE HUMBER**

£15BN
PRIVATE INVESTMENT READY TO BE INVESTED IN HUMBER-BASED ENERGY TRANSITION



Introduction

The Humber is at the heart of the UK's net zero journey. Its success is vital to tackling the so-called energy trilemma, providing energy security for homes and businesses, delivering the UK's legally binding net zero targets, and doing so in a cost-effective way that unlocks regional growth.


The Humber region, which straddles a number of administrative boundaries across Yorkshire and Lincolnshire, makes a significant contribution to UK plc. The region generates 20% of the UK's total electricity, creates one-third of the UK's refinery products, and around one-fifth of all gas imported into the UK enters via the Humber.ⁱ Industry across the Humber supports over 360,000 jobs and adds more than £18bn to the UK Economy.ⁱⁱ On top of the rich industrial heritage, the geography of the region is dominated by the Humber Estuary - a key asset in the region's growth agenda, which is reflected in its role as host to the UK's largest port complex by tonnage. Taken together these attributes make the Humber well placed to be a world leader in industrial decarbonisation.

The scale of the Humber's industrial operations, whilst its strength, also makes it the largest industrial cluster in the UK by carbon emissions.ⁱⁱⁱ Currently the region emits 20% more carbon than any other cluster, and around 4.4% of the total national emissions.^{iv} Millions of tonnes of greenhouse gas emissions emitted per year come from combined heat and power, iron and steel, power production and refining and fuels.^v These industries provide vital goods and services for businesses across the UK and support thousands of jobs across the region. Achieving net zero, delivering clean power by 2030, and driving sustainable growth cannot, therefore, come by simply closing or offshoring these industries.

Considering the challenges, decarbonising the Humber must be at the heart of any plans to decarbonise the UK. Significant work, not least the Humber Industrial Cluster Plan - prepared in partnership between the region and government, has identified that the region has several

unique assets as a cluster, which make it an ideal location to invest in decarbonisation. These strengths are in part due to the interconnected nature of the cluster, as illustrated on pages 10 and 11, with projects designed to be delivered in partnership with other businesses in the region. The work already undertaken for the Humber Industrial Cluster Plan points to a clear conclusion - that the region offers a genuinely shovel ready, net zero industrial cluster opportunity for the UK.

This report, has several aims. The first is to set out the scale of the challenge but also the opportunity. The UK has made significant progress in achieving its legally binding carbon budgets (explained on page 8), but they are becoming increasingly challenging and will require a marked step change in approach if the UK is to deliver its net zero obligations. It secondly seeks to provide policy makers with the roadmap to unlock the potential of the Humber's net zero industrial cluster. The projects across the Humber, the result of years of planning, cannot be switched on overnight. They require complex infrastructure upgrades, the development of new supply chains, and billions in private sector investment and after years of delay, decisions must be taken now to provide the certainty needed for business. Finally, this report aims to set out why the new government needs to take a whole system approach to the challenge, recognising how the different businesses across the Humber are all reliant on each other for this transition. If we are to deliver the economies of scale and circular benefits across the cluster, whether that be on supply chain development, the production and supply of raw materials, or by developing and attracting the skilled workforce needed to deliver these projects, we need to see them as more than the sum of their parts and treat this as a genuine cluster, not a list of individual projects.



**THE HUMBER HAS ACCESS TO
OVER 66% OF THE UK'S LICENSED
CO₂ STORAGE CAPACITY, ENOUGH
TO ACCOMMODATE UP TO 46
YEARS OF THE AREA'S INDUSTRIAL
CARBON EMISSIONS, WITH MUCH
MORE ON THE WAY.**

Explainer on the Carbon Budgets

The Climate Change Act was introduced in 2008, with government committing to reduce emissions by at least 100% of 1990 levels (Net Zero) by 2050. This requires the government to set legally-binding 'Carbon Budgets' which act as stepping stones to the 2050 target. They are set at least 12 years in advance to give policy makers, businesses and individuals enough time to prepare. The budgets set out the cost-effective way to achieving the long-term Net Zero target. The Climate Change Committee (CCC) advises on the right level of each carbon budget, as set out in the table below.^{vi}

Budget	Carbon Budget Level	Reduction below 1990 levels
1st Carbon Budget 2008 to 2012	3018MtCO ₂ e	26%
2nd Carbon Budget 2013 to 2017	2782MtCO ₂ e	32%
3rd Carbon Budget 2018 to 2022	2544MtCO ₂ e	38%
4th Carbon Budget 2023 to 2027	1950 MtCO ₂ e	52%
5th Carbon Budget 2028 to 2032	1725 MtCO ₂ e	58%
6th Carbon Budget 2033 to 2037	965 MtCO ₂ e	78%
7th Carbon Budget	To be set in 2025	
Net Zero Target	At least 100% by 2050	

Whilst the UK has met the first three Carbon Budgets, the advice from the CCC is that more work is needed to achieve future budgets.^{vii}

Whilst we wait for full details on the government's pathway to net zero, the recommendations set out in this report will go some way to delivering on the CCC's recommended pathway. This includes, delivering 5MtCO₂/year of engineered greenhouse gas removals by 2030 alongside 22MtCO₂/year of carbon capture and storage, contributing to the delivery of 30THw of low-carbon hydrogen by 2030, supporting industrial fuel switching and the development of sustainable aviation fuels, and achieving the 40GW offshore wind target by 2030.^{viii}

“Businesses across the Humber have demonstrated a clear vision for how they will play their role in supporting us to achieve our net zero targets, in creating new jobs, and in helping grow our economy.

The recommendations within this report set out a clear roadmap for government to help unlock **£15bn worth of investment** and create thousands of new opportunities for our residents.”

Councillor Ross, Hull City Council



THE HUMBER: UK's Energy Estuary



Unlocking the potential of Carbon Capture and Storage



Carbon capture and storage is at the heart of the Humber’s plans for industrial decarbonisation, and the UK’s net zero targets.

Carbon capture and storage (CCS) is widely recognised as having a critical role in the UK’s net zero transition. For the Humber, it is the underpinning technology that will decarbonise this industrial cluster. It will take CO₂ captured from industrial processes, power generation and greenhouse gas removal technology to permanent storage under the North Sea, via a network of pipelines or shipping. With multiple carbon capture projects across the Humber already benefitting from planning permission, decisions to progress the development of pipelines to transport the captured carbon are the most urgent and important in the plans to decarbonise the Humber.

The Climate Change Committee (CCC) estimates that an annual capture and storage of 75-175MtCO₂ is needed in 2050 for the UK to meet its climate targets.^{ix}

The Humber is uniquely positioned to deliver against this target. As outlined in the Independent Review of Net Zero by the Rt Hon Chris Skidmore, there are around 78 gigatonnes of storage potential for captured CO₂ on the UK continental shelf, enough to support the UK’s demand for hundreds of years and, offer solutions to EU neighbours.^x Two thirds of the licenced capacity for carbon capture and storage across the UK sits off the Humber coastline. The two main planned pipelines with associated storage sites for the region include Viking CCS

and the Northern Endurance Partnership. Viking CCS, which has the capacity to store 300m tonnes of CO₂, connects existing onshore infrastructure to a subsea pipeline where captured carbon dioxide from industry and power production can be stored 140km from the Lincolnshire coast in depleted gas reservoirs.

The Northern Endurance Partnership – the carbon dioxide transportation and storage infrastructure provider for the East Coast Cluster – is progressing the Humber Carbon Capture Pipeline, which aims to transport carbon dioxide from carbon capture projects in the Humber region to secure offshore storage. The Northern Endurance Partnership is developing the Endurance aquifer and five nearby stores, and aims to capture and store an average of around 23 million tonnes per year from both the Humber and Teesside regions through a phased approach, starting with 4 million tonnes per year in Phase 1.

Complementing the availability of offshore storage sites, the Humber includes the biggest concentration of potential carbon capture projects in the UK, including, but not limited to: Prax, Uniper, VPI and Air Products near Immingham, to Equinor, Triton Power, and SSE near Hull, Drax’s Power Station near Goole, SSEs Keadby Power Station near Scunthorpe, or APB Immingham Green Terminal.



Urgent action is now needed to ensure businesses across the Humber can deliver a reliable network of pipelines to transport and store CO₂. It must be done in such a way that maximises efficiency and future proofs the network, allowing smaller projects to join in the future. The need for urgency was most recently highlighted within National Grid’s Future Energy Scenarios report, which stated that “the development of carbon capture and storage capacity must proceed now if we are to achieve net zero”.^{xi}

The Humber can play its role in decarbonising the UK economy, and doing so in a way that protects jobs, delivers growth, and prevents the offshoring of emissions. This report suggests a series of recommendations to the new government to help unlock investment, ensuring we can be the UK’s flag bearer for how you decarbonise a major industrial region whilst growing the economy in a sustainable way for future generations.

Short-term activity to kick-start investment in the Humber:

- 1. Continue to progress industrial cluster sequencing that will bring carbon capture and storage projects to market**
 - a. *Provide clarity on emitters to be included within Track-1 expansion and Track-2 as soon as possible and confirm funding envelopes for both in the next budget/Spending Review.* This will give businesses the

much-needed confidence to continue investment in their projects, and ensure the UK stays on track for the 5th and 6th carbon budgets and interim targets including the 2030 greenhouse gas emissions reduction target, and the government’s mission to create a net zero power system by 2030.

- b. *Work with industry to develop business models for low-carbon power generation and carbon capture.* This is vital to creating the markets for different carbon capture projects, reflecting the diversity of opportunities across the Humber. This includes industrial carbon capture models for end users such as Phillips 66, as well as a Power-BECCS agreement to deliver carbon negative power through Drax Power Station, and Dispatchable Power Agreements for low-carbon energy providers, such as Keadby Power Station and VPI Immingham Power Station. Government has an opportunity to apply Article 6 of the London Protocol and undertake bilateral discussions with the EU and key emitter states to secure a mutual recognition of CO₂ standards. In doing so there is the opportunity to unlock major CCS export opportunities, with ABPs Immingham Green Energy Terminal a key enabler. Finally, as we look to the long-term financial sustainability of projects across the Humber, government should consider how carbon pricing can encourage the production of carbon negative emissions, working with business to identify the best route to driving greenhouse gas removals.



2. Deliver the government's missions of economic growth and clean power by breaking down the barriers that slow and stall infrastructure developments across the UK

- a. *Expedite planning permission for nationally significant net zero projects.* In the Humber, CCS infrastructure is vital to achieving net zero and will underpin critical projects, from gas and industry with CCS and BECCS, through to fuel switching with hydrogen. Many of these projects will require a buried pipeline to take captured CO₂ from the region to long term permanent storage deep under the North Sea. Under the current planning rules, it will take longer to secure planning consent for a buried pipeline than it will to build it. Buried cables, which create a similar level of disruption to buried pipeline infrastructure benefit from permitted development rights and do not require a Development Consent Order, whereas buried pipelines do. By applying permitted development rights to critical forms of infrastructure like buried pipelines to transport captured CO₂, it would significantly expedite project delivery for carbon capture across the Humber.

Medium-term initiatives to create the conditions for industrial decarbonisation and enable future clusters to thrive:

3. Introduce policy frameworks that create the conditions for future project development

- a. *Ensure future policy frameworks promote opportunities for the creation of a circular economy in industrial clusters, particularly on the creation of clean fuels.* As we look to decarbonise some of our hardest to abate sectors such as marine and aviation, embedding a circular economy model across industrial clusters should be a priority. To date, focus has been on individual technology opportunities for decarbonisation and less on how different technology types could be brought together to maximise efficiencies. One particular example is the development of eMethanol and Sustainable Aviation Fuels which requires non-fossil CO₂ as an ingredient in one of its core pathways. The Humber is capable of capturing a large volume of biogenic CO₂ that could support this process, but regulations have created a barrier to realising this opportunity. The government now has the opportunity to take a more holistic view of the approach to industrial decarbonisation and work with clusters individually to maximise the unique benefits each of them has to offer.

The private sector stands ready to invest over £15bn, creating tens of thousands of new jobs in the process, but now needs the clarity from government on the big decisions that will unlock this investment.

Dr Ian Kelly, Hull and Humber Chamber of Commerce



Hydrogen: The UK's pathway to net zero



Decarbonising industry and protecting energy security through hydrogen production, use and storage.

Hydrogen is at the heart of the UK's pathway to net zero, offering a viable solution for the decarbonisation of industry across the Humber Cluster, including chemicals, combined heat and power, and the refining sector.

According to the Humber Industrial Cluster Plan, hydrogen fuel switching could abate up to 21% of emissions by 2040, which is equivalent to 3MtCO₂e per year.^{xii} It also offers a solution for industrial sites where their individual emissions don't offer the economies of scale for carbon capture and storage.

With the right policy support, the Humber region is well placed to become the UK's leading cluster for low-carbon hydrogen production and storage, which presents national and international opportunities for the UK, as highlighted by the fact the UK is a co-lead of Mission Innovation's clean hydrogen project. The Humber's plans for large scale CCS, and proximity to offshore carbon storage sites make it well suited to CCS enabled hydrogen production from natural gas – also known as blue hydrogen. The same applies to the offshore wind sector, with 33% of the UK's total offshore wind production coming just off the Humber coast line, which with the right grid connectivity enables the efficient production of green hydrogen.^{xiii}

The scale of the planned hydrogen industry in the Humber has significant potential to decarbonise local industry, but also provides exportable opportunities for UK plc. Businesses, seeing the opportunity for the Humber to become a leader in this space, have established hydrogen production plans that in total exceed the region's industrial demand – companies like Equinor, SSE, Meld Energy and Uniper. Total planned production equals 5.2GW by 2030 which is made up of a mix of blue and green hydrogen, with green hydrogen providing a further stimulus to the Humber's renewable energy sector. Whilst this presents an opportunity for surplus hydrogen to be used in businesses and transport, when factoring in the investment into the ports across the Humber to store and transport hydrogen, it also provides an exporting opportunity. The region has been recognised already for its strength in this space by international firms who have expressed an interest in exporting Humber hydrogen as part of their decarbonisation journey.

Beyond the production capabilities, the region has a host of natural hydrogen storage assets, that if deployed, could ramp up the UK's energy storage, protecting energy security and in the case of future economic shocks, helping manage consumer bills. This is seen to be



critical to our decarbonisation journey, with the National Infrastructure Commission (NIC) placing two energy storage recommendations at the heart of its Second National Infrastructure Assessment. First that the UK should develop a minimum of 8TWh of hydrogen storage capacity by 2035, and the second that the UK should also develop a strategic energy reserve that could be used if needed to generate 25TWh of electricity. It is worth noting the government has not yet set an explicit target for energy storage.^{xiv} The Humber is already home to the UK's largest energy store, with the Rough storage site currently storing 58bcf of gas – equivalent to the volume of gas needed to heat 2.4m homes over winter – with plans by Centrica to redevelop this facility, both to expand capacity but also ensure it is capable of storing hydrogen in the future. This investment offers the opportunity to boost storage capacity to at least 35TWh (120bcf) of natural gas or 16TWh (200bcf) of hydrogen. The Aldborough site, being developed by Equinor and SSE has an initial expected capacity of 420GWh, which is enough to power over 860 hydrogen buses a year. With the Rough site alone providing twice the NIC's recommended capacity, urgently addressing the barriers to developing these storage sites must be a priority for the government.

Addressing the barriers to restoring our storage capacity and transitioning to hydrogen storage becomes more important as we look both to the

increase in flexible renewable generation, and increasingly turbulent global relations. Starting with the latter, the Russian invasion of Ukraine created a significant energy shock and highlighted the weakness in the UK's energy security. Investment in energy storage could have helped better manage the end cost to consumers; indeed, analysis by FTI Consulting finds that had the Rough storage site been fully operational as a gas storage site it could have saved UK consumers around £2-3bn in wholesale costs in each of the winters (2021-22 and 2022-23). For a typical household this would have been equivalent to around £80 each winter.^{xv} Looking to the future, as the UK looks to source our electricity from low-carbon generation, which presents challenges around intermittency when the sun isn't shining and the wind isn't blowing, we need to ensure we build more flexibility into our energy system to balance the grid and reduce overall system costs.^{xvi} Developing more robust plans for energy storage, including the transition to storing hydrogen is one way we can address this challenge. As noted by the House of Lords Science and Technology Committee 'Long-duration energy storage: get on with it' report "Deploying long-duration energy storage technologies at scale is critical to ensure the UK can maintain energy security and reach net zero".^{xvii}

With these opportunities for the region in mind, there are several decisions needed in the near and medium term future to secure the private investment in the Humber region and deliver on



our goals for both hydrogen production, use and storage. By delivering these policy levers this could help achieve our net zero targets whilst protecting both the security and stability of our energy grid in the face of the changing energy mix, and mitigate the risk of future energy security shocks.

Short-term activity to kick-start investment in the Humber:

- 1. **Continue to progress existing schemes that will bring low-carbon hydrogen production, transport and storage to market**
 - a. *Announce the projects to be included with the second Hydrogen Allocation Round (HAR2) to ensure a route to market for more hydrogen projects.* Equivalent to Contracts for Difference (CfDs) for offshore wind, this will allow businesses to confidently invest in their projects and remain globally competitive. Considerations should be given to how to maximise the deployment of hydrogen to decarbonise industry, with priority given to areas that can connect to feasible storage solutions first, and where there is already scope to retrofit industry.

- b. *Work with industry to introduce the appropriate subsidy mechanism to support investment and delivery of Long Duration Energy Storage (LDES).* With the UK falling behind our European neighbours with our storage capacity, and the risks to the system of failing to deliver LDES, any storage sites should be treated as critical national infrastructure. Given these facilities can take seven to 10 years to convert, construction needs to start as soon as possible.^{xviii} With this in mind, and building on the work of the previous government, a cap and floor style system could be used to provide the right market signals to drive the investment in these assets. Whilst plans to restore and expand storage sites today are focused on gas storage, businesses are already planning for how to convert these projects for future hydrogen storage. This is why it is important that this support scheme is delivered in tandem with hydrogen support mechanisms to ensure security of supply for future storage.



- 2. **Deliver the government's missions of economic growth and clean power by breaking down the barriers that slow and stall infrastructure developments across the UK**
 - a. *Expedite planning permissions for nationally significant net zero projects.* Whilst the Humber is already home to established gas pipeline infrastructure, as is the case with CCS, new pipelines will be needed to support the transport of hydrogen from producer to user. These pipelines will face the same planning constraints as those being developed to carry captured carbon, which slows progress on project delivery and creates uncertainty for hydrogen producers and users across the region. They should therefore receive the same permitted development rights as underground cables, which as noted above, create a similar level of disruption and do not require a Development Consent Order. Removing this barrier will help create the confidence to drive investment in the transition towards a low-carbon hydrogen industry.

Medium-term initiatives to create the conditions for industrial decarbonisation and enable future clusters to thrive:

- 3. **Introduce policy frameworks that create the conditions for future project development**
 - a. *Incentivise and promote the adoption of low-carbon fuels through a comprehensive and transparent carbon accounting policy and by embedding pro-green growth in planning frameworks.* On carbon accounting, to date the Carbon Price Support and the EU/UK Emissions Trading Scheme (ETS) have helped drive investment for low-carbon generation and act as the main policies for carbon accounting in the UK. In the future these policies could continue to support in the further decarbonisation of industry and power generation and create a large and liquid market for low-carbon hydrogen production. This includes working with industry to create the appropriate market signals such as caps or allowances and aligning it with the Carbon Border Adjustment, alongside standards and certification for hydrogen production. Beyond this, embedding pro-green growth in port planning infrastructure, through the current review of the National Policy Statement for Ports will be key to delivering against the government's mission of clean growth. There is the opportunity to include an explicit presumption in favour of major green and trade enabling infrastructure, helping support strategic market-led port development.

The Humber presents a world-leading opportunity to play a key role in the UK's energy transition. Now is the time to provide businesses with a clear roadmap, giving them the confidence to kickstart their investments and deliver against these opportunities.

Adam Berman, Energy UK

Accelerating progress on offshore wind



Achieving the government's ambition for clean power by 2030 and net zero by 2050, alongside driving growth, and creating jobs, relies on the strength of our offshore wind.

Whilst the UK is well placed geographically to become a world leader in offshore wind, it's the North East coast, which on almost every measure, is leading the way.^{xix} The region is home to 33% of the UK's total offshore wind production capacity, and this is growing with the development of key sites such as Sofia, based off the North East coast but managed from the Humber, capable of providing 1.4GW of electricity,^{xx} and Dogger Bank South, providing an additional 3GW. The current pipeline of offshore wind projects in the region is set to provide an additional 11GW to the grid by 2030.^{xxi}

The strength of the industry today, and potential for growth in the future has also created robust supply chains and delivered investment in skills and people across the Humber. As set out within the Humber Offshore Wind Cluster Prospectus wind turbines are manufactured and installed in Hull, the UK's only significant wind turbine manufacturing facility and innovations are developed at the Aura Innovation Centre within the East Riding. Operations and maintenance are undertaken at the Port of Grimsby, Europe's largest O&M Hub - which is also home to the Offshore Renewables Energy Catapult, and helicopter transport to offshore sites is available from Humberside Airport.^{xxii} Within the Humber the industry already employs over 4,700 people, which is set to grow to over 14,750 by 2030.^{xxiii}

However, achieving the ambition of 55GW of offshore wind capacity by 2030^{xxiv} will require the UK to significantly increase offshore wind generation capacity, which today stands at around 15GW. Analysis by Energy UK has shown that after the last round of CfD allocation (Allocation Round 5, or AR5) failed to receive a single bid from offshore wind developers and AR6 and AR7, the next two rounds, will need to secure 10GW each if we are to achieve our 55GW by 2030 aim.^{xxv} With 18% of fossil fuel demand used in electricity generation today and estimated to increase to 50% by 2030 due to demands from surface transport, heating and industry,^{xxvi} delivering against this target will be vital to achieving the government's ambition for clean power by 2030.

This target is not insurmountable, however urgent changes are needed if we are to stay on track for 2030. We need to create the right incentives for industry to increase capacity, and at pace. Expanding the CfD scheme, which has been vital to ensuring offshore wind has a route to market will be key. However, we can't achieve the UK's ambitions for clean power without significant investment in grid capacity. As set out within the NIC's second assessment, this has been done before, and can be done again. In the 1950s an electricity 'Supergrid' was built in just 12 years, delivering 4000 miles of



transmission lines; in the 1960-70s, all gas appliances were converted in just 10 years; and in the 1990s the UK built around 40 gas powered stations to deliver equivalent to 20GW in capacity in just 10 years.^{xxvii}

Infrastructure can be delivered at pace with the right signals from government. However, what's as important is ensuring a coherent plan, which all key partners including the newly created National Energy Systems Operator (NESO), through to Ofgem, Department for Energy Security and Net Zero (DESNZ), and HM Treasury are agreed on, and which catalyses private and public investment. What's more, getting this right will facilitate growth and jobs in areas like the Humber, vital to rebalancing our economy, and delivering prosperity for communities across the UK.

- Short-term activity to kick-start investment in the Humber:**
- 1. **Progress and expand existing schemes that will bring planned and future offshore wind capacity to market**
 - a. *Address the backlog on grid connectivity to enable shovel ready generation projects to connect.* It is vital that the work of the NESO in developing a Strategic Spatial Energy Plan is openly consulted upon and delivered on time in 2024, alongside the Transmission Acceleration Action Plan. Implementation of a "first ready, first connected" principle is anticipated for grid queue management from 2025, however details are currently unclear, and in order for projects to understand how this change will impact them NESO and Ofgem should ensure that the details are consulted upon prior to decisions being taken.
 - b. *Work closely with key partners such as NESO and The Crown Estate to increase information sharing on seabed leasing plans.* This can build on the partnership that was announced in December 2023 and should look to feed into the Strategic Spatial Energy Plan as being developed by NESO.



- Medium-term initiatives to recognise the critical role of the Humber in the UK's drive to net zero:**
- 2. **Provide greater certainty on future demand for offshore wind and ensure routes to market**
 - a. *Provide long-term clarity on future allocation rounds by aligning targets for volume of offshore wind deployment with 2030 and 2050 climate targets.* Currently there is no long-term plan for the annual volumes of renewables needed to reach our targets for clean power by 2030 and net zero for 2050. DESNZ should therefore look to announce a long-term allocation schedule, with capacity targets per auction for offshore wind aligned to the 2030 clean power mission, to provide clarity on the volumes of offshore wind that need to be deployed to meet our targets.
 - b. *Ensure flexibility within the CfD structure and strike price to respond to external shocks and supply chain pressures, reducing the risk of a repeat of AR5.* Those within the industry provided clear warning that AR5 would not deliver against its target of 4.8GW of offshore wind capacity due to ASPs (ceiling prices) being set below cost levels. Government was unable to respond in time to the increased costs which were caused by the energy price shock of 2022 and supply chain pressures.^{xxviii} To prevent this from happening again, the government should look to build flexibility into the allocation rounds to provide a more agile response to external pressures that push up costs. Further flexibility could also be provided through adding additional later delivery years to each round, allowing the UK supply chain to better accommodate all projects rather than forcing all delivery in one year.

Building the foundations for success in the Humber



We have the opportunity to maximise the benefits of decarbonising the Humber with a focus on devolution, innovation and skills, ensuring the benefits of private investment can be felt in homes and businesses across the region.

As has been outlined throughout this paper, decarbonising the Humber Industrial Cluster presents a significant opportunity for the region and the UK. This includes creating over 20,000 new jobs in the region, and attracting over £15 billion in private sector investment. However as also noted, the scale of the opportunity is reflected by the scale of the challenge. Whilst it is important to create the opportunities for the individual industries to succeed, and urgently if we are to meet the 5th and 6th carbon budgets, there are underpinning factors that are key to enabling the whole of the Cluster to thrive. By addressing these, the Humber region has a much greater chance of delivering a decarbonised industrial cluster, whilst supporting wider ambitions of clean power by 2030, as well as growth within the region.

1. Deliver devolution within the region at pace to unlock the benefits that come with greater local powers, autonomy, funding and leadership.

The Humber region has fallen behind on its devolution journey. Whilst Council Leaders have worked hard to provide a clear voice to represent the region into Westminster and delivered significant initiatives to drive growth across the region, the slow progress on further devolution has seen the region miss out on devolved funds and powers. We are already behind our neighbours across Yorkshire, and other cluster

developments in Teesside and the North West, who, with strong regional backing were able to secure Track-1 status to accelerate progress on CCS projects.

Recent announcements have seen much welcome progress in delivering the devolution deals that were agreed prior to the election. This would see two combined authorities, one covering the north bank and wider East Riding area, and another covering the south bank and Greater Lincolnshire. Within these deals was the recognition that the Humber Energy Board would act as a collaborative force, and was tasked with creating a joint Net Zero Strategy for the Humber, recognising the need for collaboration across the wider region to deliver a decarbonised industrial cluster. Alongside the freeport and local authorities, the chair of the Humber Energy Board was invited to sit on a Joint Strategic Committee to discuss how to take forward devolution across the Humber.

As devolution deals in the Humber are progressed and Mayors eventually elected, it is vital that the Humber Energy Board continues to be formally recognised as having a cross regional role and, given the scale and significance of the opportunity it is promoting, is invited to join any future mayoral authority to provide consistency and ensure the roadmap can be delivered at a local level.



2. Create a more coherent innovation landscape, that focuses equally on the development of new technologies, and on creating a route to market to support the deployment of these new technologies

The Humber has a long history of leading the way on innovations. From household brands, Dettol and Gaviscon, through to the development and delivery of London's tube trains in Goole, or offshore wind blades made in Hull, the region has led the way when it comes to the creation of new, everyday products. More recently, focus has been on how to transition to a low-carbon industrial economy, with industry trialling solutions for low-carbon fuels, producing speciality graphite coke used in EV lithium-ion batteries, or identifying the most efficient way to deliver net negative carbon emissions through BECCS and the subsequent uses for bio-genic CO₂ such as e-fuels, or Sustainable Aviation Fuels. This appetite for innovation is reflected in the range of innovation facilities that exist within the region, including across university and college campuses, the Aura Innovation Centre in Hessle, the Offshore Renewable Energy Catapult site in Grimsby, and the range of UK Research and Innovation (UKRI) projects underway within the region.

Industry across the Humber has benefitted significantly by working in partnership with UKRI through their Industrial Decarbonisation Challenge. This includes funding for Front End Engineering Design for major projects across the region, and the Development of the Humber Industrial Cluster Plan to set the blueprint for growth.

To date, innovation funding competitions have often concentrated on low 'technology readiness level' opportunities that allowed industry to create and test technology. The result of this means the Humber is now ready to deploy this new technology at pace but is stuck waiting for clarity on how to operationalise its ambition. As set out above, urgent decisions are needed to enable business to scale up their projects, through the deployment of the industrial cluster plan – delivering solutions for power generation with CCS, low- and zero-carbon hydrogen production, storage and use, BECCS for carbon negative power generation, as well as delivering our ambitions around a circular economy through the use of biogenic CO₂. If progress is not made on the recommendations set out above, the UK is at risk of losing the IP it has developed in favour of other countries where markets are being created at a faster pace.



Industry is committed to continuing to work in partnership with government, innovation delivery bodies, and the academic sector to ensure the UK remains a world leader in net zero technologies. This includes ensuring that we can deliver a return on investment for every pound of public sector funding that has been received to bring forward new innovations to deliver a decarbonised industrial cluster. As a first step, beyond progress on the industrial cluster sequencing, industry needs clarity on the route to market that will support the deployment of new technology. This includes markets for industrial carbon capture models, power-BECCS and greenhouse gas removals, dispatchable power agreements, and improvements to the emission trading scheme by aligning with the carbon border adjustment mechanism to incentivise the deployment of low-carbon fuel options.

3. Ensure skills development is flexible to meet the needs of the region, supporting businesses in offering the range of courses and course types needed to reskill and upskill the region ready for a net zero future.

The Humber Industrial Cluster Plan creates a range of new employment opportunities for communities across the region, however, action is needed to successfully deliver a future fit workforce. Based on conservative estimates, the Industrial Cluster Plan has outlined that over

22,800 direct jobs could be created in the region from plans for industrial decarbonisation.^{xxxix} The majority of these will be in construction and related industries, followed closely by technical and professional skills.^{xxx}

The region already has the foundations for success. It has a strong university and college network, and a range of specialist providers. The education sector has established collaborative networks including the Institute of Technology and works closely with regional bodies such as the Greater Lincolnshire LEP, the Hull and East Riding Business Growth and Skills Hub, and the four councils. Sector representatives sit on cross Humber collaborative bodies including the Humber Energy Board, on the Engineering Construction Industry Trading Board, that industrial partners pay a levy to alongside their apprenticeship levy commitments, and on the Freeport Board to ensure skills alignment across industrial initiatives. Industry has also committed its support for reskilling and upskilling through a range of initiatives. This includes, but is not limited to working alongside skills providers including the Humberside Engineering and Training Association (HETA), the Humber Energy Skills Training Academy, and CATCH – a process, energy, engineering and renewables skills provider. This is in addition to long-standing relationships with further and higher education providers across the region. In anticipation of further demand for a skilled workforce across the Humber, providers are already looking to expand



the capacity for training provisions helping the region become a leader in engineering and construction training provision. Delivering against the recommendations below could provide the launchpad for further success.

1. Use the development of Skills England to refine the skills landscape, whilst keeping employers at the heart of reforms to T-levels, apprenticeships and wider skills provisions.

With the development of Skills England and the hope of future devolution across the region, as well as the government's ambition to develop 650,000 new jobs by 2030 through their Green Prosperity Plan, there is opportunity to further refine the skills landscape. This should focus on keeping employers at the heart of reforms. This includes continuing to make progress on incorporating T-Levels into the skills system and working alongside businesses to embed them in inclusive workforce plans, and providing more flexibility and agility in the use of the Apprenticeship Levy in order to deliver more upskilling and short courses. By doing so we could better meet the real-world needs of learners and businesses.

2. Build on the track record within the Humber, delivering a more holistic approach that better aligns the range of skills initiatives with the local needs to prevent barriers to reskilling.

Skills bootcamps have, for example, been a useful tool across the Humber, where the focus has been on upskilling and reskilling to ensure employees are future ready. As the government looks to develop their post-16 skills strategy, setting out the role for different providers and enabling students to move between different institutions more easily, there is scope for the Humber Industrial Cluster, through the Humber Energy Board to work closely with DESNZ, the Department for Education and Skills England to collaborate and inform models of best practice.



3. *Use devolution as an opportunity to better align skills initiatives with the specific needs of the region, and work to build inclusive workforce plans.*

There is an opportunity to build upon the Local Skills Improvement Plans, aligning these with other initiatives under review by the newly created Skills England, such as the reformed Apprenticeship Levy (Growth and Skills Levy), the Lifelong Learning Entitlement, and the Adult Skills Fund. The devolved authorities, through their Local Growth Plans should look to continue their close working with major employers, universities, colleges, and industry bodies to produce long-term plans that identify growth sectors. In doing so they can support with the

development of programmes and the infrastructure regions need to thrive, aligning with the national industrial strategy. These plans could also provide useful guidance and wrap around support to education providers to help those furthest from the job market back into training. This would address a major barrier to employment, where currently the administrative burden of supporting this group is significantly higher than for those already in work and undergoing reskilling. Industry is already working with partners in neighbouring Teesside and through local partners as listed above to deliver the training provision the region needs, and in particular working with the supply chain to deliver skills excellence across the region.



4. *Support people into the workforce by providing a more holistic approach to careers guidance, and ensuring supply of teaching experts, work experience placements and apprenticeships meets the region's demands.*

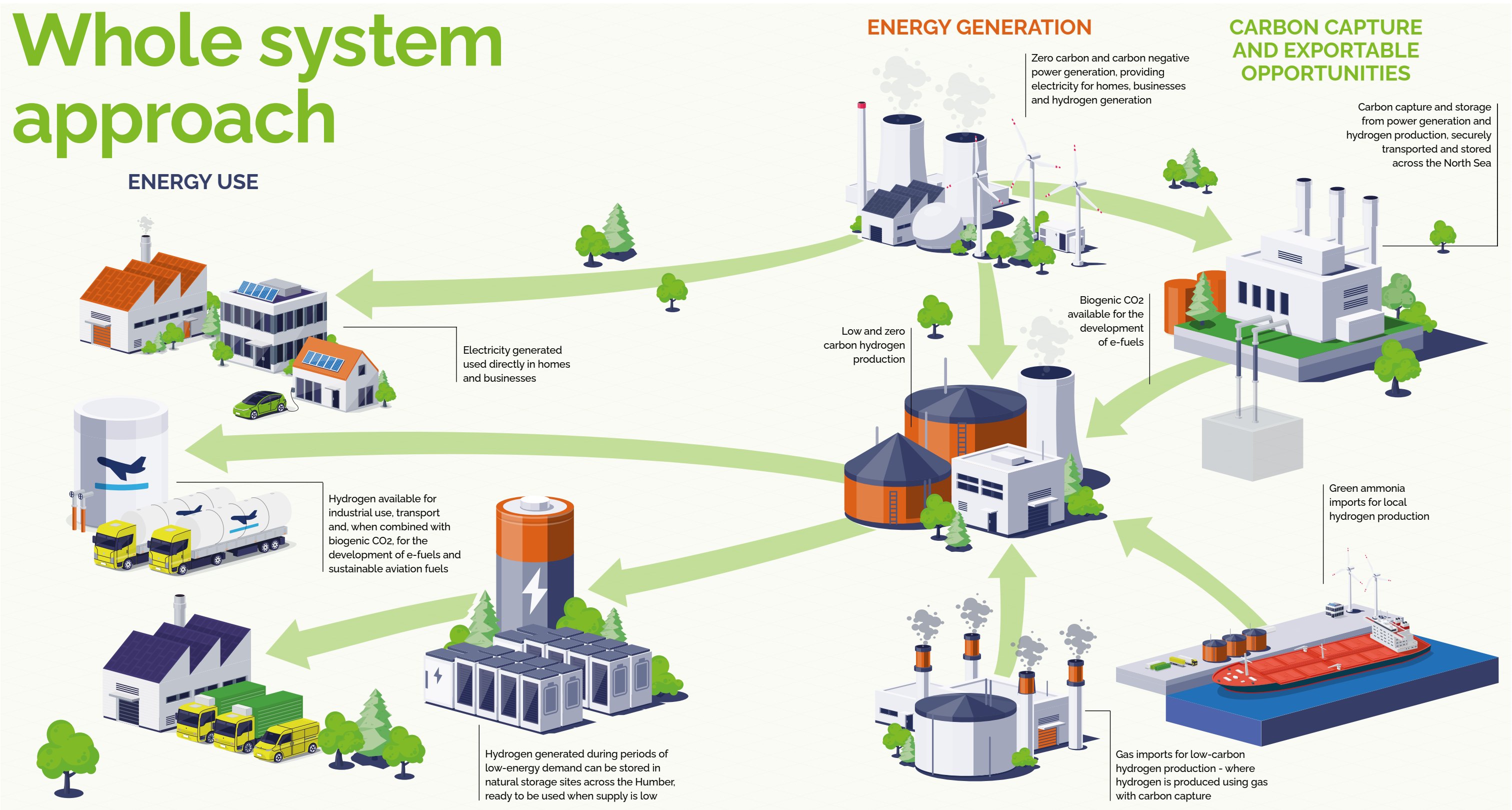
When looking to the future talent in the region, more can be done to support people into the workforce, and unlock the potential of the Humber. As already noted by Engineering UK, there is a lack of 'back-casting' to understand the numbers of technical and engineering students needed to undertake STEM subjects at a younger age to ensure we have the future pipeline for homegrown talent.^{xxx1} The Unit for Future Skills should look to provide analysis on numbers of young people undertaking STEM subjects and put in place plans to address any shortfall that may prevent us from developing the skills needed in construction and engineering in the future.^{xxx1} For education providers in the region, there is often a lack of placements for work experience, internships and apprenticeships. Work is underway nationally to help young people make informed choices on the future of work, and locally in partnership with the National Careers Service, Department for Work and Pensions, the Careers and

Enterprise Company and industry to re-think best practice for work experience that helps meet the needs of users and businesses. However more support could be provided for small and medium sized businesses who struggle to make placements viable within their operations. With the reform to the apprenticeship levy, and the need to incorporate T-Levels within wider skills plans, further consideration is needed on how more support can be provided to these smaller businesses to help create real-world work experience and apprenticeship opportunities to people.

Finally, a major challenge for education providers is the shortage in teaching experts. With engineering and construction roles already in short supply across the UK, education providers are unable to compete with industry on cost to attract talent. Whether led by devolved authorities where they exist, or by Skills England, addressing this shortage of teaching experts, such as through bursaries and grants, or creating routes for day release from industry, will be vital to ensuring the education sector has the instructors, assessors and lecturers needed to ensure the region has the pipeline of talent needed to meet future demands.



Whole system approach



EAST YORKSHIRE CONTINUES TO LEAD THE WAY WHEN IT COMES TO OPPORTUNITIES AROUND NET ZERO, AND THIS REPORT SHOWS HOW MUCH POTENTIAL WE HAVE TO PLAY OUR PART IN THE COUNTRY MEETING OUR NET ZERO TARGETS. NOW IS THE TIME FOR INDUSTRY AND GOVERNMENT TO COME TOGETHER ACROSS THE HUMBER AND INTO WESTMINSTER, GIVING OUR BUSINESSES THE CONFIDENCE TO INVEST IN THEIR PLANS FOR DECARBONISATION.

Councillor Handley, East Riding Council

Conclusion



From achieving the UK's net zero ambition whilst keeping the lights on, through to the delivery of future jobs and skills and exportable innovations, the Humber must be at the heart of the UK's plans for a decarbonised, thriving economy. Achieving this now requires urgent action, and business stands ready to work with government, from Whitehall to town halls to ensure we can deliver this plan at pace, and in a way that protects our local economy and the people within it.

This report sets out in detail the policies and interventions that are needed to give businesses the confidence to invest. At the heart of this plan are three core technologies, carbon capture and storage, hydrogen production, use and storage, and offshore wind. Whilst the recommendations for each are unique to the technology, they all revolve around three reoccurring key themes:

- Urgent clarification is needed on in flight opportunities including CCS Cluster Sequencing and Hydrogen Allocation Rounds to shore up investor confidence and help unlock billions in private sector investment across the Humber to accelerate our journey to net zero.
- There is a time critical need to break down bureaucratic barriers to progress, ensuring that critical, enabling infrastructure in the region – from pipelines to cables - are expediated using the planning rules to support rather than hinder progress.
- And finally we need to create the markets for these technologies to thrive. This includes embedding a circular economy in industrial clusters to support the development of

e-fuels, and delivering a comprehensive and transparent carbon accounting policy to drive demand in low-carbon fuels. It also means providing a long-term forecast on volumes of offshore wind needed to meet climate targets and flexible funding mechanisms to ensure we achieve them. Finally, considering the long-term sustainability of the projects, there is the opportunity to deliver robust carbon pricing to help transition from subsidy to market-let opportunities for carbon capture and storage projects.

The scale of the opportunity, including the commitments from business can be found in the proceeding pages of this report. Transforming the Humber is an unparalleled opportunity illustrated by the breadth and depth of the showcase of projects available. But what really sets this region apart is the recognition that by working together these projects are more than the sum of their parts. The Humber Energy Board has led the way in bringing this opportunity together – transforming individual projects into an industrial ecosystem that can revive the region's economic fortunes. It has built partnerships across the region to deliver a common and unified narrative to government. But the reason that it's bringing this message to government is because this plan cannot be achieved in the region alone.

Now we need government to add their support, delivering on the policy priorities outlined in this report, prevent further delays to decision making, shore up investor confidence and ensure we can achieve our shared ambition of jobs, growth, opportunities in a thriving net zero economy.

Summary of Humber projects

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BECCS at Drax



Bioenergy with CCS at Drax (BECCS) – Through producing negative emissions and sustainable renewable electricity, Drax will power the nation while enabling the UK to decarbonise.

BECCS at Drax will transform Drax Power Station from the largest power station in the UK to the largest negative emissions project in the world, anchoring the CO2 pipelines in the Humber and creating and supporting thousands of jobs in the region, subject to a £2bn investment decision being taken in 2027.

BECCS at Drax will use proven technology to remove up to 8MT of CO2 emissions from the atmosphere each year by 2030, while continuing to be the UK's single largest source of renewable energy, powering the equivalent of 4 million homes. The project has already secured planning consent and completed engineering design, and through BECCS can help kickstart a new CCS industry right here in the Humber, driving new clean growth and supporting thousands of green jobs.

 **Decarbonisation potential:**
8 MT CO₂ p.a. negative emissions by 2030

 **Investment**
£2bn investment to be made by Drax



Keadby Carbon Capture Power Station



The proposed Keadby 3 Carbon Capture Power Station would be a new 910MW power station in North Lincolnshire, fitted with carbon capture technology to remove CO2 from its emissions.

The power station, which was the first of its kind to gain planning consent in December 2022 would use natural gas as its fuel and be fitted with a carbon capture plant to remove the CO2 from its emissions.

Plugging into the shared pipelines with the CO2 being stored off the coast, when complete, Keadby Carbon Capture alone is expected to offset up to 1.5 MT of CO2 – at least 5% of the UK Government's 2030 target.

 **Decarbonisation potential:**
1.5 MT CO₂ p.a. captured



Prax Lindsey Carbon Capture Project



Prax Lindsey Oil Refinery plans to deploy carbon capture technology on its strategic energy infrastructure to capture >1 MT p.a. CO₂.

Prax Lindsey Oil Refinery is critical infrastructure, helping to ensure the UK's energy security and providing the fuels needed to keep the UK moving. It is vital that we decarbonise. To do this, the Prax Group plans to deploy carbon capture technology as part of the proposed Humber Carbon Capture Pipeline and Viking Pipelines to capture >85% of our CO₂ emissions. In the current manufacturing and industrial processes at the refinery, flue gases including CO₂ are released into the atmosphere. The Prax Lindsey Carbon Capture Project will see a dedicated amine-based carbon capture unit built to capture carbon, before it is released. The unit will dehydrate / decontaminate the captured CO₂ and compress it into a dense fluid, whereupon it will be routed for safe storage under the North Sea via the Humber Carbon Capture Pipeline (HCCP)/East Coast Cluster/Viking Pipelines.

 **Decarbonisation potential:**
>1 MT CO₂ p.a. captured






Humber Zero



Located in the heart of the industrial Humber region, we are aiming to deliver one of the world's largest carbon capture projects, whilst strengthening UK infrastructure and creating local jobs.

Through Humber Zero, VPI and Phillips 66 Limited plan to deliver almost a fifth of the UK Government's 2030 targets for captured carbon, with plans to capture up to 3.8 million tonnes of CO₂ starting from 2028 from VPI's Combined Heat and Power (CHP) plant and Phillips 66 Limited's Humber Refinery respectively.

The projects aim to deploy post-combustion capture technology on two of the gas turbines in VPI's CHP plant and on Phillips 66 Limited's Humber Refinery fluid catalytic cracking (FCC) process, which processes renewable and conventional feedstocks. The captured carbon dioxide would be compressed and transported for storage.

-  **Decarbonisation potential:**
3.8 MT CO₂ p.a.
-  **Investment:**
In excess of £2bn private sector investment value
-  **Jobs:**
2,500 construction jobs created



**BY IMPLEMENTING THE RECOMMENDATIONS
WITHIN THIS REPORT, WE CAN SEIZE THE
OPPORTUNITIES FROM DECARBONISING
ONE OF THE UK'S MOST CARBON INTENSIVE
REGIONS, WHILST PROTECTING AND
CREATING JOBS, AND DRIVING GROWTH.**

Beckie Hart, Yorkshire and Humber Regional Director, CBI



CARBON CAPTURE, UTILISATION AND STORAGE IS AN ESSENTIAL TECHNOLOGY TO REACH NET ZERO EMISSIONS, AND THE HUMBER PROVIDES ONE OF THE UK'S LARGEST CARBON CAPTURE OPPORTUNITIES.

Olivia Powis, Chief Executive of the CCSA



Phillips 66



The only producer in Europe of speciality graphite coke used in EV lithium-ion batteries and the only UK refinery to make and supply sustainable aviation fuel at scale.

Phillips 66 Limited's Humber Refinery has started its journey to build a thriving, lower carbon business by leveraging its existing capabilities and investing in new energy technology. The refinery already produces lower carbon road fuels and is the UK's only refinery to make and supply sustainable aviation fuel (SAF) at scale. Additionally, the refinery is Europe's only producer of speciality graphite coke used in lithium-ion batteries. These are the same high-performance batteries that power electric vehicles, personal electronics, medical devices and grid storage. As part of its plans to lower operational emissions by up to 1.8 million tonnes of CO₂ per year, the refinery is exploring multiple carbon capture plants, with their first one planning to be part of Humber Zero, one of the world's largest carbon capture projects. Through a separate project they are also exploring how hydrogen refuelling can be used across site to replace some of the fossil fuels used to power its heaters with lower carbon hydrogen.

- Decarbonisation potential:**
Up to 1.8 MT CO₂ p.a.
- Investment**
In excess of £1bn private sector investment value
- Jobs**
1,000 jobs maintained



Northern Endurance Partnership



The Northern Endurance Partnership (NEP) is the CO₂ transportation and storage company which enables the East Coast Cluster (ECC) carbon capture proposals.

The NEP is the operator of the full, end-to-end CO₂ transport and storage system for the ECC, and will develop the common infrastructure needed to transport CO₂ from carbon capture projects across the Humber and Teesside to secure offshore storage in the Endurance aquifer and nearby stores in the Southern North Sea. In the Humber, NEP is progressing the engineering design of the Humber Carbon Capture Pipeline (HCCP) project. This pipeline will offer carbon emitting sites across the region the opportunity to capture their carbon emissions and transport them for safe offshore storage. This infrastructure is important to achieve net zero in the Humber – the UK's most carbon intensive industrial region.

- Decarbonisation potential:**
Up to 23 Mt PA CO₂ storage potential at project peak in 2035
- Jobs:**
The East Coast Cluster could support an average 25,000 jobs per year (between 2027-2050)



Harbour Energy, Viking CCS



A Track-2 selected CCS Cluster in the Humber, targeting a reduction of 15 million tonnes per annum of UK emissions by 2035.

Led by operator Harbour Energy, with non-operated partner bp, Viking CCS will develop the infrastructure to transport and store CO2 in secure offshore storage sites. Making a critical contribution to the 2030 clean power goal, Viking CCS will support the decarbonisation of 4GW of power generation (including from gas, BECCS and energy from waste) across the Humber and from further afield. Working with a wide range of capture partners, the project will promote inward investment and generate a jobs and skills boost for the region's workforce and wider supply chain. This includes creating nearly 20,000 jobs at peak construction of the project. Viking CCS will reuse existing pipelines and utilise decommissioned gas fields in the Southern North Sea to provide UK industries with a competitive option for the transport and storage of their CO2 emissions.

Decarbonisation potential:
15 MT CO₂ p.a. by 2035

Investment:
Unlocking a combined **£13.9 billion** of capital investment from 2025-2035 across the full CCS chain



H2H Saltend



H2H Saltend is Equinor's flagship 600-megawatt low carbon hydrogen production project with carbon capture.

This offers to reduce the site's CO2 emissions by nearly one million tonnes annually, representing a 30% reduction in the Saltend Chemicals Park's total current carbon emissions. The plan is backed by local industrial operators who could potentially use this hydrogen to lower the carbon footprint of their processes and products. For example, hydrogen could be used in industrial heating, power generation, or as an ingredient in widely used chemicals such as ammonia and methanol. The on-site Saltend Power Station, which is co-owned by Equinor and SSE Thermal, will seek to blend hydrogen into the natural gas which currently powers it. It is hoped that eventually the power station could run entirely on low carbon hydrogen, replacing natural gas. Given its location near to the coastal landfall, H2H Saltend can act as the first site to link into regional hydrogen and CO2 pipelines, kick-starting the development of this infrastructure across Yorkshire and northern Lincolnshire, and ultimately leading to a zero carbon Humber.

Decarbonisation potential:
900KtPA CO₂ abatement potential,
30% reduction in plant's current emissions

Jobs:
1,000 jobs during construction,
100 during operations, over 500 maintained



This report provides the blueprint for the new government on how to unlock £15 billion worth of private investment and deliver growth across the region and beyond. With business working in partnership with government, now is the time to deliver.

Henri Murison, Chief Executive,
The Northern Powerhouse Partnership



Saltend Power Station



This joint venture by Equinor and SSE Thermal is exploring ways to decarbonise power generation through low-carbon hydrogen, helping cut chemicals park emissions by 30%

Saltend Power Station is currently fuelled by natural gas and provides power and steam to industrial users at Saltend Chemicals Park in addition to energy to the national grid. Decarbonising the power station by displacing natural gas with low carbon hydrogen can considerably reduce its emissions, while also reducing those of its users, such as chemicals manufacturers at the chemicals park and other nearby industrial premises. Initially, hydrogen can be blended with natural gas at a ratio of circa 30% by volume, with the ambition to increase this to 100% as technology evolves and hydrogen storage infrastructure develops.

Decarbonisation Potential:
Initially up to 30% displacement of natural gas with low carbon hydrogen, increasing over time up to 100%



Aldbrough Hydrogen Storage



The Aldbrough Hydrogen Storage Project aims to deliver security of supply through enabling large scale hydrogen storage to deliver for other key projects across the region.

Being developed by SSE Thermal and Equinor, Aldbrough Hydrogen Storage would help support and enable a low-carbon hydrogen economy in the Humber and beyond, providing a buffer for the variable nature of a renewables led energy system. Located at the existing Aldbrough Gas Storage site in East Yorkshire, Aldbrough Hydrogen Storage will include the creation of nine new caverns with an expected capacity of up to 420mcm of low-carbon hydrogen and could be operational by the early 2030s. Connecting to other key decarbonisation projects such as H2H Saltend and H2H Easington via a dedicated hydrogen pipeline to form the Humber Hydrogen Hub, Aldbrough will act as a vital balancing mechanism between hydrogen producers and hydrogen users across the region, whilst also storing excess renewable energy at scale. Aldbrough Hydrogen Storage would be a critical asset for the UK's energy security and helping the country to meet its low carbon hydrogen ambitions.

Decarbonisation Potential:
420m cubic metres of hydrogen storage capacity



Aldbrough Hydrogen Pathfinder



The Aldbrough Hydrogen Pathfinder (AHP) will chart a path for electrolytic hydrogen in the Humber, integrating production, storage and offtake. It will showcase how hydrogen can provide security of supply and power the UK to net zero.

Located within SSE Thermal and Equinor's Aldbrough Gas Storage site, the proposed development comprises a 35MW electrolyser, a repurposed storage cavern and a 50MW OCGT running on up to 100% hydrogen. AHP will support the evidence base for wider deployment of flexible hydrogen power as an enabler of at-scale hydrogen offtake and a key provider of home-grown, secure, dispatchable power. By demonstrating an integrated approach for electrolytic hydrogen production, salt cavern storage and gas turbine offtake, AHP can play a crucial role in unlocking the hydrogen value chain, underpinning the development of a hydrogen economy while adding flexibility to the system.

Decarbonisation potential:
Repurposing an existing fossil fuel storage cavern, providing up to 100GWh hydrogen storage capacity



H2H Easington



In 2022 Centrica and Equinor signed a co-operation agreement to explore developing a low-carbon hydrogen production hub at Easington.

Detailed engineering studies have been conducted to assess production of up to 1.2GW of blue hydrogen production and up to 1GW of green hydrogen at Easington within the 2030s. These are technically feasible, with the relevant gas, water and carbon capture facilities in place, allowing for economies of scale and driving down the cost of hydrogen. Proposals for a green hydrogen electrolyser have been submitted to government as part of the second Hydrogen Allocation Round process. If successful, this initial electrolytic hydrogen system would be operational by early 2029 and would fuel switch off-takers within the Easington terminal, significantly reducing the site's CO2 footprint by over 100,000 tonnes per year by displacing current natural gas demand. Equinor and Centrica are thereafter planning to scale up H2H Easington to 400MW in 2030, with the additional hydrogen utilised by other off takers including potentially for Sustainable Aviation Fuel (SAF), which is key to facilitating the energy transition in the aviation sector.

Decarbonisation Potential:
Up to 100,000 tonnes PA during first phase, up to 3MtPA upon completion

Jobs:
944 direct FTE, and around 2000 total FTE jobs at construction peak. GVA Impact: £1bn



Saltend Green Hydrogen Hub



Meld Energy is a green hydrogen project developer that is backed by World Kinect Corporation, the international Fortune 100 energy management company. We plan to develop a portfolio of projects to supply green hydrogen for use in industry, road transport, shipping and aviation.

The Saltend Hydrogen Hub scheme at Saltend Chemicals Park will deliver in its first phase 100MW of hydrogen production, supplying almost 40,000kg per day of clean hydrogen to the occupiers on the Park. Expansion plans will see supply increase to the Park for industrial use and as an ingredient for hydrogen derivatives like green ammonia and clean fuels targeting 500MW of production. Construction for phase 1 is set to start in 2026 with operation targeted for 2028, creating c1400 jobs through construction into operation and driving over £200m of investment to the Humber. Built today, the Saltend Hydrogen Hub would be the largest green hydrogen production site in the UK and its delivery and expansion plans will provide a massive stimulus to the development of the hydrogen economy on the Humber and the UK.



Decarbonisation Potential:

100MW increasing to 500MW green hydrogen production. More than 10MT CO2 reduction targeted.



Investment:

£200m rising to £1bn for hydrogen development and delivery



Humber Hydrogen Pipeline



The Humber Hydrogen Pipeline is under development by partners Equinor, Centrica Energy Storage and SSE Thermal. It proposes a dedicated hydrogen pipeline connecting a network of hydrogen production, usage and storage sites in East Yorkshire and northern Lincolnshire, with potential for future expansion.

The pipeline, covering approximately 45Km will link projected green and blue hydrogen producers and users at Saltend, Easington and Immingham with the proposed storage site at Aldbrough. The pipeline crossing under the River Humber will also provide connectivity between both banks, enabling access to hydrogen storage for producers and users in Lincolnshire.

It also allows for connection to the wider hydrogen economy via the proposed National Gas 'Project Union' and National Gas, Cadent and Northern Gas Networks 'East Coast Hydrogen Project' infrastructure.

The Humber Hydrogen Pipeline and the projects it enables could help to meet the Government's UK-wide low carbon hydrogen targets and demonstrate a model to be rolled-out in industrial regions throughout the world.

Delivering carbon removals is critical to achieving our net zero goals, this report provides a clear sense of the ambition of industry across the Humber and outlines the scale of the opportunity if we get this right - driving regional and national growth, and creating thousands of jobs in and around the region.

Samantha Smith, REA



Keadby Hydrogen Power Station



Keadby Hydrogen Power Station is a proposed 900MW plant located to the west of Scunthorpe

The proposed development, which could be operational from 2030, will bolster security of supply and support the UK's long-term decarbonisation by providing back-up low-carbon power.

The new power station will be designed to run on 100% hydrogen from the outset with the capability of generating using natural gas for an initial period, it's 'dual fuel' nature will help to ensure security of supply alongside delivering further investment at the strategic Keadby site. Using market leading technology to maximise efficiency and deliver for the system, Keadby Hydrogen is the next step in delivering reliable and flexible generation.

CO₂ Hydrogen production: 900MW



Stallingborough Generating Plant



The Stallingborough Generating Plant is a proposed natural gas-fired power station equipped with carbon capture technology. It is strategically located by the Humber Estuary near Stallingborough, North East Lincolnshire.

The station will generate up to 900 megawatts (MWe) of decarbonised electricity, providing a secure energy supply to the grid during periods when renewable energy generation is low.

The proposal will add to RWE's expanding presence in the region. Once constructed it will support 50 high skill jobs and foster growth in the local supply chain. At present RWE are also involved in other significant projects in the area, including the 1.4GW Sofia offshore wind project in the North Sea, a solar farm proposal at Tween Bridge, North Lincolnshire and the construction of the state-of-the-art Grimsby Hub operations and maintenance centre.

As the Stallingborough CCGT Generating Plant with Carbon Capture would generate over 50MWe, it is classed as a Nationally Significant Infrastructure Project (NSIP) and will proceed through the Development Consent Order (DCO) planning process. The Secretary of State will make the final decision on whether to grant consent for the project for the Department for Energy Security and Net Zero.

CO₂ Decarbonisation potential:

Up to **2MT** year of CO₂ captured, the equivalent of removing **400,000** petrol cars from the road

Up to **900MWe** of decarbonised energy, enough to power around **1 million** homes



Rough Hydrogen Storage



Centrica's redevelopment of Rough would provide 16 TWh of hydrogen storage capacity to UK infrastructure and is the least-cost option to meet the UK's hydrogen storage demand.

As the remaining gas in the Rough reservoir nears economic depletion, alternative uses for the unique facility have been investigated by Centrica Energy Storage+ (CES+). Given the UK Government's target to transition to net zero greenhouse gas emissions by 2050, CES+ has identified that the Rough field could provide a vital component in the UK's hydrogen infrastructure. Re-purposing Rough, an existing depleted gas field that historically has operated as the UK's largest proven natural gas storage facility, is expected to be the most cost-efficient option to meet the long-term need for hydrogen storage. Rough's unique geological and geographical advantages position it well to support a growing hydrogen economy and have no insurmountable technical barriers to conversion to hydrogen storage. The successful redevelopment could offer a phased capacity build up to 16 TWh of storage to UK infrastructure.

CO₂ Hydrogen storage: 200 bcf/ up to 16 TWh of hydrogen storage (working gas)

£ Investment: £2bn private sector investment



Humber H2ub® (Green)



The Humber H2ub® is a proposed large scale, low carbon hydrogen production facility at Uniper's Killingholme site.

The Humber H2ub® (Green) project development will include green hydrogen production capability with a capacity of up to 120MW (subject to further engineering assessment) and potential future expansion of a further 200MW+. The hydrogen would be used to replace refinery fuel gas in industrial-scale fired heaters as part of Phillips 66 Limited's plans to reduce the Humber Refinery's scope 1 operational emissions.

The project is targeted to be operational by 2029.

CO₂ Decarbonisation potential:

An initial up to **120MW** green hydrogen production capacity with potential **200MW+** future expansion



Humber H2ub® (Blue)



The Humber H2ub® is a proposed large scale, low carbon hydrogen production facility at Uniper's Killingholme site.

The Humber H2ub® (Blue) project development will include hydrogen production capability with a capacity of up to 720 megawatts, using gas reformation technology with carbon capture and storage (CCS). The hydrogen generated could be used to decarbonise heavy industry, transport and power throughout the Humber region. The captured carbon will then be transported to permanent storage offshore in facilities such as re-purposed offshore geological storage fields in the UK's North Sea. The project could be operational in 2030, but more clarity is needed on CO2 transport and storage solutions, and when regional hydrogen pipeline infrastructure could be in place.

Decarbonisation potential:
720MW blue hydrogen production capacity with **1.6MT CO₂** p.a. captured

Jobs:
Around **120** permanent jobs created



Immingham Renewable Hydrogen Facility



Air Products is planning to build, own and operate a large-scale renewable (green) hydrogen facility in Immingham.

The facility would use imported green ammonia to produce up to 210 tonnes per day of green hydrogen, equivalent in energy terms to an output of 300MW and delivering up to 3% of the UK Government's 10GW of low-carbon hydrogen by 2030 target. This would help kickstart the UK green hydrogen market, decarbonise heavy duty transport and energy intensive industries. It would also deliver up to 1,400 direct jobs and create more than £4.6 billion in economic growth for the region. The facility would make the Humber a major location for low-carbon energy production, businesses and jobs. The production facility would allow heavy industry and transport operators to source reliable green hydrogen that is independent of intermittent renewables.

Decarbonisation potential:
Up to **580,000** tonnes of CO₂

Hydrogen production:
300MW

Jobs:
1,400

Economic contribution:
£4.6bn

Humber Freeport is accelerating the region as a world-leading hub for renewable energy, clean growth, digital innovation and advanced manufacturing.





**DECARBONISING
THE HUMBER WILL
SAFEGUARD 1 IN 10
EXISTING JOBS IN THE
REGION AND PROVIDE
THOUSANDS OF NEW
WELL PAID JOBS**



Immingham Green Energy Terminal (IGET)



ABP is progressing the DCO process for a new green energy import/export terminal known as IGET. This is central to enabling major developments for green hydrogen production and CCS.

IGET is a £100m+ nationally significant infrastructure project that will enable the UK's first large scale, green hydrogen production facility to help decarbonise hard-to-abate sectors such as industry and transport at a highly unit competitive cost.

This project will stimulate demand, support the development of a UK green hydrogen market, and support government ambitions to make the UK a "global leader in low-carbon hydrogen" as well as supporting our energy security needs.

IGET is also an enabler of the Viking CCS Cluster. The terminal will provide a large-scale facility to connect CO2 emissions from industrial businesses around the UK to Viking's CO2 storage sites in the Southern North Sea.

The seaborne transport access it gives will provide unrivalled high-volume options for both decarbonising UK industry and also opening up export opportunities for European trade.

This provides an opportunity for the UK to become a significant player in internationally shipped sequestered carbon.

CO₂ Decarbonisation potential:
Supporting Viking CCS to capture and store 10m tonnes of CO₂ by 2030 and Air Products to eliminate 580,000 tonnes per year.

H Hydrogen production:
Enabling 300MW of Air Products hydrogen production.

£ Investment:
Enabling £1bn+ of private sector investment.



Dogger Bank Wind Farm



This world-record-beating project will provide 3.6GW of offshore wind capacity off the Yorkshire coast.

The 3.6 GW Dogger Bank Wind Farm is being constructed in UK waters more than 70 nautical miles (130km) off the coast of Yorkshire and in the UK's North Sea in three 1.2 GW phases known as Dogger Bank A, B and C.

The project is a joint venture partnership between SSE Renewables (40%), Equinor (40%) and Vårgrønn (20%) with expected operational life of around 35 years.

When fully complete, Dogger Bank's world-record-beating 3.6GW capacity will comprise 277 giant offshore turbines capable of producing enough clean energy to power the equivalent of six million homes annually and deliver yearly CO₂ savings equivalent to removing 1.5 million cars from the road.

Operations and maintenance will be carried out from the recently opened O&M base at the Port of Tyne. The base will host around 400 jobs, including staff from the Dogger Bank Wind Farm, Equinor, GE Vernova and North Star.

CO₂ Decarbonisation Opportunity:
Once fully operational, the wind farm will generate annual carbon savings equivalent to 1.5m cars

Jobs:
2,000 jobs created

We are delivering for the UK



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THE HUMBER WILL BE ABLE TO PRODUCE
HALF OF THE UK'S RENEWABLE ELECTRICITY,
ENOUGH TO POWER 25 MILLION HOMES.

DELIVERING THE VISION

THE HUMBER'S ROADMAP
FOR INDUSTRIAL DECARBONISATION



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