

# Creating a Zero Carbon Industrial Cluster

# ZERO STARTS HERE

BusinessGreen Lunchtime Webinar – hosted in association with Zero Carbon Humber

11am – 1pm, Thursday 19 November 2020

# AGENDA

1. **Introduction** – James Murray, Editor of Business Green
2. **Background to Industrial Decarbonisation Mission + Q&A session** – Will Lochhead, Deputy Director, Industrial Carbon Capture & Hydrogen Business Models, Department for Business, Energy & Industrial Strategy
3. **Zero Carbon Humber**
  - a) **An introduction to the Partnership** – Dan Sadler, UK Low Carbon Strategy Director, Equinor
  - b) **Onshore infrastructure** – Chris Newitt, CCUS Lead Project Manager, National Grid Ventures
  - c) **Northern Endurance Project** – Dan Sadler, Equinor
  - d) **The bid's anchor project: H2H Saltend** – Dan Sadler, Equinor
  - e) **Unlocking low carbon projects across the region:**
    - i. **Hydrogen Hub at Killingholme** – Peter Marshall, International Hydrogen Business Development, Uniper
    - ii. **Enabling paths to sustainable steelmaking** – Gari Harris, Research & Development Manager, British Steel
    - iii. **Clean Power Hub at Keadby** – Oonagh O'Grady, Head of Business Development, SSE Thermal
    - iv. **Carbon Capture at Drax** – Richard Gwilliam, Head of Cluster Development, Drax
  - f) **Creating opportunities for the UK supply chain** – Ben Morgan, Research Director, University of Sheffield Advanced Manufacturing Research Centre
  - g) **The wider benefits of a Zero Carbon Humber** – Dan Sadler, Equinor
4. **Q&As** – Chaired by James Murray, Editor of Business Green

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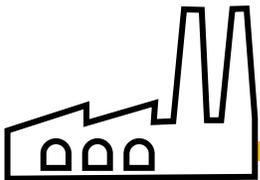
# Carbon Capture, Usage and Storage (CCUS) and Hydrogen

**Will Lochhead**

19<sup>th</sup> November 2020

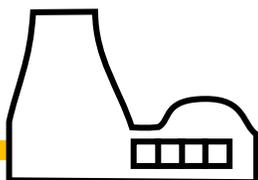
# CCUS & Hydrogen landscape

## Industrial CCS



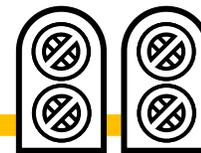
Emissions will be directly captured from industrial exhausts.

## Power CCS



Emissions will be directly captured from power generation facilities contributing to the grid.

## Direct Air and Bio Energy CCS

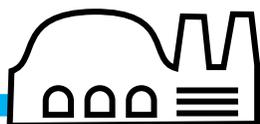


CCS will also enable the realisation of negative emissions through either direct capture of carbon from the air, or using CCS in tandem with bioenergy generation.

## Carbon Capture Usage and Storage

### Transport and Storage

Captured carbon will be compressed and transported via a shared, distributed network. The carbon will be stored geologically in undersea sites.



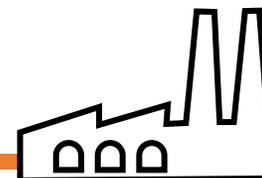
## Blue Hydrogen Production

Blue Hydrogen will be produced by breaking down natural gas via a reformation reaction. The carbon emitted in this process will be captured and stored through the CCS system.

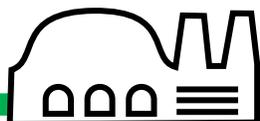
## Hydrogen

### Hydrogen Users

Generated hydrogen could be used in a multitude of sectors including the decarbonisation of industry, domestic heating and transport.



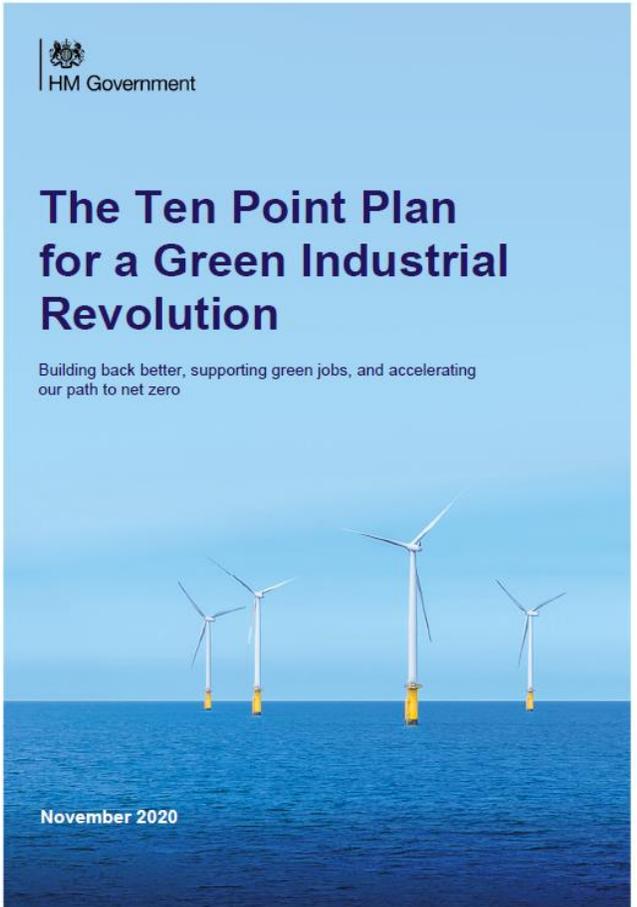
## Green Hydrogen Production



Green Hydrogen will be produced directly from water via electrolysis. This process requires renewable or low carbon electricity.



The Prime Minister has set out his ambitions ten-point plan for a green industrial revolution – an innovation and ambitious programme of job creation that will support levelling up and up to 250,000 jobs



The Ten Point Plan for a Green Industrial Revolution 7

### The Ten Point Plan for a Green Industrial Revolution

-  **Point 1**  
Advancing Offshore Wind
-  **Point 2**  
Driving the Growth of Low Carbon Hydrogen
-  **Point 3**  
Delivering New and Advanced Nuclear Power
-  **Point 4**  
Accelerating the Shift to Zero Emission Vehicles
-  **Point 5**  
Green Public Transport, Cycling and Walking
-  **Point 6**  
Jet Zero and Green Ships
-  **Point 7**  
Greener Buildings
-  **Point 8**  
Investing in Carbon Capture, Usage and Storage
-  **Point 9**  
Protecting Our Natural Environment
-  **Point 10**  
Green Finance and Innovation

# Hydrogen and CCUS in 10 Point Plan

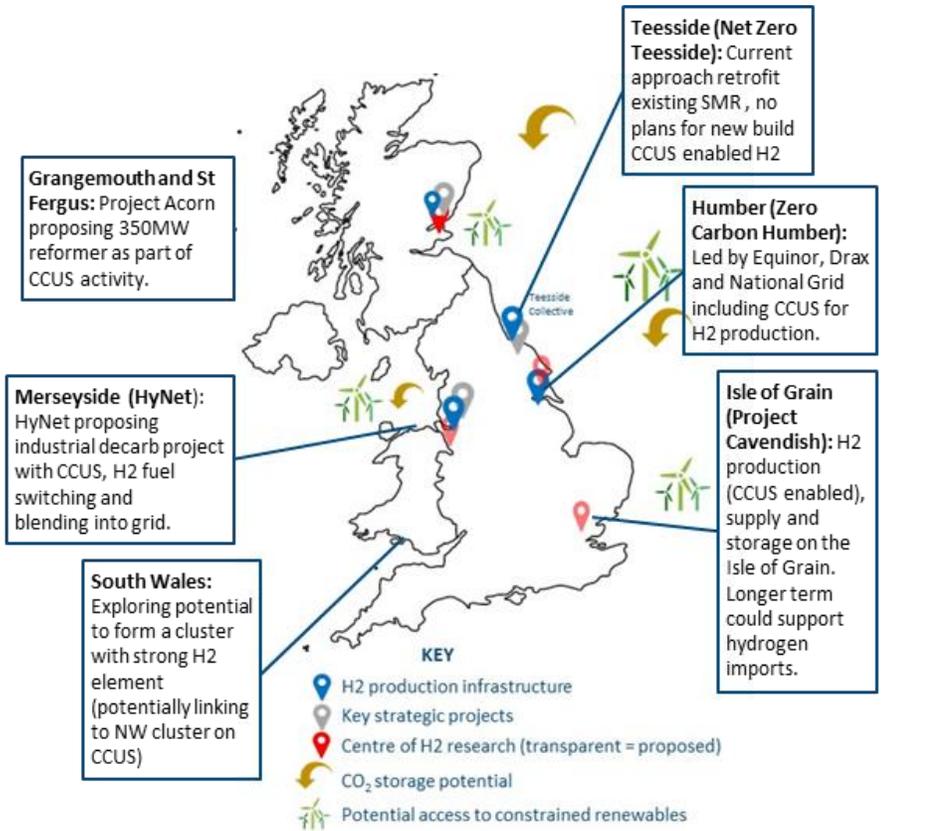
## Hydrogen

- Working with industry, the UK is aiming for 5GW of low carbon H2 capacity by 2030 for use in power, transport, industry and homes.
- £240m for Net Zero Hydrogen Fund.
- Also pioneering hydrogen heating trials, starting with a Hydrogen Neighbourhood and scaling up to a potential Hydrogen Town before the end of this decade
- In 2021 set out H2 business models (consultation) and revenue mechanism to bring through private sector investment.
- Aim to finalise H2 business models in 2022.

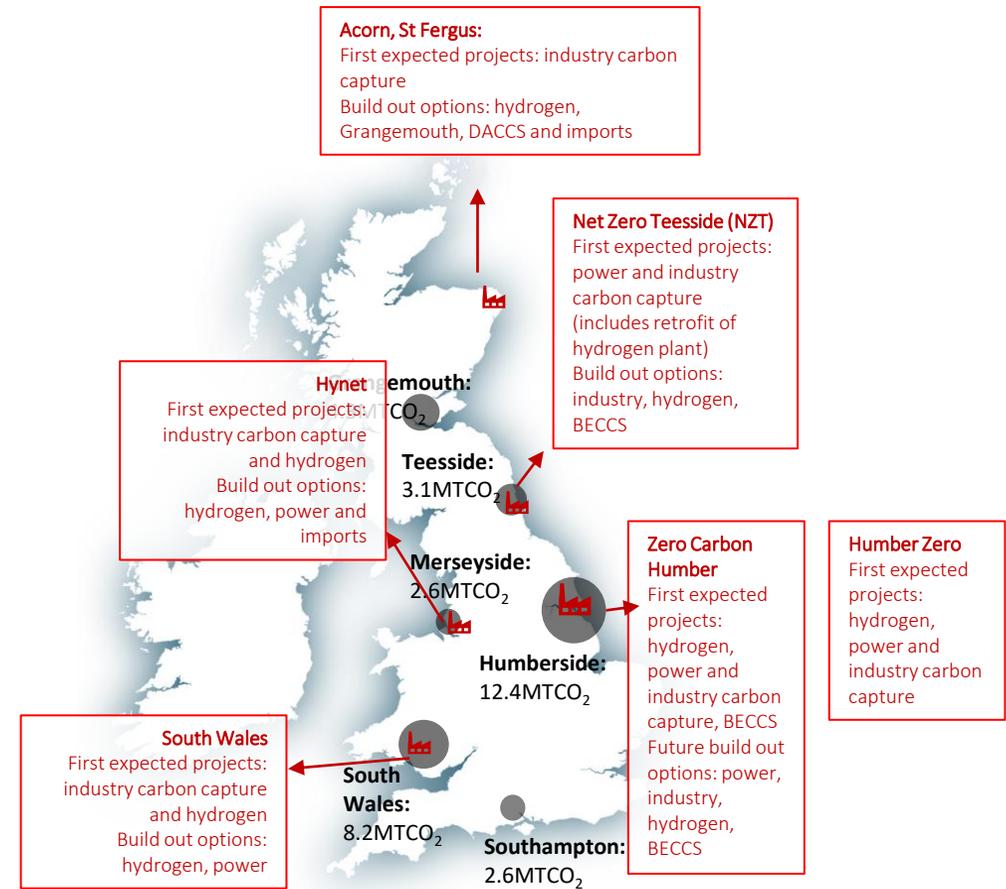
## CCUS

- Ambition to capture 10MtCO<sub>2</sub>/yr by 2030.
- CCUS in 4 industrial clusters, with 2 by the mid-2020s.
- Invest up to £1bn by 2025 through the CCS Infrastructure Fund.
- 2021 bring through details of revenue mechanism for industrial carbon capture.
- Aim to finalise CCUS business models in 2022.

# Potential Hydrogen and CCUS projects



NOTE: Widespread renewable/green hydrogen opportunities; notably in areas with significant offshore wind resource (often coming to shore at/near industrial clusters)

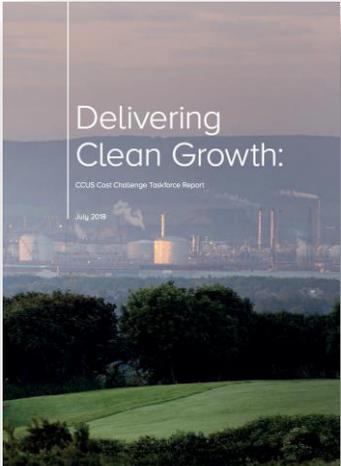


# Policy progression

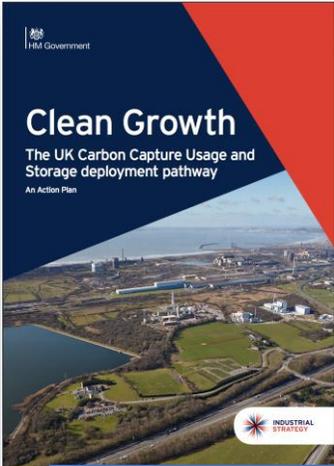
2017



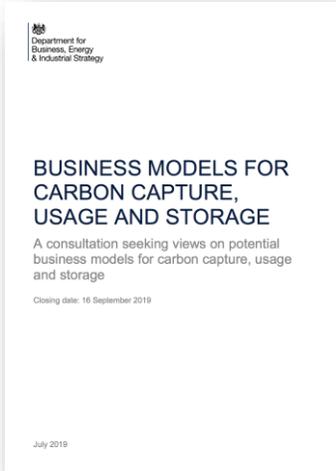
2018



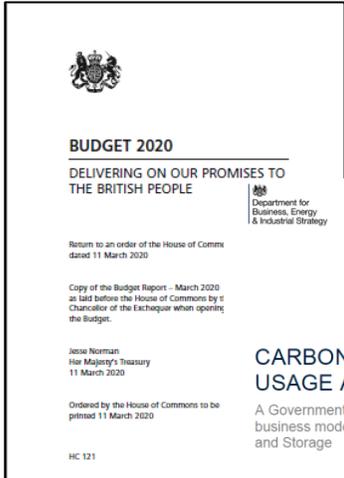
2018



2019



2020



**CARBON CAPTURE, USAGE AND STORAGE**  
A Government Response on potential business models for Carbon Capture, Usage and Storage

Reaffirmed commitment to CCUS after previous competitions and to investigate cost reductions

Proposing strategic plan to Government for supporting cost reductions and development of CCUS in the UK

Shift to deployment focus and committed to review CCUS business models

Sets out emerging thoughts from Review and seeks industry, academic and others' opinion

CCS Infrastructure Fund announced, confirming deployment of at least 2 industrial clusters over the decade  
Government response on business models published

# UK Hydrogen Strategy

- In September, Secretary of State for Business, Energy and Industrial Strategy, Alok Sharma, announced government would publish a UK hydrogen strategy in early 2021.
- Expect this to cover:
  - Case for hydrogen in UK context, HMG vision
  - Whole system view (supply through to demand)
  - Action required in 2020s, including laying ground for ramp up beyond 2030
  - Economic benefits for UK
  - Role of various actors
- Government has also established a Hydrogen Advisory Council to work in partnership with industry to inform our strategic approach. The Council is expected to run for two years and will focus on actions required across the 2020s to scale up the UK's low carbon hydrogen economy.

# The business models

## Industry Carbon Capture

- Minded for initial projects to proceed with an approach that combines upfront capital support and an industrial CfD (evolving to support through industrial CfD only);
- Industrial CfD supports ongoing operational costs (including CO<sub>2</sub> T&S) and allowing capex investment from industrial owner to be recovered;
- Further work over this year, e.g. reference price, risk allocation, counterparty; allocation.

## Low Carbon Hydrogen

- Clear role for business model to stimulate private sector investment;
- Scope should include provision for all low carbon production methods, and industry broadly of view that business model should be focused on production, though consideration must be given to wider value chain;
- Further work over this year on evaluating further options ahead of consultation on preferred model in 2021

## Power Carbon Capture

- Minded to progress work on a mechanism which consists of a payment for availability of low carbon generating capacity and a variable payment.

## CO<sub>2</sub> Transport and Storage

- Progress work on T&S business model and is currently minded, for an enduring model, to support T&S infrastructure being operated through an economic form of regulation, drawing on experiences from other regulated network models.

# Next steps

## Strategy

- Hydrogen Strategy to be published in early 2021
- Industrial Decarbonisation Strategy to be published in early 2021

## Funding support

- UKRI IDC Deployment Phase 2 - £131m of support announced in December 2020
- Further details of CCS Infrastructure Fund and Net Zero Hydrogen Fund
- Bring forward details on revenue mechanism to support industrial carbon capture and hydrogen projects

## Business models

- Provide an update on commercial frameworks for industry, CO<sub>2</sub> T&S networks and power by the end of 2020
- Consult on HMG's preferred model for hydrogen in 2021
- Progress business models for CCUS and low carbon hydrogen at pace, with a view to finalising business models within the next two years, in line with expected FIDs for projects

PROVEN PARTNERS COMMITTED TO CLEAN GROWTH

# ZERO CARBON HUMBER

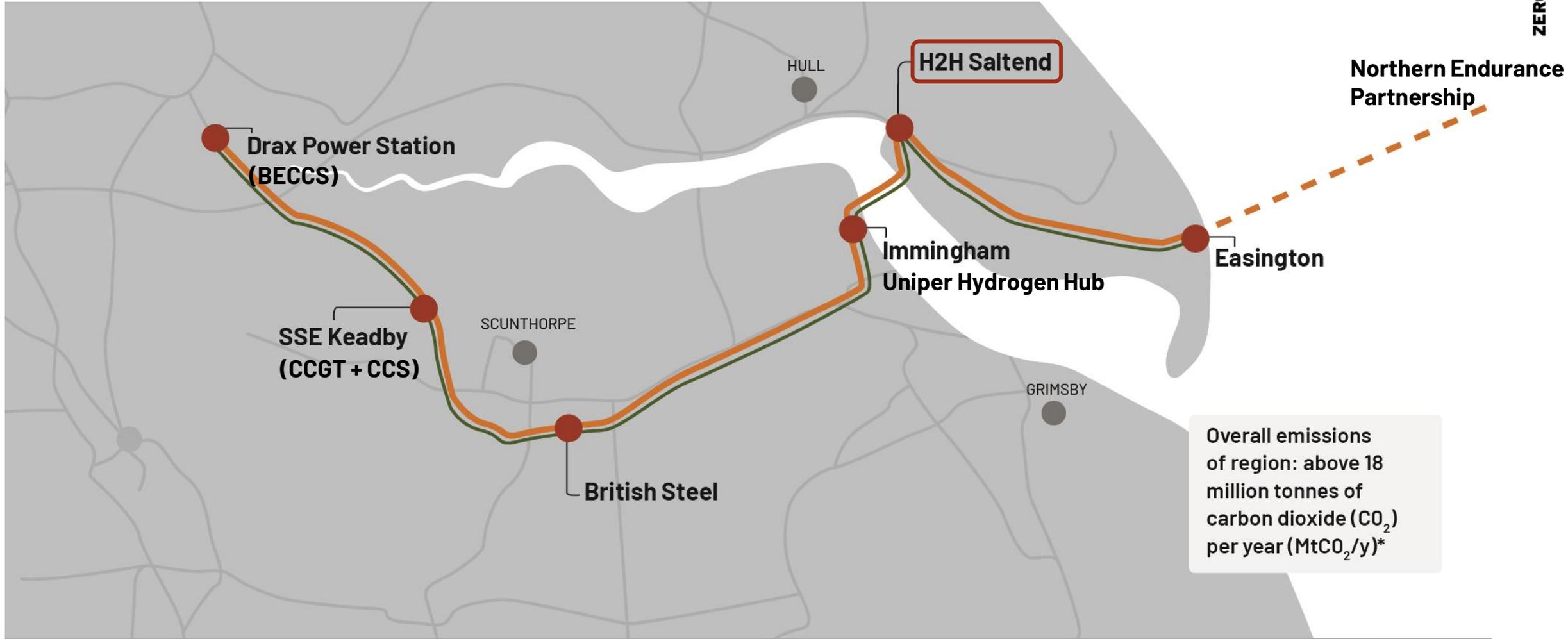
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# WIDESPREAD SUPPORT FOR OUR UNIFIED CAUSE



# A £75M BLUEPRINT TO KICK-START A NEW LOW CARBON ECONOMY



KEY

— Hydrogen pipeline (illustrative)

— CO<sub>2</sub> pipeline (illustrative)

● ZCH businesses / facilities

\* Combined industry and power emissions for the Humber, excluding Drax Power Station

# NORTHERN ENDURANCE PARTNERSHIP



## CCC's 'Net Zero' report (p35):

- “Carbon capture and storage (CCS) is essential. We previously recommended that the first CCS cluster should be operational by 2026, with two clusters, capturing at least 10 Mtpa CO<sub>2</sub>, operating by 2030. For a net-zero target it is very likely that more will be needed.”
- “At least one of the clusters should involve substantial production of low-carbon hydrogen.”



# H2H SALTEND – THE BID’S ANCHOR PROJECT

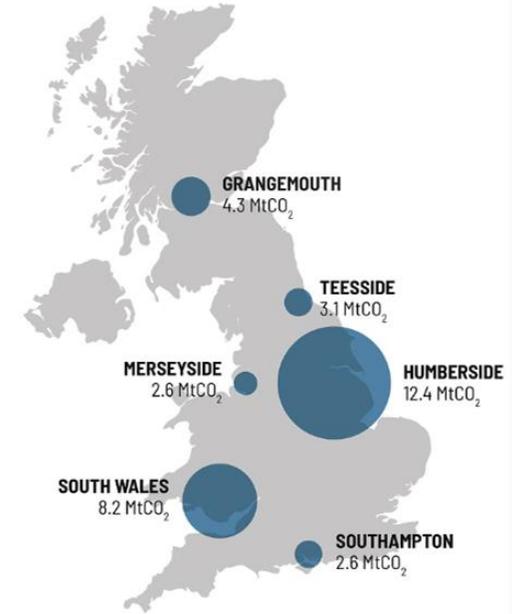
Currently 3.5 Mtpa CO<sub>2</sub> Emissions



**Hydrogen fuel switch concept:** A unique decarbonisation strategy for the UK's most established chemicals site

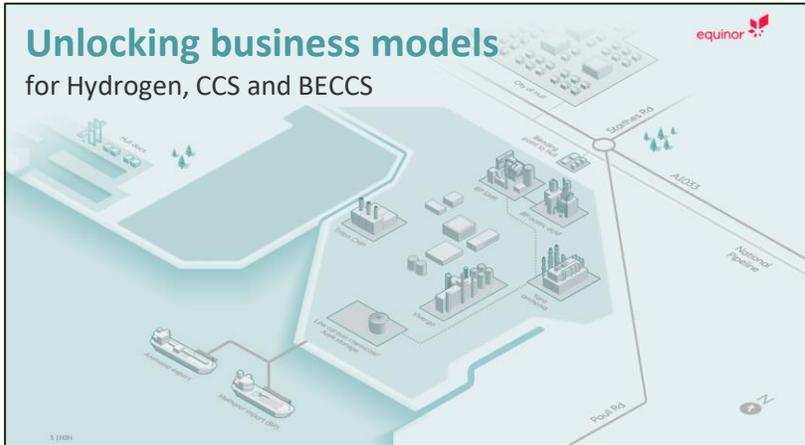
## THE UK'S LARGEST CLUSTERS BY INDUSTRIAL EMISSIONS ONLY

KEY  
MtCO<sub>2</sub> = million tonnes of carbon dioxide (CO<sub>2</sub>) emissions per year

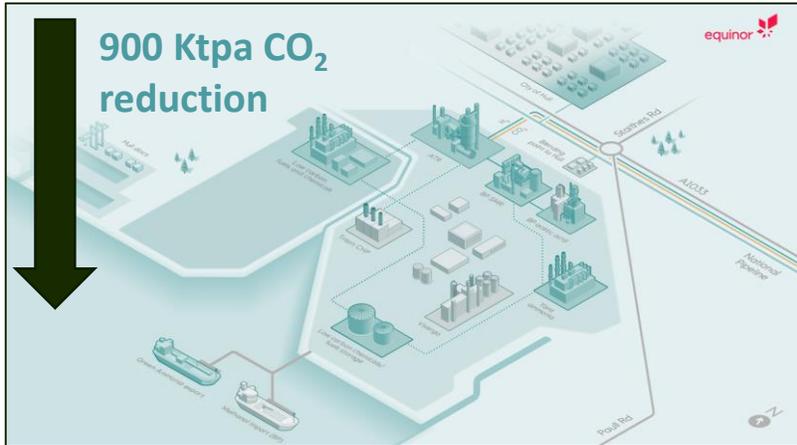


## Unlocking business models

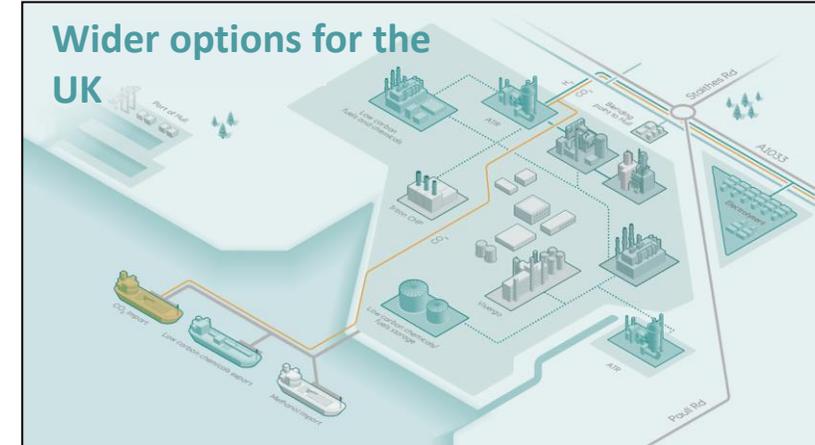
for Hydrogen, CCS and BECCS



900 Ktpa CO<sub>2</sub> reduction



## Wider options for the UK



# UNLOCKING LOW CARBON PROJECTS ACROSS THE REGION

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# BLUE & GREEN HYDROGEN HUB AT KILLINGHOLME

- Actively driving decarbonisation, targeting a carbon neutral European power generation portfolio by 2035
- Uniper is a **pioneer** in the field of hydrogen with knowledge of the entire value chain
- Experience gained developing and **operating hydrogen facilities** in Germany since 2013
- A **Hydrogen Hub** is in early development at our Killingholme site in the Humber with:
  - 32 hectares of developable land
  - Key infrastructure in place for blue and green hydrogen
  - End user opportunities to promote cross sector coupling and optimisation for the production and use of hydrogen



Uniper's Power to Gas facility, Falkenhagen, Germany

# BRITISH STEEL: ENABLING PATHS TO SUSTAINABLE STEELMAKING



- Steel is vital to modern economies
- The sector is currently responsible for about 8% of global final energy demand and 7% of energy sector CO<sub>2</sub> emissions
- New steelmaking processes are critical, but there is **no one right answer**.
  - Hydrogen Direct Reduction,
  - Carbon Capture, Use and Storage (CCUS),
  - Bioenergy and
  - Direct electrification
- British Steel are engaged with bespoke Steel Industry research programmes addressing many of the technology options, including; H-DRI and CCUS
- The new ownership of British Steel have announced £1.2 billion of new investment. Much of this investment will be made in areas that will result in significant decarbonisation: materials efficiency, technical performance, H<sub>2</sub> usage & DRI, and CCUS
- Steel is the world's most recycled material, and will play a central role in transitioning to a low-carbon circular economy

The ZCH 'dual pipeline' partnership will have the potential to enable ALL technology options



# SSE THERMAL - KEADBY CLEAN POWER HUB

- We have a vision to be a **leading provider of low-carbon flexible thermal energy**, to complement renewables, in a net-zero world.
- Focused on **carbon capture and storage (CCS) and hydrogen solutions**, with more than a decade of experience.
- Plans for a **Clean Power Hub** at Keadby in North Lincolnshire, building on a **long-term commitment** to the Humber.
- **Keadby 2** is estimated to contribute more than **£1bn to the UK economy** as the most efficient power station on the grid.
- Now developing **Keadby 3** to become the **UK's first gas-fired power station with CCS**.
- Future options for **hydrogen-fired generation** at the site.



# CARBON CAPTURE BY DRAX

- Drax Power Station is the **largest in the UK** & operates with sustainably sourced biomass.
- **Commenced capture of Carbon Dioxide at pilot scale in 2019** using BECCS technology.
- **Zero Carbon Humber will support the large scale deployment of BECCS** at Drax with potential to capture 16mt of Carbon Dioxide per year.
- The BECCS process is carbon negative meaning Drax can become the world's first **carbon negative power station**.
- **16,700 jobs created** and supported at its peak including 7,700 direct and 9,000 indirect jobs.
- **Carbon Capture by Drax** will underpin investment in ZCH and help the Humber become the **fastest UK industrial cluster to reach NetZero**.

*“Without negative emissions from bioenergy with carbon capture and storage (BECCS), net zero cannot be achieved.”*

nationalgridESO



drax  
ZEROCARBON  
HUMBER

# ADVANCED MANUFACTURING RESEARCH CENTRE



- **Research hub at heart of Advanced Manufacturing Park and Sheffield Business parks.**
- **AMRC and Nuclear AMRC part of HVMC network**
- **600+ world leading researchers, technicians and support staff.**
- **Over 120 member companies – from global giants to local SMEs.**
- **Over £300 million investment brought to former coalfield.**
- **Part of Rolls-Royce & Boeing global research networks.**

## What?

- Secure workshare for UK
- Ensure on-time, on-budget delivery of work
- Develop high value highly paid jobs
- Improve competitiveness
- Decarbonise supply chain
- Develop exportable world class capability

## How?

- Manufacturing Value Analysis
- UK Supply Chain Mapping
- Codes, standards and health and safety
- Fit4NetZero -tailored programmes to deliver sustained competitive advantage
- Fit4NZ derived for successful Fit4Nuclear (Nuclear AMRC) programme

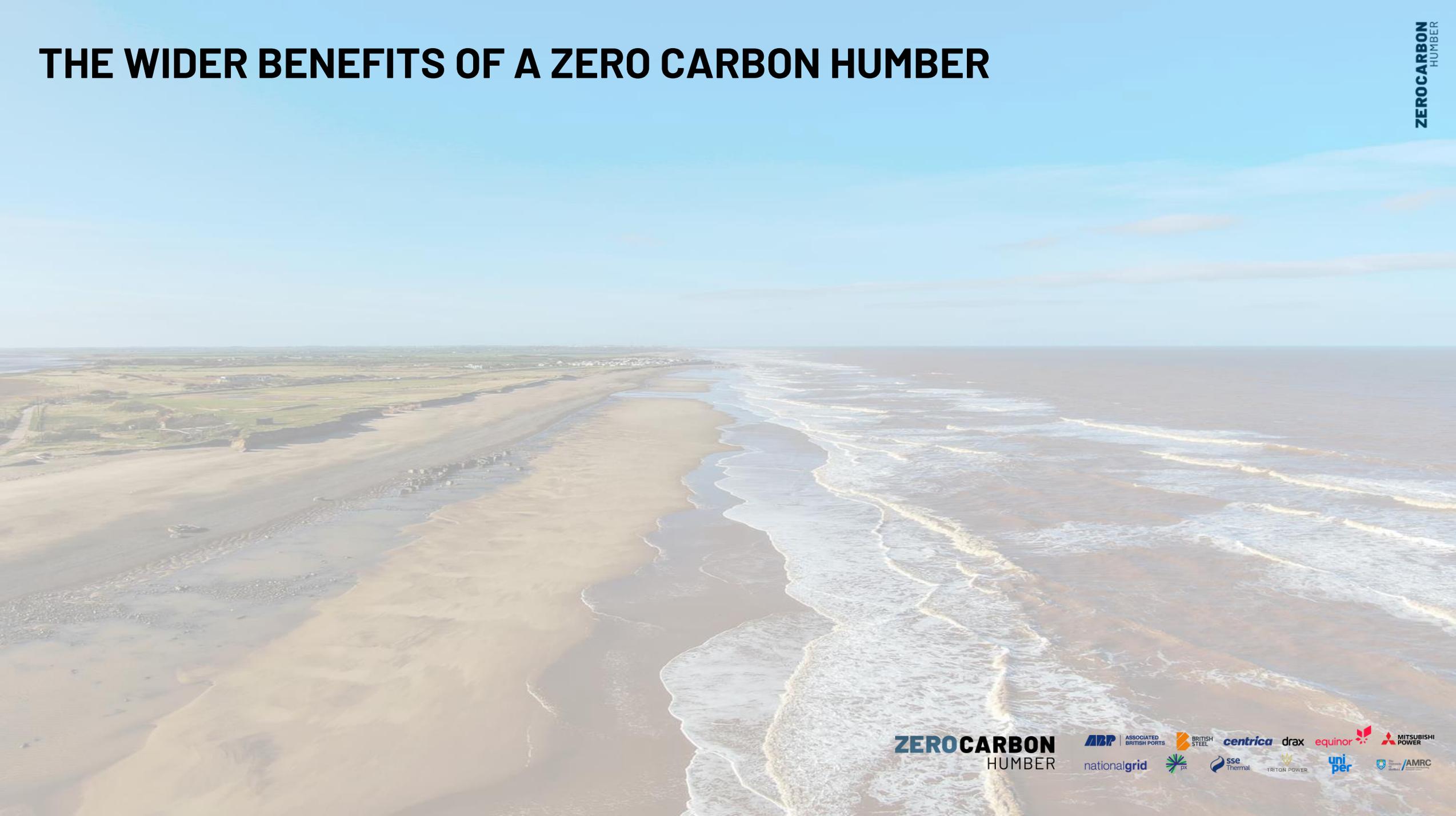
## Impact?

- Fit4Nuclear programme combined 2014-2020 impact of F4N and CNSiG programmes:
  - £1.9bn new contract wins
  - Created or sustained over 8,248 UK jobs



# THE WIDER BENEFITS OF A ZERO CARBON HUMBER

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# DELIVERING THE WORLD'S FIRST NET ZERO CLUSTER

We want to transform the Humber into **the world's first carbon neutral industrial cluster by 2040.**

This ambition would be realised by creating:

- The **world's largest hydrogen production plant** with CCS at Equinor's H2H Saltend project
- The **world's first carbon negative power station** at Drax
- The **UK's first decarbonised gas power station** at SSE's Keadby site
- Additional **hydrogen production capability** at Uniper's Killingholme site
- **Low carbon steel production** at Scunthorpe steelworks

This would be enabled by:

- **A regional carbon dioxide (CO<sub>2</sub>) transportation system**, shared by multiple users
- **Hydrogen pipelines** enabling the decarbonisation of the Humber and the wider North of England
- **Safe offshore subsea CO<sub>2</sub> storage**, which can also be utilised by the Teesside cluster

# DELIVERING FOR UK PLC

**A TRANSFORMATIVE VISION  
FOR THE HUMBER**



**PROVEN PARTNERS WITH A  
SHARED AMBITION TO TURN  
THE HUMBER INTO THE  
WORLD'S FIRST ZERO  
CARBON INDUSTRIAL  
CLUSTER BY 2040**

**BUILDING BACK BETTER AS  
PART OF A GREEN RECOVERY**



**SAFEGUARDING OF 55,000  
EXISTING INDUSTRIAL JOBS  
AND CREATION OF  
THOUSANDS OF NEW LOW  
CARBON JOBS BASED  
AROUND CCS AND  
HYDROGEN**

**VALUE FOR MONEY  
PROPOSITION FOR THE UK**



**THE HUMBER CAN DELIVER  
COST EFFECTIVE  
DECARBONISATION BY  
REALISING ECONOMIES OF  
SCALE IN THE REGION AND  
IN PARTNERSHIP WITH  
TEESSIDE**

**SUPPORTING GB CLIMATE  
LEADERSHIP AHEAD OF COP26**



**SHOWCASING UK LEADERSHIP  
ON THE WORLD STAGE,  
DRIVING INWARD  
INVESTMENT & ENABLING THE  
UK TO TRADE IN LOW-CARBON  
MANUFACTURED PRODUCTS**

**THANK YOU  
Q&A SESSION**

**ZERO STARTS HERE**

**ZEROCARBON  
HUMBER**

