Tees Valley Industrial Cluster

Systems Thinking & Approach

All-Energy Conference, Glasgow 2023

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Tees Valley Combined Authority

Introduction & Background

- The Project
- The Cluster
- The Cluster Plan

Department for Energy Security & Net Zero

UK Research and Innovation

Tees Valley Net Zero Cluster Plan

bp

nepic

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The Cluster Plan

teesvalley-ca.gov.uk/net-zero

- Cluster Plan Key Findings
  – available today
- Cluster Plan Full Report
  – to follow in May 2023

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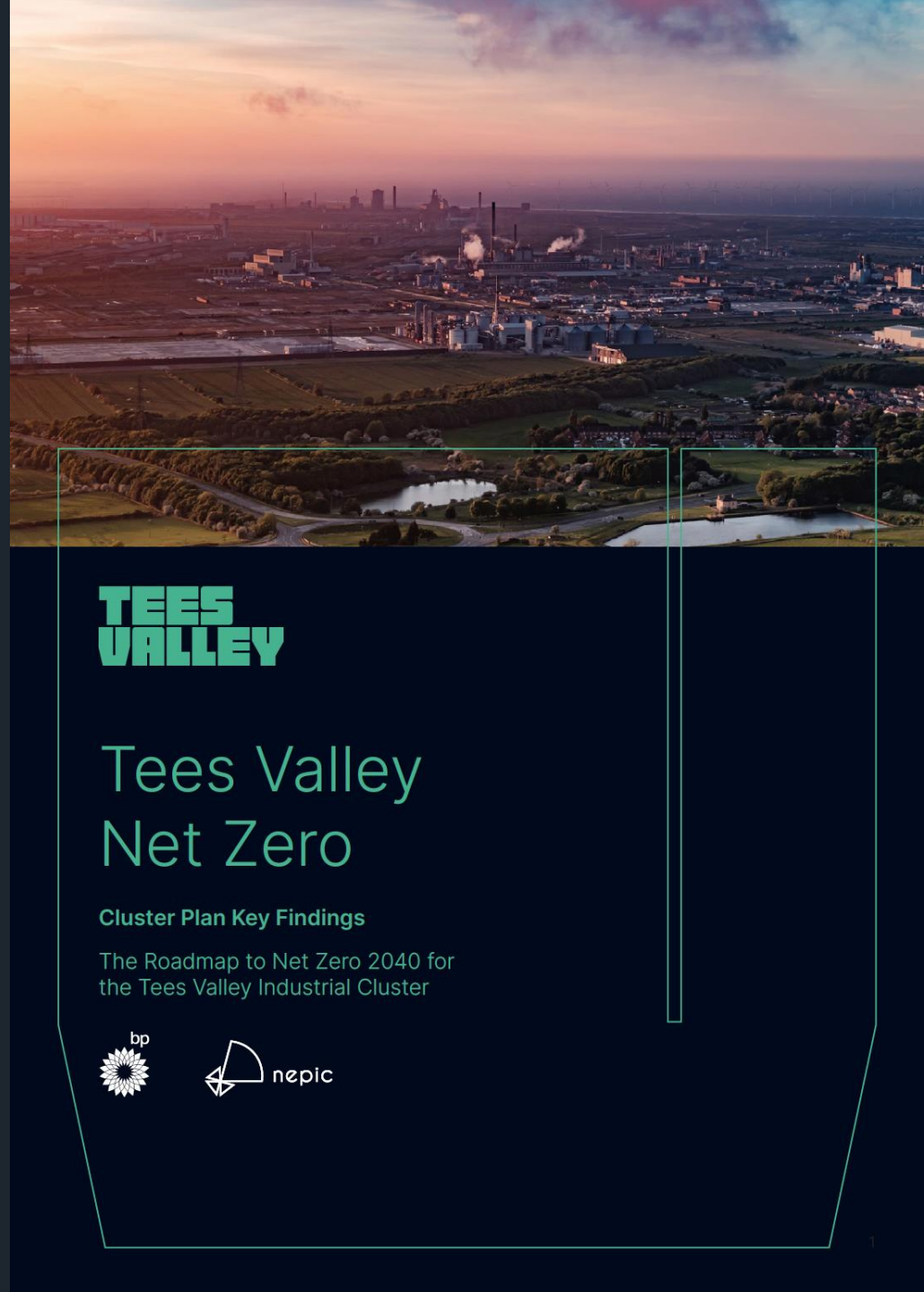

The Cluster

66 companies | 5 mile radius

Legacy Industries:

- ICI Integrated Chemical Works | Teesworks

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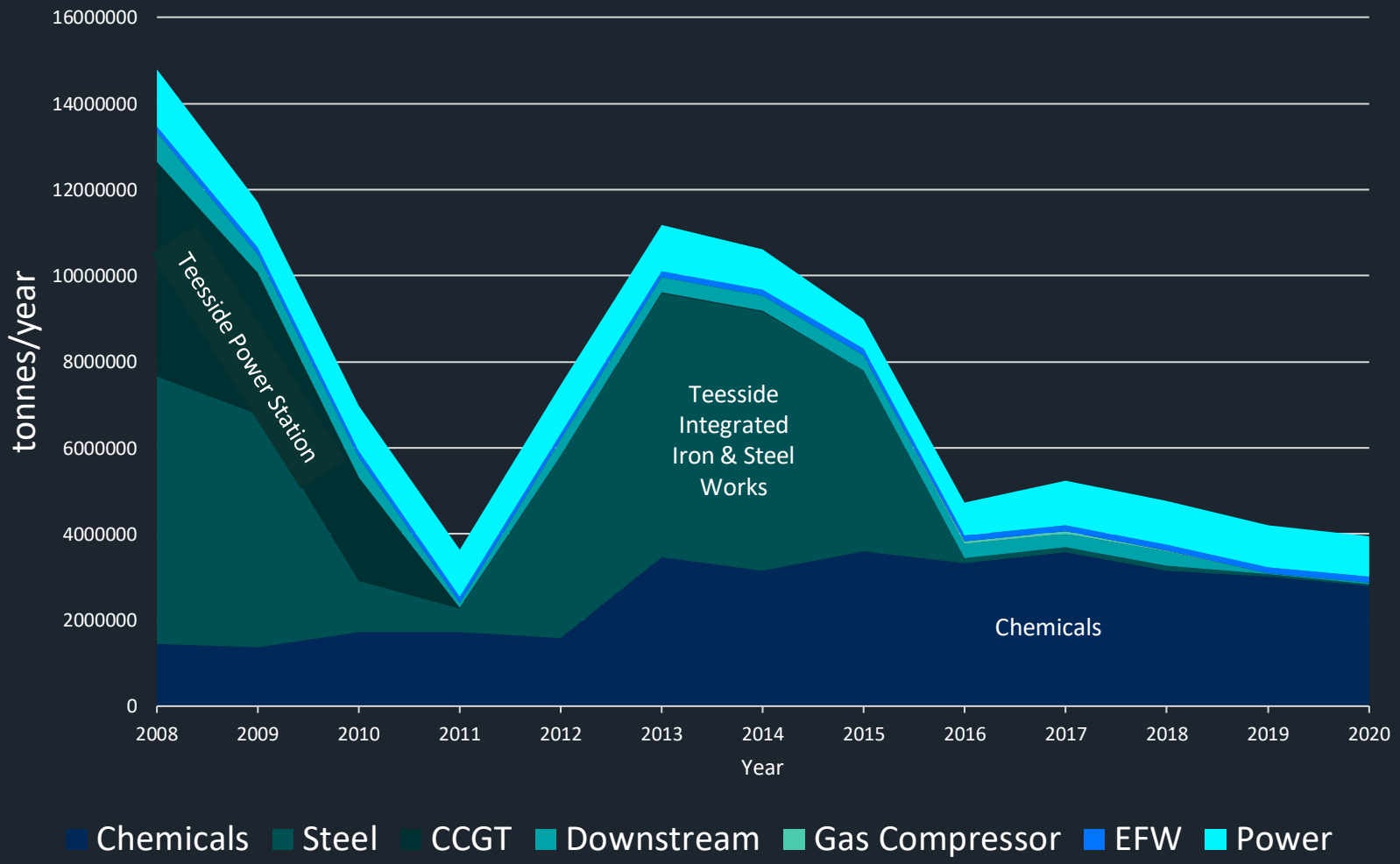
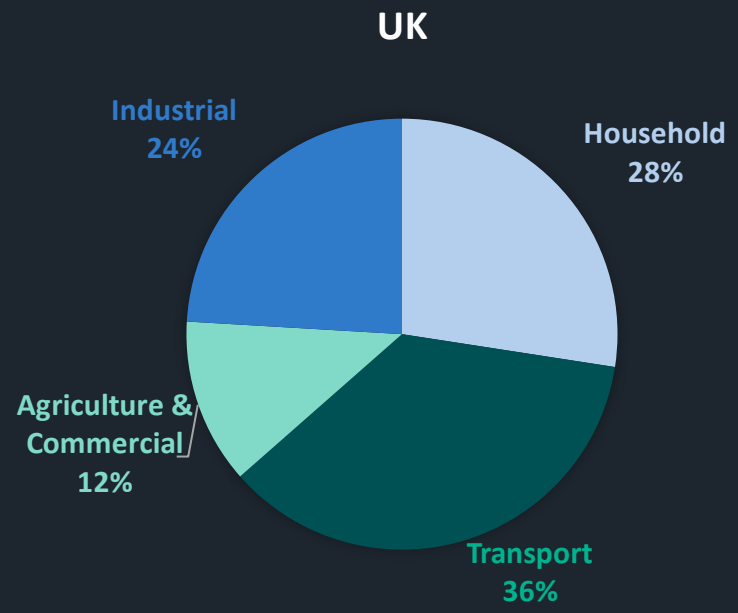
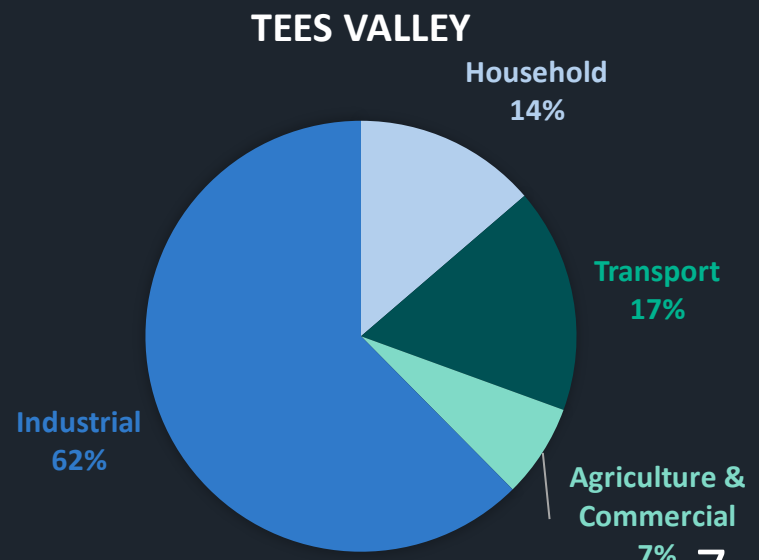
The Route to Net Zero

- Historic Emissions
- Future Projected Emissions
- Net Zero

Historic Emissions







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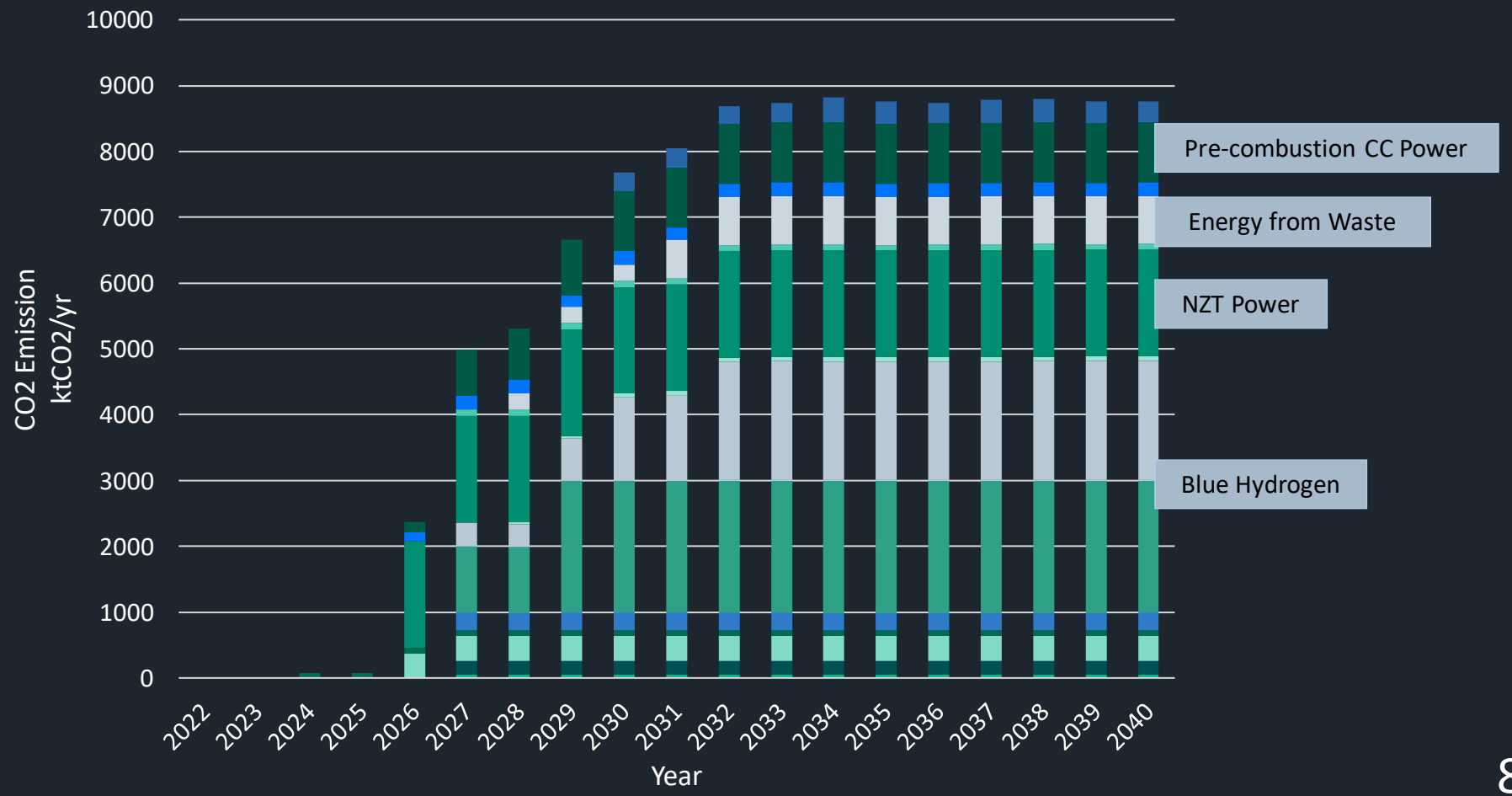
Potential Future Emissions

Scope 1 CO2 Captured = 8.4 MtCO2/yr



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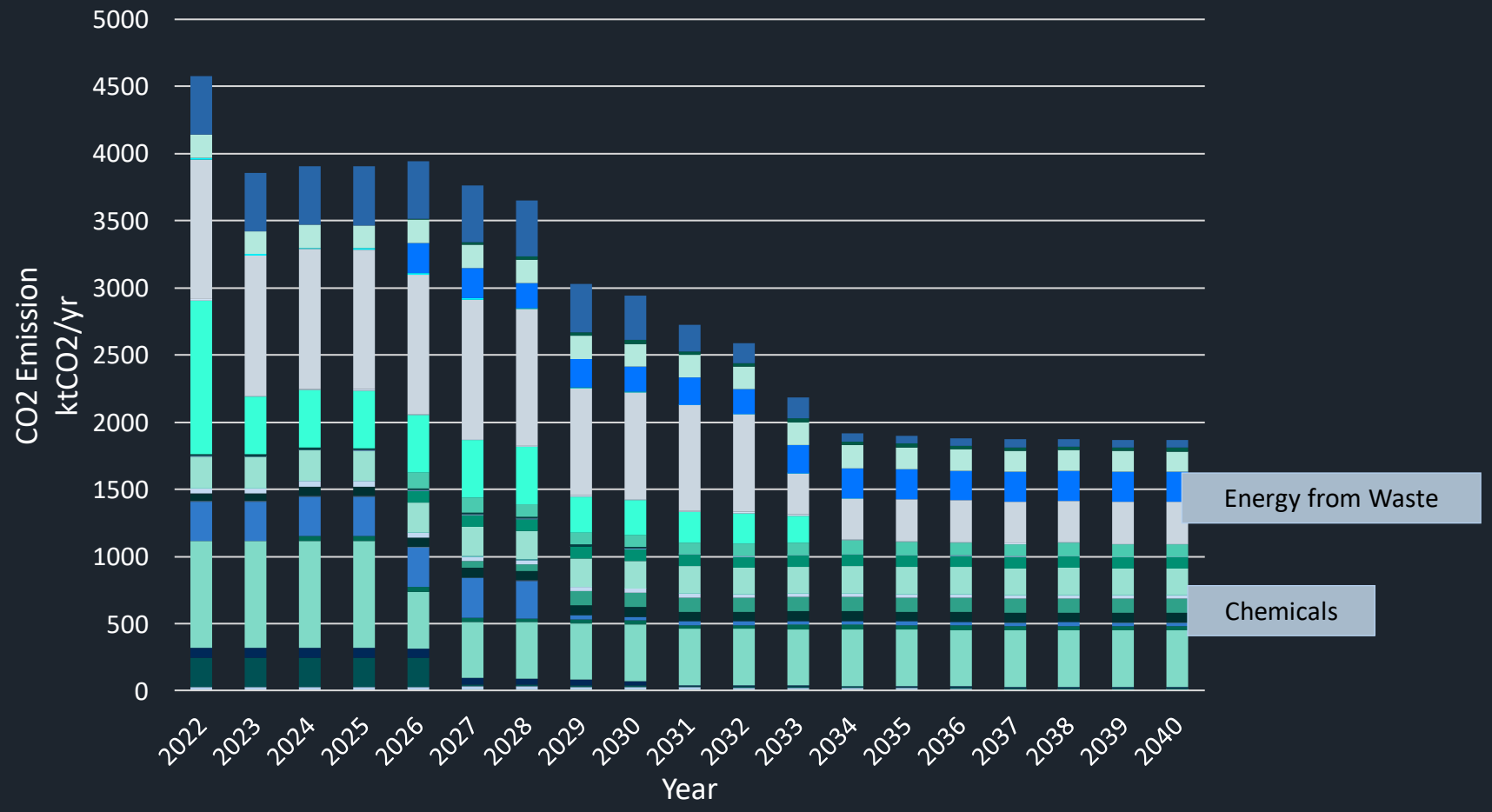
Potential Future Emissions

Scope 1 CO2 Residual Emission = 1.5 MtCO2/yr



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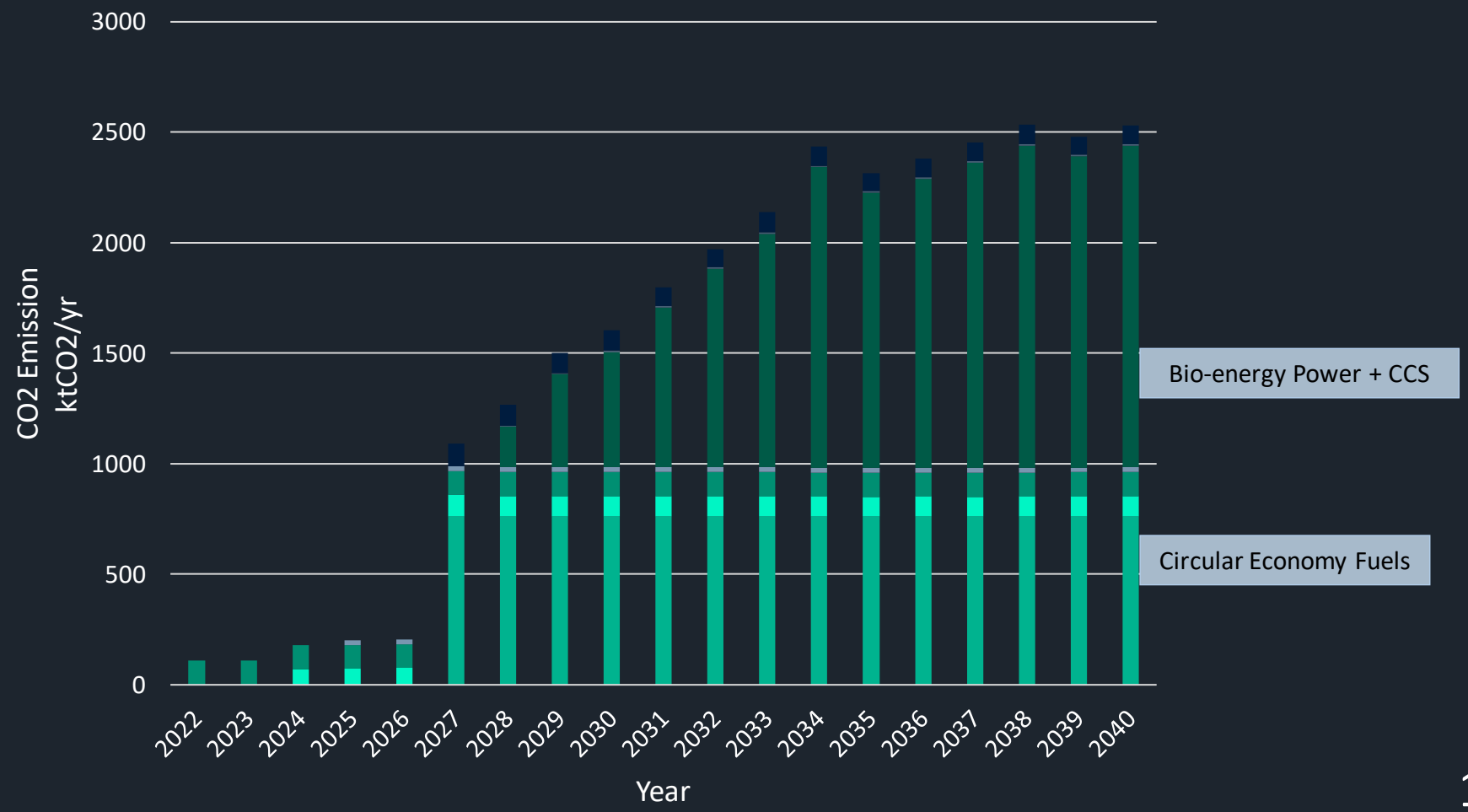
Potential Future Emissions

Biogenic CO2 Available for Capture = 2.7 MtCO2/yr



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Net Zero

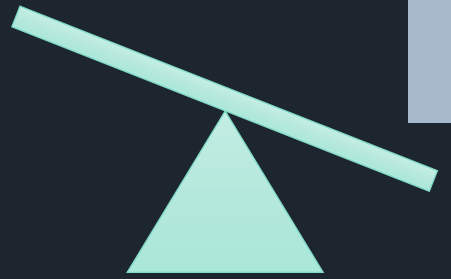
A route to Net Zero…

Net Zero Teesside
10 MtCO2/yr

Fossil Fuel Derived
CO2
Scope 1
Emissions Captured
8.4 MtCO2/yr

Biogenic Derived
CO2
Non-Scope 1
Emissions Captured
1.6 MtCO2/yr

Residual Scope 1
Emissions
1.5 MtCO2/yr



Biogenic Emissions
Available for CCUS
1.6 MtCO2/yr

Net Zero - Dependencies

The balance shows:

- 16% residual emissions and dependency on negative emissions to offset these

To put this in context

- SBTi limits organisations' residual emissions to 10% (reduction = 90%)
- IEA's Net Zero Emissions Scenario reduces industrial CO2 by 95%

Residual Emission and Negative Emissions are not created by the same organisations.

To achieve Net Zero in the Tees Valley Cluster we need:

(i) collaboration between different industrials
(ii) carbon accounting – to understand where our emissions lie
(iii) a sense of shared purpose

The Case For Growth

Net Zero Teesside is a key enabling project

Cluster Sequencing Phase 2:

- Blue Hydrogen
- Power + CCS
- Energy from Waste

Other Projects

- Fuels from Waste – SAF & rDME
- Lithium refining & production

Future Potential

- Other CO2 consumers - Biofuels

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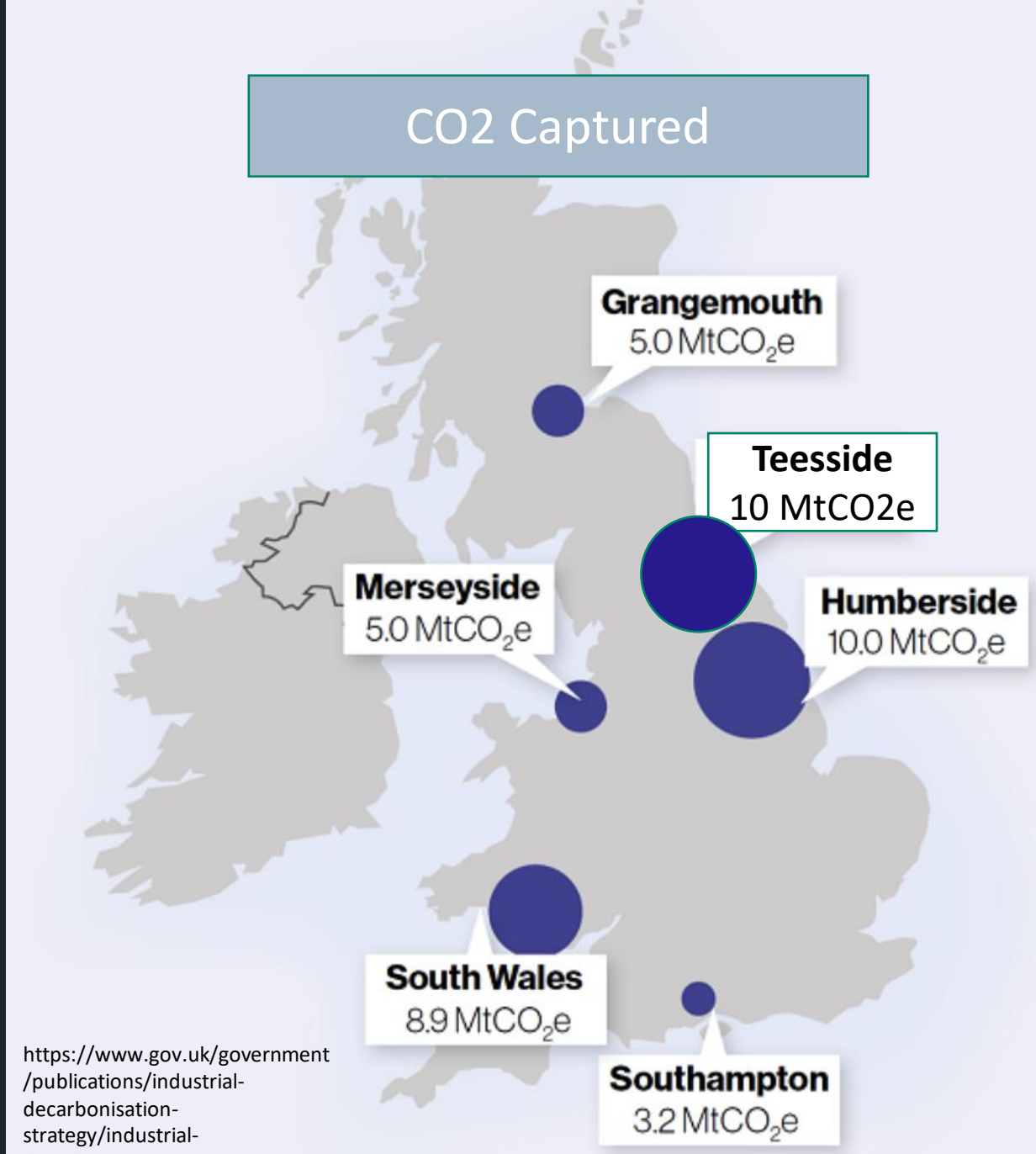


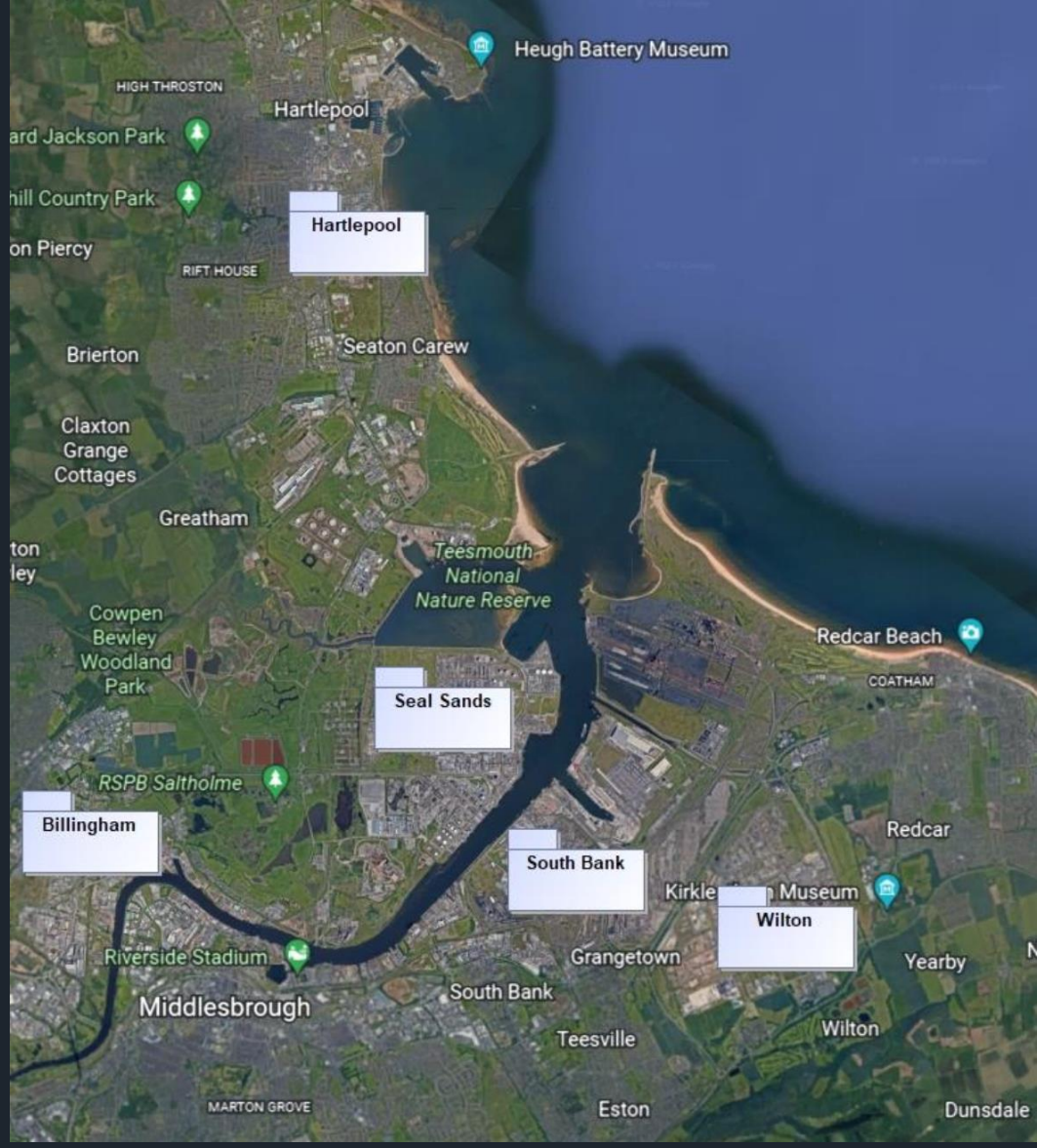
https://www.gov.uk/government/publications/industrial-decarbonisation-strategy/industrial-decarbonisation-strategy-accessible-webpage

Systems Modelling Approach

- A system of systems
- Modelling the Cluster
- Viewpoints & Pathways

A Systems of Systems

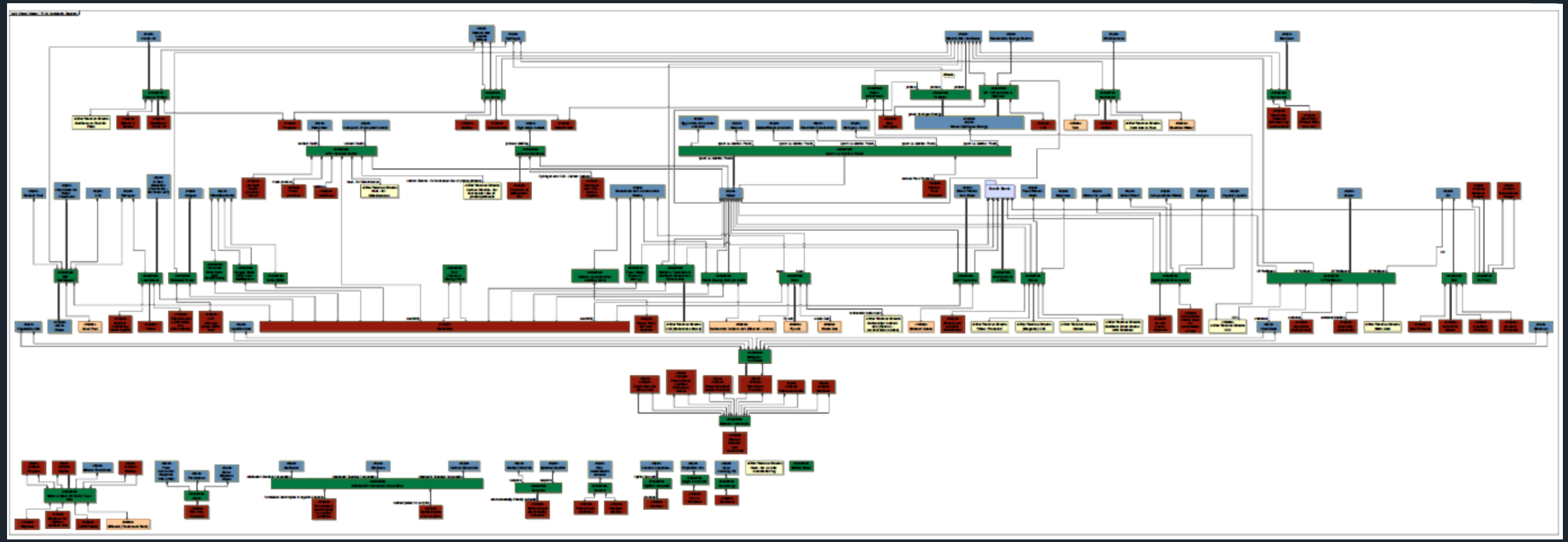
- A collection of independent systems, integrated into a larger system that delivers unique capabilities.
- A means to graphically represent and share data enabling the analysis of complexity.
- Aims to provide a graphical means of presenting the structure, behaviours, complexity and interconnectivity of a range of systems.



The Systems Model

The diagram represents the complexity of interactions between the industrial

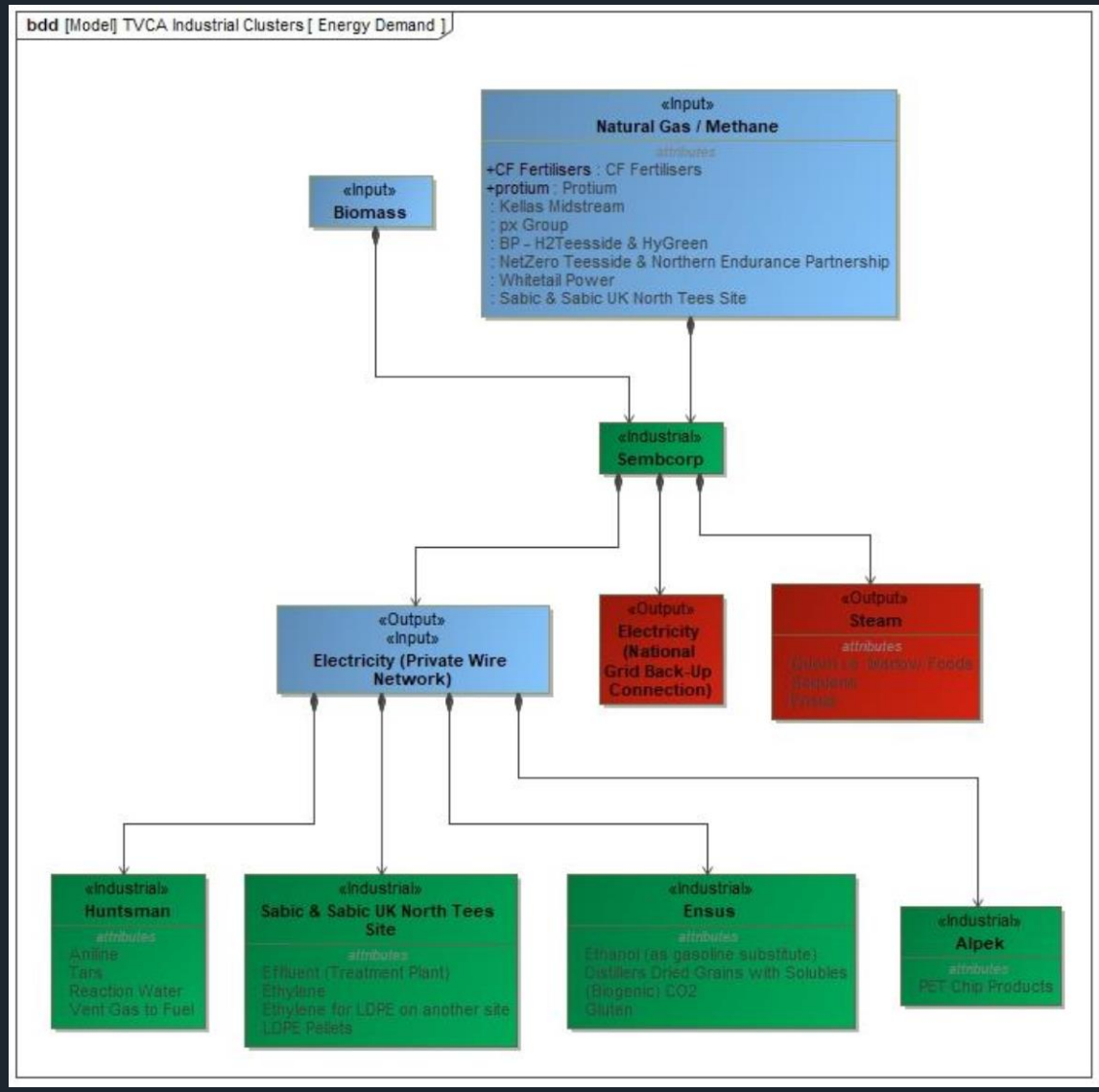
- inputs, outputs, wastes, revenue streams and by-products



Example - Energy Switching

Use model to inform energy transition options for heat / power from hydrocarbons to electricity.

- Viewpoint for a single industrial
- How is this energy currently generated and where could it be replaced with green alternatives ?



What questions are we answering?

Energy

- What are the current energy demands of the cluster?
- Who are the major consumers/producers of energy?
- How is this energy currently generated and where could it be replaced with green alternatives?
- What are the future demands likely to be and what is influencing this?
- What could the future energy generation of the cluster be?
- How much excess energy could be produced by the cluster for sale to the grid/stored within the cluster?

Carbon

- What are the current Net emissions to the atmosphere from the cluster?
- What are the future increased emissions from the cluster?
- How is the carbon captured/stored/transferred/ emitted?
- Could the excess carbon be captured/stored/transferred?
- Are there new industrials in the cluster seeking additional carbon?
- What carbon pathways are available in the cluster?

Hydrogen

- What is the current hydrogen production rate from the cluster?
- What is the planned production rate for the cluster?
- How is the hydrogen captured/stored/transferred/ emitted?
- Could the excess hydrogen be captured/stored/transferred?
- Are there new industrials in the cluster seeking additional hydrogen supply?
- What hydrogen pathways are available in the cluster?

Process

- What materials are delivered to the cluster?
- What leaves the cluster as revenue generators?
- What wastes are currently produced within the cluster?
- How are the wastes produced dealt with?
- Is there a market for by-products which has not been previously accessed?
- Is there a market for by-products which has not been previously accessed?

Economic Case

Breaking the link between economic output and CO2 emissions.

Three future scenarios:

- Do nothing
- Limited Policy On
- Full Policy On

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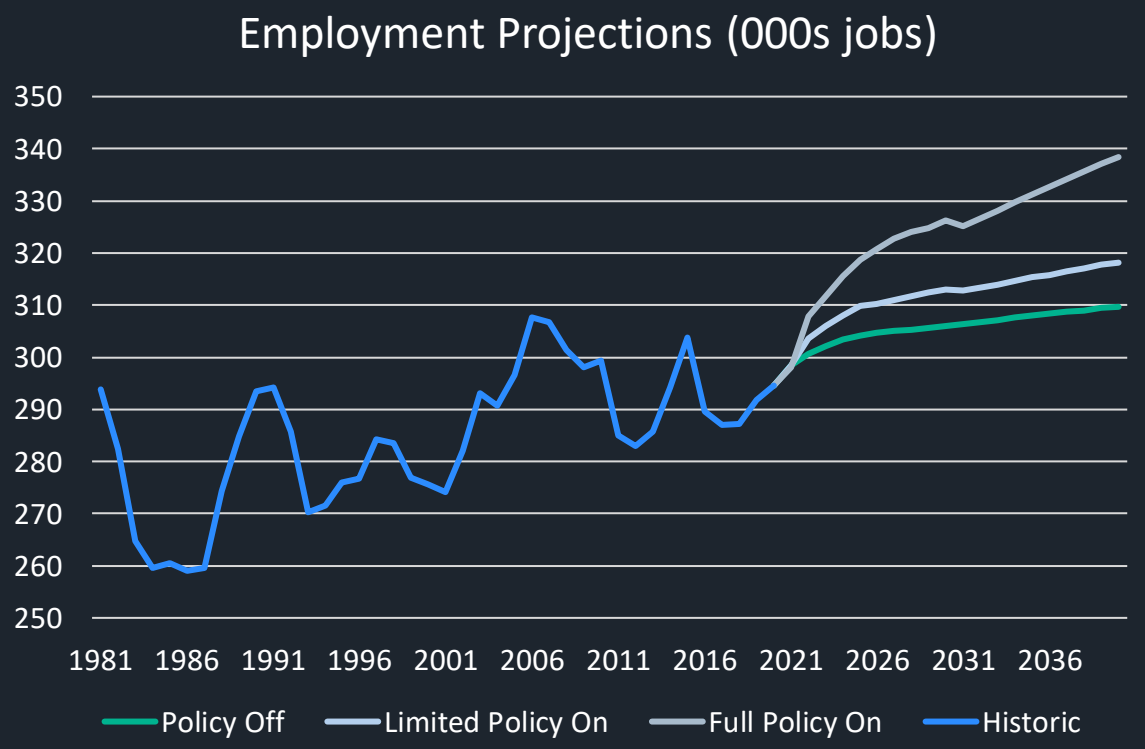
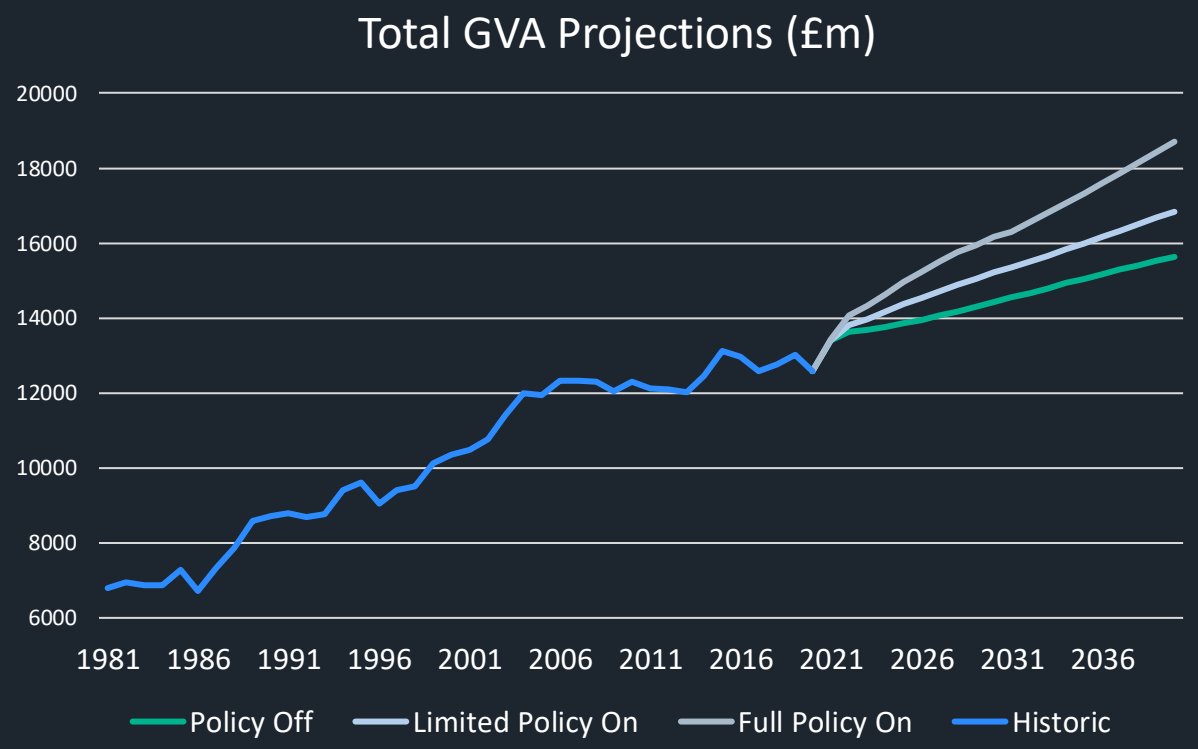
Regional GVA and Jobs Projections





Economic Benefits

Decarbonisation technologies provide:

New Investment

- Over £10 billion already identified

Limited Policy On

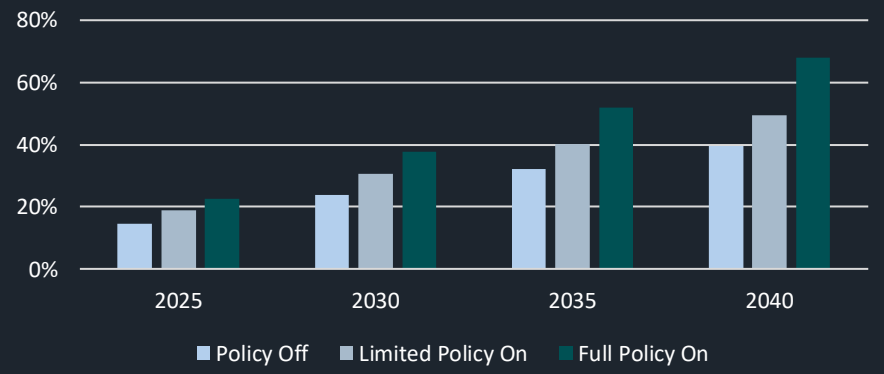
- 8,500 additional jobs
- £14.7 billion additional GVA (2022-2040)

Full Policy On

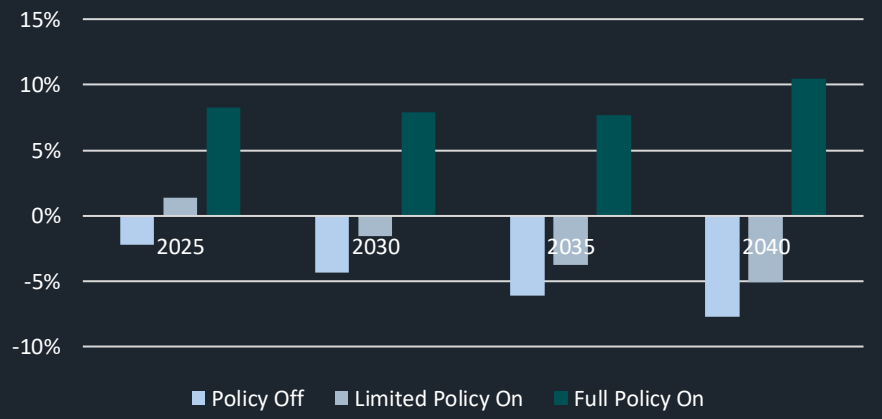
- 30,000 additional jobs
- £34.6 billion additional GVA (2022-2040)

Driving the need for a skilled workforce in the Tees Valley

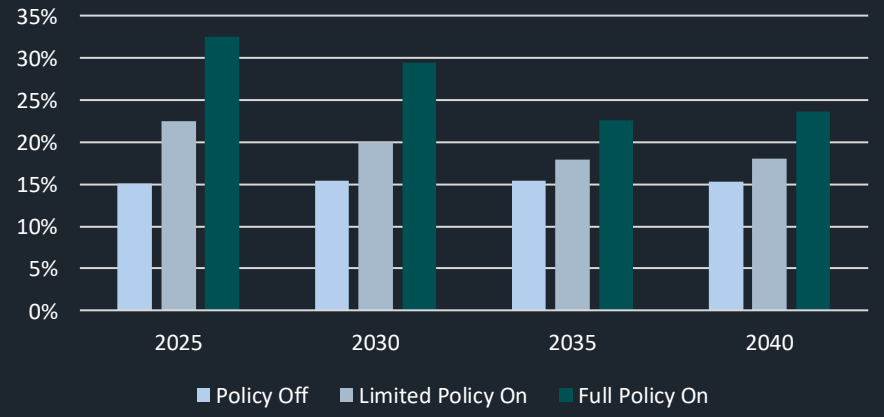
Science, research, engineering and technology professionals



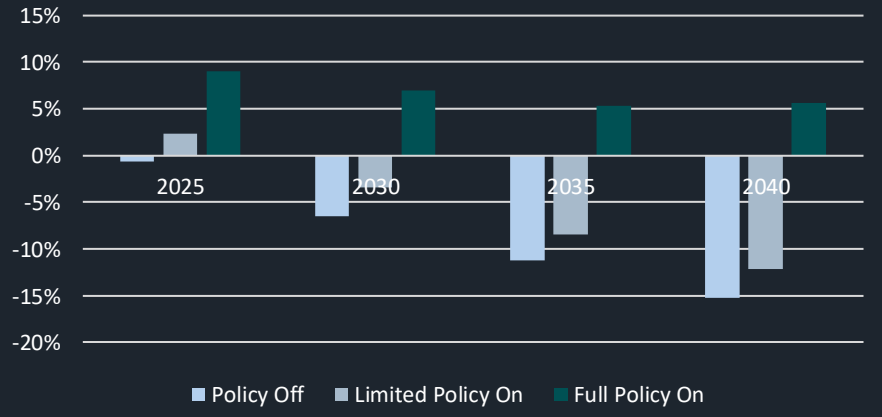
Skilled metal, electrical and electronic trades



Skilled construction and building trades



Process plant and machine operatives



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The Cluster Plan

- Full Report
- Actions
- Timeline

Tees Valley Net Zero Cluster Plan – Full Report

1. Decarbonisation in the Tees Valley Industrial Cluster	2. Net Zero Planning	3. Societal & Regional Benefit	4. Enablers & Future Opportunities
- Introduction - Tees Valley Industrials Case Studies - National Policy Overview - Net Zero Teesside - CCS and the CO2 gas gathering network - Mapping the Cluster Plan to UN Sustainable Development Goals	- The Cluster Model - Scope 1 CO2 emissions reduction and the net zero balance - Tees Valley Industrial Cluster Systems Model - - a tool for maximising the benefit of the Tees Valley cluster's inherent integration - Carbon Accounting - GHG Protocol with Life Cycle Analysis showing the wider value of Scope 1/2/3 emissions reduction	- Economic impact assessments - The "Policy Off" scenario" - what happens if we do not adopt industrial decarbonisation - The "Limited Policy On" and "Full Policy On" scenarios - the benefits of adopting different degrees of industrial decarbonisation - Barriers to decarbonisation - Jobs & GVA - Skills and workforce planning	- Infrastructure requirements I - electricity Infrastructure requirements II - hydrogen - The future opportunity for CCS and CO2 storage - Shipping Industrial Gases I - importing CO2 by sea - Shipping Industrial Gases II - exporting hydrogen - Circular economy fuels and Energy from Waste

The Cluster Plan - Actions

A Unified Voice for the Cluster 2023

- Industrial Net Zero Leadership Group has the aim to ensure Net Zero is delivered in the Cluster.

Carbon Accounting
2023-2025 & onwards

- Using the methodology defined in the Cluster Plan. Demonstrating & quantifying the positive impact of the Tees Valley on the wider UK economy

Carbon Capture & Storage
2027 – 2030

- Working with and supporting NZT, NEP and East Coast Cluster
- Promote and support all CO2 emitters including those not on Cluster Sequencing

Negative Emissions at Scale 2030-2040

- These will be essential to balance residual Scope 1 emission and ensure Net Zero is achieved

Infrastructure & Planning
2023-2030

- Working with our electricity, gas and water providers to develop their networks to support and optimize decarbonised industries

Renewable & Sustainable Fuels 2023-onwards

- Support to renewable and circular economy fuels, creating the conditions for investment here, bringing production technologies for SAF, rDME and more

Low Carbon Hydrogen at Scale 2027-2030

- Working with support and supporting the new supply/demand economy.
- Creating a centre for industrial scale low-carbon hydrogen production

Local & National Coordination

- Working with our local and national stakeholders to communicate plans, exchange knowledge and ensure the pace of decarbonisation is maintained

The Timeline to Net Zero

2022
A United voice for the Cluster

2023 - 2025
Carbon Accounting

2023 - onwards
Renewable & Sustainable Fuels: Energy from Waste & Circular Economy

2023 - 2030
Infrastructure & Planning

2027 - 2030
Net Zero Teesside Commissioned and Initial Operations

2027 - 2030
Low-Carbon Hydrogen – Industrial Scale Production Commissioned

2030
Tees Valley becomes the first low-Carbon Cluster

2030 - 2040
Negative Emissions available at Industrial Scale

2040
Tees Valley becomes the first **Net Zero Cluster**

- Storing **180% of baseline CO2 emissions**
- **£10 billion** invested in decarbonisation
- Creating **30,000 new jobs**
- Increasing GVA by **£34.6billion**

SUSTAINABLE DEVELOPMENT GOALS

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