Net Zero Teesside

# Net Zero Teesside Project

Planning Inspectorate Reference: EN010103

**Land at and in the vicinity of the former Redcar Steel Works Site, Redcar and in Stockton-on-Tees, Teesside**

**The Net Zero Teesside Order**

**Document Ref. No. 5.2 – Need Statement**

**Applicants: Net Zero Teesside Power Limited (NZT Power Ltd) & Net Zero North Sea Storage Limited (NZNS Storage Ltd)**

**Date: May 2021**

## DOCUMENT HISTORY

| | | | |
|---|---|---|---|
| **Document Ref** | 5.2 | | |
| **Revision** | 1.0 | | |
| **Author** | Jessica Howe (JH) | | |
| **Signed** | JH | **Date** | 21.05.21 |
| **Approved By** | David Yates (DY) | | |
| **Signed** | DY | **Date** | 21.05.21 |
| **Document Owner** | bp | | |

## GLOSSARY

| **Abbreviation** | **Description** |
|---|---|
| Action Plan | An Action Plan |
| AOD | Above Ordnance Datum - a spot height (an exact point on a map) with an elevation recorded beside it that represents its height above a given datum. |
| Applicants | Net Zero Teesside Power Limited and Net Zero North Sea Storage Limited. |
| BECCS | Bioenergy with Carbon Capture and Storage. |
| BEIS | Department of Business, Energy and Industrial Strategy - a department of the UK Government. |
| CCC Report | Net Zero - The UK's Contribution to Stopping Global Warming' (May 2019). |
| CCGT | Combined Cycle Gas Turbine - a highly efficient form of energy generation technology. An assembly of heat engines work in tandem using the same source of heat to convert it into mechanical energy which drives electrical generators and consequently generates electricity. |
| CCS | Carbon Capture and Storage - technology that can capture carbon dioxide ($CO_2$) emissions produced from the use of fossil fuels in electricity generation and industrial processes. |
| CCUS | Carbon Capture, Usage and Storage - is group of technologies designed to reduce the amount of carbon dioxide ($CO_2$) released into the atmosphere from coal and gas power stations as well as heavy industry including cement and steel production. Once captured, the $CO_2$ can be either re-used in various products, such as cement or plastics (usage), or stored in geological formations deep underground (storage). |

| | |
|---|---|
| $CO_2$ | Carbon Dioxide - an inorganic chemical compound with a wide range of commercial uses. |
| DCO | Development Consent Order - A Development Consent Order made by the relevant Secretary of State pursuant to The Planning Act 2008 to authorise a Nationally Significant Infrastructure Project. A DCO can incorporate or remove the need for a range of consents which would otherwise be required for a development. A DCO can also include rights of compulsory acquisition. |
| EPC | Engineering Procurement and Construction. |
| ES | Environmental Statement - a report in which the process and results of an Environment Impact Assessment are documented. |
| EWP | Energy White Paper - policy paper produced by the Department for Business, Energy and Industrial Services. |
| FOAK | First-of-a-Kind. |
| ha | Hectares - a metric unit of measurement for area. There are 10,000 square metres in a hectare. |
| IDS | Industrial Decarbonisation Strategy. |
| IPCC | Intergovernmental Panel on Climate Change - the United Nations body for assessing the science related to climate change. |
| km | Kilometres - a metric unit of measurement for distance, equal to 1,000 metres |
| m | Metres - a metric unit of measurement for length, equal to 100 centimetres. |
| MLWS | Mean Low Water Springs - the height of the mean low water springs is the average height obtained by the two successive low waters during those periods of 24 hours when the range of the tide is at its greatest. |
| MPcp | Major Projects common Process. |
| NEP | Northern Endurance Project. |
| NIS | National Infrastructure Strategy. |
| NPS | National Policy Statement - a statement produced by Government under the Planning Act 2008 providing the policy framework for Nationally Significant Infrastructure Projects. They include the Government's view of the need for and objectives for the development of Nationally Significant Infrastructure Projects in a particular sector such as energy and are used to determine applications for such development. |

| | |
|---|---|
| NSIP | Nationally Significant Infrastructure Project - defined by the Planning Act 2008 and covering projects relating to energy (including generating stations, electric lines and pipelines); transport (including trunk roads and motorways, airports, harbour facilities, railways and rail freight interchanges); water (dams and reservoirs, and the transfer of water resources); waste water treatment plants and hazardous waste facilities. These projects are only defined as nationally significant if they satisfy a statutory threshold in terms of their scale or effect. |
| NTS | National Transmission System for gas - the gas national grid used to transport natural gas around the UK. |
| NZNS Storage | Net Zero North Sea Storage Limited - one of the Applicants. |
| NZT | Net Zero Teesside - the name of the Proposed Development. |
| NZT Power | Net Zero Teesside Power Limited - one of the Applicants. |
| OEMs | Manufacturers. |
| Order | The Net Zero Teesside Order – the DCO for the Proposed Development. |
| PA 2008 | The Planning Act 2008 - setting out the legislative regime for Nationally Significant Infrastructure Projects. |
| Proposed Development | The Net Zero Teesside Project. |
| Site | The Proposed Development Site. |
| SoS | Secretary of State - the decision maker for DCO applications and head of Government department. |
| STDC | South Tees Development Corporation - a Mayoral Development Corporation responsible for approximately 400 hectares of land south of the River Tees in the borough of Redcar and Cleveland. |
| TVCA | Tees Valley Combined Authority - a partnership of five local authorities; Darlington, Hartlepool, Middlesbrough, Redcar & Cleveland and Stockton-on-Tees, working together to promote the growth of the local economy. |
| UKCS | UK Continental Shelf. |
| ZCH | Zero Carbon Humber. |

## CONTENTS



**TABLES**



**FIGURES**

# 1.0 EXECUTIVE SUMMARY

1.1.1 bp is leading the development of two closely integrated projects; Net Zero Teesside (NZT) and the Northern Endurance Project (NEP).

1.1.2 NZT involves developing a new flexible gas-fired electricity generating station with integrated carbon capture and a carbon dioxide ($CO_2$) gathering pipeline network in the area to connect to existing industrial emitters. Overall, this will enable decarbonisation of local industry, provide low carbon power generation and also facilitate future hydrogen production in the Teesside area.

1.1.3 The NEP will develop geological storage in the Southern North Sea, to which captured $CO_2$ emissions from both NZT and the Zero Carbon Humber (ZCH) projects will be connected via new transport/export pipelines. These emissions will then be permanently stored underground in Endurance, the UK's largest appraised saline aquifer for carbon storage.

1.1.4 'Net Zero Teesside' and 'NZT' are used to refer to Proposed Development, which is the subject of the DCO Application. That encompasses onshore and near shore parts of both the NZT the NEP projects in Teesside, which are of national significance.

1.1.5 In June 2019, the UK became the first OECD economy to legally commit to reducing greenhouse gas emissions to net zero by 2050, compared with the previous target of at least 80% reduction from 1990 levels. This is intended to deliver on the UK's commitment to the Paris Agreement.

1.1.6 This followed shortly after the publication of the Climate Change Committee (CCC) "Net Zero – The UK's contribution to stopping global warming" report, which developed emissions scenarios based on ten new research projects, three expert advisory groups, and reviews of the work of the Intergovernmental Panel on Climate Change (IPCC) and others. In each of these scenarios, Carbon Capture and Storage (CCS) is identified as vital for curbing emissions across the power, energy-intensive industries (fertiliser, steel, cement, paper and chemical production) as well as decarbonising the heat sector through low-carbon hydrogen. With UK electricity demand set to double (300-594TWh) and hydrogen demand expected to grow 2-3GW per annum, as much as 176mtpa of CCS may be required by 2050.[1]

1.1.7 The CCC report recognised that this is only possible if clear, stable and well-designed policies to reduce emissions further are introduced across the economy without delay and specifically stated that policy was insufficient for even the targets in place at that time (80% reduction by 2050).

1.1.8 The UK Government is currently developing policy to enable Carbon Capture Usage and Storage (CCUS) business models with the intent of incorporating lessons learned

[1] https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/

and recommendations from previous CCUS competitions alongside the CCUS Cost Challenge Taskforce Report[2].

1.1.9 Alongside this, the UK Chancellor announced in March 2020 that the HMT budget would seek *"the establishment of a new CCS Infrastructure Fund (CIF) of at least £800 million aiming to support the development of at least two UK CCS sites".* In November 2020, the Prime Minister re-iterated this importance in the 'Ten Point Plan' where the UK Government decided to increase the CCUS target to 10 million tonnes by 2030, and the number of industrial clusters from two to four, as well as increasing the CIF to £1 billion[3].

1.1.10 The Chancellor stated that the first CCUS site will be established by the mid-2020s, with *"at least one CCS gas power station by 2030 with the help of consumer subsidies"*[4].

1.1.11 The 'Clean Growth Grand Challenge' and 'Industrial Clusters Mission' have set out an ambition to establish at least one low-carbon industrial cluster by 2030 and the World's first net-zero carbon industrial cluster by 2040.

1.1.12 NZT's objective is to implement innovative First-of-a-Kind (FOAK) onshore low-carbon CCUS infrastructure in the UK, anchored by a flexible gas-fired electricity generating station and CCUS concept to provide around 750MWe of low carbon dispatchable electricity in support of decarbonising the UK grid.

1.1.13 NZT will establish dispatchable low-carbon power generation, which is identified as crucial to fully decarbonising the UK grid and complementing the intermittent nature of renewables. NZT thus makes an important contribution toward grid operability and the security of national energy supply, providing much needed firm capacity to the UK's existing generation mix.

1.1.14 Captured carbon will be collected via an onshore pipeline gathering system with multiple tie-in points for current and future industries, therefore helping to decarbonise several industrial sectors.

1.1.15 NZT will support the UK's industrial strategy by attracting investment in low-carbon industries across Teesside, including the transport sector and the production of synthetic fuels.

1.1.16 As the UK Government seeks to drive a recovery from the economic downturn caused by COVID-19, there is likely to be support for large infrastructure investment projects that can provide a significant economic impact. NZT offers economic and employment benefits in an economically less advantaged region of the UK and

---

2 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727040/CCUS_Cost_Challenge_Taskforce_Report.pdf

3 https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/871799/Budget_2020_Web_Accessible_Complete.pdf

combines this with low-carbon credentials that provide further future growth opportunities. NZT brings substantial infrastructure investment that enables economic regeneration within Teesside in particular, and which is strategically aligned to the agenda of the recently elected government to 'level up' the North of England. By helping to decarbonise carbon-intensive industries on Teesside and enabling their continued operation with significantly reduced carbon footprints, it is estimated NZT could support and safeguard between 35% and 70% of existing manufacturing jobs in Tees Valley[5].

1.1.17 NZT will aim to source substantial workforce, expertise and equipment from UK suppliers, and it is the intention that high-value contracts will be awarded to a range of local suppliers, helping to build a new low-carbon supply chain across the North of England. The Proposed Development's investment in new technologies, such as innovative carbon capture solvents and $CO_2$capture equipment, has the potential to nurture the development of a new supply chain, and regenerate and revitalise the region.

1.1.18 NZT could enable the start-up of the World's first low carbon industrial cluster as early as 2026 in line with the Industrial Clusters Mission (ICM), designing the necessary low-carbon infrastructure required to enable large scale decarbonisation of current and future industries.

[5] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/20200508_NZT_Economic_Benefits_Report_Edited_Clean_web.pdf

# 2.0 INTRODUCTION

## 2.1 Overview

2.1.1 This Need Statement (Document Ref. 5.2) has been prepared on behalf of Net Zero Teesside Power Limited and Net Zero North Sea Storage Limited (the 'Applicants'). It forms part of the application (the 'Application') for a Development Consent Order (a 'DCO'), that has been submitted to the Secretary of State (the 'SoS') for Business, Energy and Industrial Strategy ('BEIS'), under Section 37 of 'The Planning Act 2008' (the 'PA 2008').

2.1.2 The Applicants are seeking development consent for the construction, operation and maintenance of the Net Zero Teesside Project ('NZT'), including associated development (together the 'Proposed Development') on land at and in the vicinity of the former Redcar Steel Works site, Redcar and in Stockton-on-Tees, on Teesside (the 'Site'). The former Steel Works site, along with other land required for the Proposed Development, lies within the boundary of the land controlled by the South Tees Development Corporation ('STDC'), which is now known as 'Teesworks'.

2.1.3 A DCO is required for the Proposed Development as it falls within the definition and thresholds for a 'Nationally Significant Infrastructure Project' (a 'NSIP') under Sections 14(1)(a) and 15 of the PA 2008, associated development under Section 115(1)(b) and by direction under Sections 35(1) and 35ZA of the same Act. The DCO, if made by the SoS, would be known as the 'Net Zero Teesside Order' (the 'Order').

2.1.4 The Proposed Development will be the UK's first commercial scale, full chain Carbon Capture, Usage and Storage ('CCUS') project and will initially capture up to 4 million tonnes (Mt) of carbon dioxide ($CO_2$) emissions per annum. It will comprise a number of elements, including a new gas-fired electricity generating Station with post-combustion carbon capture plant; gas, water and electricity connections (for the generating station); a $CO_2$ pipeline network (a 'gathering network') for collecting $CO_2$ from a cluster of local industries on Teesside; a $CO_2$ compressor station (for the compression of the $CO_2$) and a $CO_2$ export pipeline.

2.1.5 The $CO_2$ captured from the electricity generating station and local industries will be compressed and then transported (via the export pipeline) for secure storage within the Endurance saline aquifer located 145 kilometres offshore from Teesside under the North Sea. The export pipeline has the capacity to carry up to 10Mt of $CO_2$ per annum. The Proposed Development will therefore make a significant contribution toward the UK reaching its greenhouse gas emissions target by 2050.

## 2.2 The Applicants

2.2.1 NZT encompasses proposals to both decarbonise electricity generation and a cluster of carbon intensive industries on Teesside. In line with the CCUS business models published by BEIS in December 2020, there will be separate entities who will be responsible for:

- electricity generation with post-combustion carbon capture (including the gas, water and electricity connections);

- $CO_2$ gathering (from industrial emitters), $CO_2$ compression and $CO_2$ export and storage; and
- industrial (including hydrogen production) carbon capture and connections to the $CO_2$ gathering network.

2.2.2 The entities are set out in **Table 2.1** below:

**Table 2.1: NZT Entities**

| Onshore works scope | Partnership | NZT Entity | Within the scope of the DCO Application? |
|---|---|---|---|
| Electricity Generating Station with post-combustion carbon capture (including the gas, water and electricity connections) | bp*, Eni, Equinor and Total | Net Zero Teesside Power Limited | Yes |
| $CO_2$ gathering network, $CO_2$ compression and the onshore section of $CO_2$ export pipeline | bp*, Eni, Equinor, National Grid, Shell and Total | Net Zero North Sea Storage Limited | Yes |
| Industrial and hydrogen production carbon capture and connection to the $CO_2$ gathering network | Individual industrial emitters | N/A | No |

*Operator on behalf of the relevant Partnership

2.2.3 NZT is being promoted by Net Zero Teesside Power Limited ('NZT Power') and Net Zero North Sea Storage Limited ('NZNS Storage'). NZT Power and NZNS Storage (together the Applicants for the purposes of the DCO Application) have been incorporated on behalf of bp as operator of the two Partnerships.

2.2.4 The electricity generation with post-combustion carbon capture Partnership comprises bp, Eni, Equinor and Total, with bp leading as operator. NZT Power will be responsible for the Proposed Development in so far as it relates to the construction, operation and eventual decommissioning of the electricity generating station together with its carbon capture plant (both within the scope of the DCO Application).

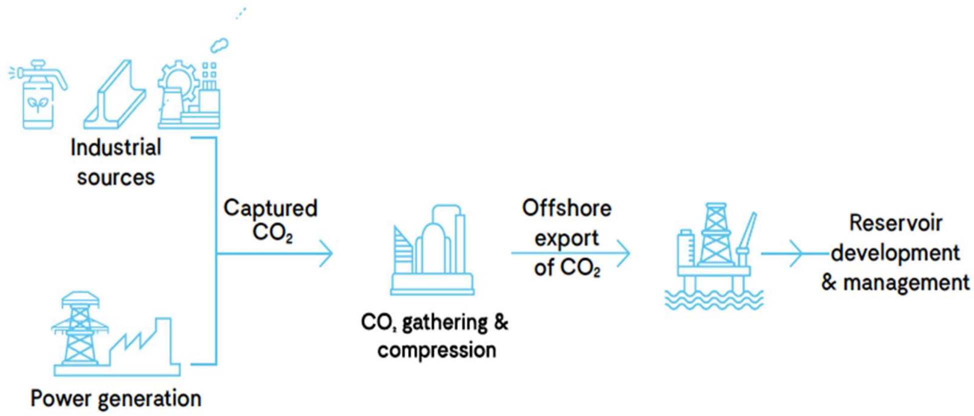
2.2.5 The $CO_2$ gathering network, $CO_2$ compression and onshore section of $CO_2$ export pipeline Partnership comprises bp, Eni, Equinor, National Grid, Shell and Total, with bp leading as operator. NZNS Storage will be responsible for the Proposed Development in so far as it relates to the construction, operation and eventual decommissioning of the equipment required for the high-pressure compression of $CO_2$ from the electricity generating station and industrial emitters via the $CO_2$ gathering network and the onshore section of the $CO_2$ export pipeline (these are all within the scope of the DCO Application).

2.2.6 NZNS Storage will also be responsible for the offshore elements of NZT, comprising the offshore section of the $CO_2$ export pipeline (below Mean Low Water Springs ('MLWS')) to a suitable offshore geological $CO_2$ storage site under the North Sea, $CO_2$ injection wells and associated infrastructure. The offshore elements of NZT (with the exception of the gas and $CO_2$ pipeline crossings of the River Tees and the water outfall from the electricity generating station) do not form part of the DCO Application.

## 2.3 What is Carbon Capture, Usage and Storage?

2.3.1 Carbon Capture, Usage and Storage ('CCUS') is a process that removes $CO_2$ emissions at source, for example emissions from an Electricity Generating Station or industrial installation, and then compresses the $CO_2$ so that it can be safely transported to secure underground storage sites. It is then injected into layer of solid rock filled with interconnected pores where the $CO_2$ becomes trapped and locked in place, preventing it from being released into the atmosphere. **Figure 2.1** below shows what is involved in the process.

**Figure 2.1: CCUS Process**




2.3.2 The technologies used in CCUS are proven and have been used safely across the World for many years. Storage sites are located several kilometres underground and are subject to stringent tests to ensure that they are geologically suitable. In the UK, it is expected that the storage sites will be located offshore, in areas such as the North Sea.

2.3.3 CCUS is one of a number of technologies that are crucial to reducing $CO_2$ emissions and combatting global warming. The UK Government has committed to achieving 'Net Zero' in terms of greenhouse gas emissions by 2050. This is a legally binding target.

## 2.4 The Site

2.4.1 The Site lies within the administrative boundaries of both Redcar and Cleveland Borough Council and Stockton-on-Tees Borough Council. It also partly lies within the boundary of the Teesworks area that is controlled by the STDC.

2.4.2 Most of the Site lies within the administrative area of Redcar and Cleveland Borough Council, although parts of Site (for the electricity generating station's gas supply connection to the National Transmission System for gas and the $CO_2$ gathering network) cross the River Tees into the administrative area of Stockton-on-Tees Borough Council. At this location, the River Tees is tidal. In addition, there are elements of the Site which extend into South Gare, Coatham Sands and the North Sea. Those sections of the Site that are below MLWS are outside the jurisdiction of either local authority being part of the UK marine area.

2.4.3 The Site extends to approximately 462 hectares ('ha') in area. Much of it comprises previously developed (including part of the former Redcar Steel Works Site) and existing industrial land, some of which was reclaimed from the Tees Estuary in the late C19th and during the C20th. The Site is relatively flat and low-lying and sits at a level of between sea level and approximately 9 metres Above Ordnance Datum ('AOD'). The area surrounding the Site is largely characterised by industrial and commercial uses, although there are open areas of land to the north in the form of

South Gare and Coatham Sands, which are used for recreational purposes and that are of nature conservation importance.

2.4.4 A more detailed description of the Site and its surroundings is provided at Chapter 3 'Description of the Existing Environment' in the Environmental Statement ('ES') Volume I (Document Ref. 6.2).

## 2.5 The Proposed Development

2.5.1 The Proposed Development will work by capturing $CO_2$ from the electricity generating station in addition to a cluster of local industries on Teesside and transporting it via a $CO_2$ export pipeline to the Endurance saline aquifer under the North Sea. The Proposed Development will initially capture and transport up to 4Mt of $CO_2$ per annum, although the $CO_2$ export pipeline has the capacity to accommodate up to 10Mt of $CO_2$ per annum thereby allowing for future expansion.

2.5.2 The Proposed Development comprises the following elements:

- a combined cycle gas turbine ('CCGT') electricity generating station with an electrical output of between 750 and 860 megawatts and post-combustion carbon capture plant;
- cooling water, gas and electricity grid connections and infrastructure for the Electricity Generating Station;
- a $CO_2$ gathering network (including connections under the tidal River Tees) to collect and transport the captured $CO_2$ from industrial emitters to a $CO_2$ compressor station (the industrial emitters using the gathering network will be responsible for consenting their own carbon capture plant and connections to the gathering network);
- a high-pressure $CO_2$ compressor station to receive and compress the captured $CO_2$ from the Electricity Generating Station and gathering network before it is transported offshore; and
- a dense phase $CO_2$ export pipeline for the onward transport of the captured and compressed $CO_2$ to the Endurance saline aquifer under the North Sea.

2.5.3 The electricity generating station, its post-combustion carbon capture plant and the $CO_2$ compressor station will be located on part of the STDC Teesworks area (on part of the former Redcar Steel Works Site). The $CO_2$ export pipeline will also start in this location before heading offshore. The electricity generating station connections and the $CO_2$ gathering network will require corridors of land within both Redcar and Stockton-on-Tees, including crossings beneath the River Tees.

2.5.4 All of the above elements are included in the scope of the DCO Application, with the exception of the $CO_2$ export pipeline, where only the onshore section of pipeline above MLWS is included. The $CO_2$ export pipeline below MLWS and the $CO_2$ storage site under the North Sea (the Endurance saline aquifer) will be the subject of separate consent applications, including under the Petroleum Act 1998 and the Energy Act 2008. These applications will be supported by an Offshore Environmental Statement.

2.5.5 The ancillary development required in connection with and subsidiary to the above elements of the Proposed Development is detailed in Schedule 1 of the draft DCO (Document Ref. 2.1). A more detailed description of the Proposed Development is provided at Schedule 1 'Authorised Development' of the draft DCO and Chapter 4 'The Proposed Development' in ES Volume I (Document Ref. 6.2) and the areas within which each of the main elements of the Proposed Development are to be built are denoted by the coloured and hatched areas on the Works Plans (Document Ref. 4.4).

## 2.6 The Purpose and Structure of this Document

2.6.1 The purpose of this document is to set out the need that exists for the Proposed Development, with particular reference to the Government's objectives for decarbonising the power and industrial sectors and achieving the legally binding commitment to achieve 'net zero' in terms of greenhouse gas emissions by 2050.

2.6.2 The Need Statement should be read alongside the Planning Statement (Document Ref. 5.3) which sets out how the Applicants have taken account of relevant planning policy, notably the National Policy Statements (NPSs) for energy infrastructure, which confirms the need for new electricity generating capacity, and the extent to which the Proposed Development complies with the policies within those NPSs, as well as any other matters that are *"important and relevant"* to the SoS's determination of the DCO Application. Such matters include the UK Government energy and climate change policy, the National Planning Policy Framework and the statutory development plan.

# 3.0 UK ENERGY AND CLIMATE CHANGE POLICY

## 3.1 Introduction

3.1.1 This section provides an overview of recent UK Government energy and climate change policy, which establishes clear objectives for decarbonising the power and industrial sectors and achieving the legally binding commitment to achieve 'net zero' greenhouse gas emissions by 2050. The deployment of CCS/CCUS at scale is identified as a key priority by the Government, and advisory bodies such as the National Infrastructure Commission and Climate Change Committee, in order to decarbonise the UK economy by 2050. The policy documents considered include:

- The Clean Growth Strategy (HM Government, 2017).
- Clean Growth - The UK Carbon Capture Usage and Storage deployment pathway - An Action Plan (HM Government, 2018).
- The commitment to achieve 'Net Zero' by 2050 in the 'Climate Change Act 2008 (2050 Target Amendment) Order 2019' (HM Government, 2019).
- Reducing UK emissions: 2020 Progress Report to Parliament (Committee for Climate Change, June 2020).
- The Ten Point Plan for a Green Industrial Revolution (HM Government, November 2020).
- National Infrastructure Strategy: Fairer, faster, greener (HM Treasury, November 2020).
- The Energy White Paper (HM Government, December 2020).
- Carbon Capture Usage and Storage: Market Engagement on Cluster Sequencing (Feb 2021).
- The Industrial Decarbonisation Strategy (HM Government, March 2021).
- North Sea Transition Deal (Department for Business, Energy & Industrial Strategy and OGUK, March 2021)

## 3.2 The Clean Growth Strategy (HM Government, 2017)

3.2.1 The 'Clean Growth Strategy - Leading the way to a low carbon future', was published by the Department for BEIS in October 2017 (and amended in April 2018). The Clean Growth Strategy (the CGS) sets out the aims of the Government to deliver increased economic growth while reducing carbon emissions. It estimates that the low carbon economy could grow 11% per year between 2015 and 2030, four times faster than the projected growth of the economy as a whole.

3.2.2 The Executive Summary (page 9) confirms that for the UK to achieve its fourth and fifth carbon budgets (2023 - 2027 and 2028 - 2032), it is necessary to drive a significant acceleration in the pace of decarbonisation. The Executive Summary sets out several key policies and proposals (pages 12 - 16) relating to 'Improving Business and Industry Efficiency'. These include to:

*"4. Publish joint industrial decarbonisation and energy efficiency action plans with seven of the most energy intensive industrial sectors;*

*5. Demonstrate international leadership in carbon capture usage and storage (CCUS), by collaborating with our global partners and investing up to £100 million in leading edge CCUS and industrial innovation to drive down costs.*

*6. Work in partnership with industry, through a new CCUS Council, to put us on a path to meet our ambition of having the option of deploying CCUS at scale in the UK, and to maximise its industrial opportunity.*

*7. Develop our strategic approach to greenhouse gas removal technologies, building on the Government's programme of research and development and addressing the barriers to their long-term deployment."*

3.2.3 Chapter 3 (page 47) of the CGS sets out the Government's approach and states:

*"…we must create the best possible environment for the private sector to innovate and invest. Our approach will mirror that of our Industrial Strategy: building on the UK's strengths …; improving productivity across the UK; and ensuring we are the best place for innovators and new business to start up and grow. We are clear about the need to design competitive markets and smart regulation to support entrepreneurs and investors who will develop the new technologies at the scale we need."*

*… we are laying the groundwork for major decisions in the areas where we face greatest uncertainty and challenge: in how we work with industry to make carbon capture, usage and storage (CCUS) a viable future option."*

3.2.4 Page 49 of the CGS goes on to state that:

*"We want to use the power of Government to support innovation in a low carbon economy using all the tools available to us, including market design, taxation and regulation, as well as investment in our education systems, our science base and innovative companies. Our aim is to become one of the best places in the world for low carbon innovation."*

3.2.5 Chapter 3 of the CGS 'Our Clean Growth Strategy' sets out the various projects that have been announced as part of the 'BEIS Energy Innovation Programme' (page 50). This includes up to £20m of investment in a carbon capture and usage demonstration programme.

3.2.6 The Proposed Development will accord with the Government's ambitions set out above, in particular, removing uncertainty and working with industry to make CCS/CCUS a viable future option.

3.2.7 Chapter 4 of the CGS deals with different sectors of the UK economy, including at pages 61-71, a section on 'Improving Business and Industry Efficiency and Supporting Clean Growth'. Page 62 states (as at the time the CGS was prepared) that business and industry account for approximately 25% of the UK's emissions and 50% of its electricity use.

3.2.8 This section of Chapter 4 sets out various policies and proposals to increase energy efficiency in business and industry. However, it is acknowledged (page 64) that energy-intensive industries will require steps beyond energy efficiency:

*"Out to 2030, this will require industry to make progress in switching from fossil fuel use to low carbon fuels such as sustainable biomass, in line with broader Government priorities in delivering on clean air, and clean electricity. Beyond 2030, this switching will need to substantially increase in scale and be coupled with the deployment of new technologies, for example, carbon capture, usage and storage (CCUS). Over the course of this Parliament, we will therefore also develop a framework to support the decarbonisation of heavy industry."* [underlining added]

3.2.9 Figure 17 'Carbon reduction opportunities across industry (2050)' (page 65) confirms that the deep decarbonisation of industry will need to go beyond energy efficiency and highlights the significant contribution that CCUS could make toward decarbonisation.

3.2.10 Page 69 deals with CCUS in detail. Its states:

*"There is a broad international consensus that carbon capture, usage and storage (CCUS) has a vital future role in reducing emissions. This could be across a wide range of activities such as producing lower-emission power, decarbonising industry where fossil fuels are used and/or industrial processes as well as providing a decarbonised production method for hydrogen which can be used in heating and transport. This makes CCUS a potentially large global economic opportunity for the UK. The International Energy Agency estimates there will be a global CCUS market with over £100 billion – with even a modest share of this global market, UK GVA could increase between £5 billion and £9 billion per year by 2030."*

3.2.11 The Proposed Development would contribute to achieving the carbon budgets. It would serve as a demonstration that CCS/CCUS can be delivered at a commercial scale in the UK in connection with both power generation and industry. Furthermore, it would have the potential to encourage further similar development in the future, thereby contributing to the wider decarbonisation of power generation and industry within the UK. The CGS (page 70) confirms that the Government will set up a new Ministerial-led CCUS Council with industry to review progress and priorities. Furthermore, the Government will continue to work with ongoing initiatives, including in locations such as Teesside, to test the potential for the development of CCUS industrial carbonisation clusters. It goes on to state (page 71) that:

*"The Government will spend up to £100 million from the BEIS Energy Innovation Programme to support Industry and CCUS innovation and deployment in the UK including £20 million of funding available for a carbon capture and utilisation demonstration programme to invest in new innovative technologies that capture and utilise carbon dioxide."*

3.2.12 Pages 93 - 101 of Chapter 4 cover 'Delivering Clean, Smart, Flexible Power'. The overriding objective is to deliver a reduction in emissions from the power sector. Page 96 states that in order to achieve this, it will be necessary to continue to bring down the costs of low carbon generation from renewables and nuclear and ensure that the UK can deploy CCUS at scale during the 2030s. Page 101 reiterates the Government's commitment to supporting CCUS innovation and deployment through the BEIS Energy Innovation Programme.

3.2.13 The Proposed Development will clearly contribute to the delivery of the CGS through the Government's objective to decarbonise both the power and industrial sectors. Furthermore, the Proposed Development is particularly well located to support industrial decarbonisation, due to the concentration of major energy-intensive industry in Teesside.

## 3.3 Clean Growth - The UK Carbon Capture Usage and Storage deployment pathway - An Action Plan (HM Government, 2018)

3.3.1 'Clean Growth - The UK Carbon Capture Usage and Storage deployment pathway - An Action Plan' (the 'Action Plan') was published by the Government in November 2018. The Executive Summary (pages 5 and 6) confirms that the Government's vision is for the UK to become a global leader in CCUS. The Action Plan is aimed at enabling the development of the first CCUS facility in the UK, with commissioning in the mid-2020s, which would support the ambition of being able to deploy CCUS at scale during the 2030s, subject to the costs coming down sufficiently. It goes on to state (page 6):

*"Through our Clean Growth Strategy we re-affirmed our commitment to the domestic deployment of CCUS subject to cost reductions. This Plan sets out our next steps to progress this commitment."*

3.3.2 The Action Plan states that this can only be achieved through close Government and industry partnership (page 14) and that CCUS is central to a least-cost energy system decarbonisation pathway to 2050. It goes on to state (page 14) that:

*"The Committee on Climate Change (CCC) stresses the importance of CCUS to "achieving an 80% emissions reduction at lowest cost, as well as its crucial role in enabling deeper emissions reduction beyond that". Modelling by the Energy Systems Catapult (ESC) for the Energy Technologies Institute (ETI) supports the conclusion by the CCC that energy system decarbonisation could be up to fifty per cent cheaper by 2050 if CCUS is deployed at scale, and conclude that delaying deployment beyond the 2020s will increase the risks of decarbonising the UK's energy system. Both the CCC and ETI analysis concludes that initial deployment is required during the 2020s in order to have the option of deploying at scale during the 2030s, and in particular to keep open the option of UK CCUS deployment towards the levels both state are required in 2050. This timeline was endorsed by the CCUS Cost Challenge Taskforce, and the conclusion was also reached by the Parliamentary Advisory Group on CCS. A key message from all these independent bodies is that deployment of CCUS during the 2020s is essential to unlock the greatest opportunities for cost reduction."*

3.3.3 Teesside, with its concentration of heavy industry, including chemicals production, and access to North Sea storage, is identified as one of the key potential locations for CCUS (page 16), building on the work undertaken to date by the Teesside Collective. In page 27 ('Delivering our 2030s ambition') reference is made to CCUS being central to the long-term competitiveness of areas such as Teesside.

3.3.4 In page 32 ('Industrial decarbonisation with CCUS') the Action Plan highlights the importance of CCUS in decarbonising energy-intensive industries (EIIs), including iron and steel, cement, chemicals, and oil refining. It goes on to state:

*"Some of these industries produce volumes of emissions from chemical processes, in addition to combustion of fossil fuels, for example, up to 70% of emissions from cement production are from the process of producing cement, rather than from energy use. These emissions cannot be abated by fuel switching or electrification.*

*Overall, CCUS could provide 37% of the total abatement potential in EIIs by 2050. A recent study by McKinsey on decarbonising EIIs showed that where carbon dioxide storage sites are accessible, CCUS is the lowest-cost decarbonisation option at current commodity prices. CCUS also enables the large-scale use of hydrogen as an industrial fuel, which the recent CCC and Element Energy reports have indicated could be one cost-effective pathway to industrial decarbonisation."*

3.3.5 The Action Plan (pages 35 to 37) also highlights the role of CCUS in decarbonising electricity generation, alongside an expansion of other forms of low and zero-carbon power generation to achieve *"deep decarbonisation"* of the UK power sector.

3.3.6 The Proposed Development is consistent with the vision and ambition of the Action Plan. Furthermore, Teesside's concentration of heavy industries, particularly within the chemicals sector and proximity to North Sea storage, is identified as a potential key location for the deployment of CCUS at scale.

### 3.4 'Net Zero' by 2050 (HM Government, 2019)

3.4.1 On 27 June 2019, the 'Climate Change Act 2008 (2050 Target Amendment) Order 2019' came into force. The Order amends the Climate Change Act 2008 and enshrines within UK law, the commitment to achieve 'net zero' in terms of greenhouse gas emissions by 2050. The Order amended the previous target which sought a reduction in greenhouse gas emissions of 80% by 2050 compared to 1990 levels.

3.4.2 The commitment to achieve net zero by 2050 was based on the recommendations of the Climate Change Committee (CCC) set out in its report 'Net Zero - The UK's Contribution to Stopping Global Warming' (May 2019) (the 'CCC Report'). The CCC Report is clear that if this target is to be achieved, greenhouse gas emissions will need to be offset by schemes that are capable of sequestering large amounts of emissions. The CCC Report identifies CCUS as having a key role to play in mitigating greenhouse gas emissions.

3.4.3 The Executive Summary to the CCC Report (page 12) states that the net zero target cannot be met by simply adding mass removal of $CO_2$ onto existing plans associated with the previous target of an 80% reduction by 2050 compared to 1990 levels. It highlights that CCUS is crucial to the delivery of zero greenhouse gas emissions and that it is of strategic importance to the economy. However, it raises concern that CCUS has barely started in the UK, and that of the 43 large-scale CCUS projects operating in the World, none are in the UK.

3.4.4 The CCC Report is very clear that the remaining greenhouse gas emissions in the UK must be offset by removing $CO_2$ and permanently sequestering it through technologies such as CCUS. The important role of CCUS in capturing the $CO_2$ from non-renewable electricity production, industry and the production of hydrogen is also stressed (given the ambition to move to a hydrogen economy that is seen as critical to achieving net zero) (page 23). The scenarios considered involve the aggregate annual capture and storage of 75 - 175Mt $CO_2$ in 2050, which would require major $CO_2$ transport and storage infrastructure servicing at least five clusters. The CCC Report concludes that CCUS is a necessity for the UK, not an option.

## 3.5 Reducing UK emissions: 2020 Progress Report to Parliament (Committee for Climate Change, June 2020)

3.5.1 The CCC is an independent statutory body that was established under the Climate Change Act 2008. The purpose of the CCC is to advise the UK and devolved governments on emissions targets, and to report to Parliament on progress made in reducing greenhouse gas emissions and in preparing for and adapting to the impacts of climate change.

3.5.2 The CCC issued its latest progress report ‘Reducing UK emissions: 2020 Progress Report to Parliament’, in June 2020 (the ‘Progress Report’). The Progress Report (required under the Climate Change Act 2008) provides an annual review of UK progress in reducing greenhouse gas (GHG) emissions. This followed a May 2020 update published on the CCC’s website, which raised concerns over the UK’s ability to meet its fourth (2023 - 27) and fifth (2028 - 32) carbon budgets (despite these being set against the previous target of an 80% reduction in emissions by 2050) and stressed the need, given the more challenging net zero target, for progress on emissions reductions to be accelerated.

3.5.3 Much of the Progress Report focuses on providing advice to government on delivering a recovery from COVID-19 that both accelerates the transition to net zero and strengthens the UK’s resilience to the impacts of climate changes, whilst driving new economic activity. The Executive Summary (page 13) raises concern that over the past 12 months government has not made the policy progress that the CCC called for in 2019. It highlights the importance of the Energy White Paper (EWP), including measures to expand supplies of low-carbon power, encourage a resilient and flexible energy system, and provide enduring market mechanisms to drive investment in low-carbon industrial technologies and industrial sectors.

3.5.4 On page 18, the Executive Summary calls for the National Infrastructure Strategy to set a vision for infrastructure development over the next 30 years consistent with net zero and that important priorities should include *“hydrogen production and carbon storage infrastructure”*. It goes on to state that policy announcements have been piecemeal and slow. The Government has consulted on mechanisms to incentivise CCS and announced a £250m ‘Clean Steel Fund’:

*“However, coverage of these policies is far too narrow and progress has been too slow, as has delivery of the existing £600m capital funds for decarbonising manufacturing. There is still no strategic approach to drive change at the required scale and pace.” (page 19)*

*"A funding mechanism is needed for the operational costs of demonstration and early deployment of industrial electrification and hydrogen use as well as carbon capture and storage (CCS). Faster deployment of announced funds would support jobs, skills and the recovery, while enabling crucial progress on decarbonisation." (page 21)*

3.5.5 The Executive Summary sets out the CCC's recommendations by government department. Table 4 sets out recommendations for the Department of Business, Energy and Industrial Strategy (BEIS). In page 28 these cover CCS and include:

- Choosing a preferred funding model and mechanism for delivering $CO_2$ infrastructure – by 2020.
- Planning for carbon capture plant to be operational at multiple clusters – by the mid-2020s.
- Supporting business models for CCS designed for use in industry, electricity, and hydrogen production and GHG removals – by 2020/ongoing.

3.5.6 Table 4 (page 31) also recommends that BEIS delivers plans to decarbonise the power system and develops a strategy for low-carbon hydrogen use (across power, industry, transport and buildings), production and infrastructure, aiming for large scale hydrogen trials to begin in the early 2020s.

3.5.7 Chapter 1 of the Progress Report 'A review of the climate challenge after COVID-19' sets out 'Medium-term milestones' at Table 1.1 (pages 57 and 58) to be on track for net zero emissions, which include the following where there is a role for CCS:

*"Industry – $CO_2$ transport and storage infrastructure operational, and hydrogen available, at multiple industrial clusters by the mid-2020s.*

*"Hydrogen – … demonstrate that hydrogen production with CCS can be sufficiently low-carbon to play a significant role.*

*"Greenhouse gas removals – Initial deployment of engineered greenhouse gas removals (e.g. BECCS in power generation, hydrogen production, industry and/or aviation fuel production), driven by incentives and enabled by $CO_2$ infrastructure development."*

3.5.8 Chapter 2 'Progress since 2008' (page 68) highlights that while in the power sector there has been an increase in generation from low-carbon sources over the decade, deployment of CCS technologies as a means of decarbonising industry has remained limited. CCS (page 80) is seen as a key pillar in achieving net zero, and the Progress Report stresses that significant progress is required in the 2020s to get on track to meet the target by 2050. It goes onto state that CCS is yet to be developed at scale in the UK and that it must be a priority progress area for the 2020s.

3.5.9 Chapter 4 'Progress on emissions, indicators and policy in the last year' at Table 4.2 (pages 114 - 115) again highlights concerns over the lack of progress by the UK Government in terms of setting out a preferred mechanism for $CO_2$ transport and storage infrastructure and a plan to enable multiple CCS facilities to be operational by the mid-2020s. The Progress Report, however, welcomes (page 117) the commitment by the Government to the £800m CCS Infrastructure Fund to establish

CCS in at least two industrial clusters, as well as the £250m Clean Steel Fund adding to support of around £600m for industrial decarbonisation.

3.5.10 Chapter 5 'Planning a resilient recovery' (page 141) refers to how the CCC reconvened its Expert Advisory Group on the Costs and Benefits of net zero in May 2020 to consider the macroeconomics of the COVID-19 pandemic and the role of climate change measures in supporting a recovery. The Group was clear that climate change policy should play a central role in efforts to rebuild from COVID-19 and set out a range of short and long-term measures to achieve this. This includes a recommendation (page 142) that investments in low-carbon and climate adaption infrastructure are at the heart of measures to restore economic growth (page 142 - Box 5.4). In page 152 key priorities for infrastructure investments are identified as including:

*"… new hydrogen and carbon capture and storage (CCS) infrastructure which will be needed to support the next phase of the net-zero transition."*

3.5.11 Chapter 6 'What is needed now - UK climate policy' sets out the CCC's view on priorities for the UK Government in terms of achieving net zero. These include (page 167) showing clear leadership on CCUS and hydrogen with concrete and funded plans for deploying CCUS in the mid-2020s, and developing a strategy for low-carbon hydrogen production and use. Page 181 goes on to state that UK industry can be decarbonised to near-zero emissions without offshoring, and that government must implement an approach to incentivise industries to reduce emissions through energy and resource efficiency, fuel switching and CCS, amongst other measures.

3.5.12 The Progress Report set out a number of priorities for the EWP (page 184), including that:

*"<u>Carbon Capture and Storage is a necessity, not an option</u>, for the UK's net-zero objectives. Plans should be delivered for CCS to be operational at multiple industrial clusters from the mid-2020s, with ambition for scaling up infrastructure beyond this.*

*<u>Low-carbon hydrogen</u> is critical to achieving Net Zero, and needs to be deployed at scale during the 2020s. Given the potential of the fuel across multiple sectors, a cross-cutting vision and strategy for a hydrogen economy will be required from Government, with production and use starting from the early 2020s. Risk sharing mechanisms for the first users and producers of low-carbon hydrogen are likely to be required, in order to develop a market for low-carbon hydrogen."*

3.5.13 It is therefore clear that CCS/CCUS is at the heart of the CCC's priorities and recommendations for the Government. The Proposed Development is consistent with these priorities and recommendations as it will deliver the UK's first decarbonised industrial cluster on Teesside by the 2030s, whilst also ensuring the infrastructure is in place to support the production of low-carbon hydrogen.

## 3.6 The Ten Point Plan for a Green Industrial Revolution (HM Government, November 2020)

3.6.1 'The Ten Point Plan for a Green Industrial Revolution – Building back better, supporting green jobs, and accelerating out path to net zero', was published on 18

November 2020 and is aimed at delivering a 'Green Industrial Revolution' in the UK. The foreword by the Prime Minister states that the Ten Point Plan will aim to mobilise £12 billion of government investment, and potentially three times as much from the private sector, to create and support up to 250,000 green jobs.

3.6.2 The Introduction to the Ten Point Plan (pages 5 - 6) states that:

*"We will generate new clean power with offshore wind farms, nuclear plants and by investing up to half a billion pounds in new hydrogen technologies. We will use this energy to carrying on living our lives, running our cars, buses, trucks and trains, ships and planes, and heating our homes while keeping bills low. And to the extent that we still emit carbon, we will pioneer a new British industry dedicated to its capture and return to under the North Sea…"*

3.6.3 The 'Ten Points' of the Plan are summarised in page 7 of the document. Those of particular relevance to the Proposed Development are:

*"Point 2 – Driving the Growth of Low Carbon Hydrogen.*

*Point 8 – Investing in Carbon Capture, Usage and Storage (CCUS)."*

3.6.4 Point 2 'Driving the Growth of Low Carbon Hydrogen' is covered in pages 10 - 11 of the Ten Point Plan. It highlights how hydrogen could provide a clean source of fuel and heat for our homes, transport and industry and recognises the potential role of CCUS in hydrogen production (by capturing the $CO_2$ created when using natural gas to create hydrogen). It refers to an aspiration to create *"hubs"* where renewable energy, CCUS and hydrogen congregate that will put our industrial *"SuperPlaces"* at the forefront of technological development. It goes on to state that:

*"Producing low carbon hydrogen at scale will be made possible by carbon capture and storage infrastructure, and we plan to grow both of these new British industries side by side so our industrial 'SuperPlaces'* [Teesside is identified as a key location for green industries and technology] *are envied around the world."*

3.6.5 Point 8 'Investing in Carbon Capture, Usage and Storage (CCUS)' is dealt with in pages 22 - 23 of the Ten Point Plan. The Ten Point Plan states that CCUS will be an exciting new industry to capture the carbon we continue to emit and revitalise the birthplaces of the first Industrial Revolution. It states that the Government's ambition is to capture 10Mt of $CO_2$ a year by 2030, the equivalent of four million cars' worth of annual emissions. It goes on to set out the Government's commitment to invest up to £1 billion to support the establishment of CCUS in four industrial clusters, creating SuperPlaces in areas such as the North East, the Humber, North West, Scotland and Wales. The government will bring forward details in 2021 of a revenue mechanism to bring through private sector investment into industrial carbon capture and hydrogen projects via our new business models to support these projects.

3.6.6 The Ten Point Plan (page 24) highlights the function and necessity of CCUS in achieving a green economy and the Government's commitment to establish CCUS in two industrial clusters by the mid-2020s:

*"CCUS technology captures carbon dioxide from power generation, low carbon hydrogen production and industrial processes, storing it deep underground where it cannot enter the atmosphere. This technology will be globally necessary, but no one country has yet captured the market. The UK has an unrivalled asset – our North Sea, that can be used to store captured carbon under the seabed. Developing CCUS infrastructure will contribute to the economic transformation of the UK's industrial regions, enhancing the long-term competitiveness of UK industry in a global net zero economy. It will help decarbonise our most challenging sectors, provide low carbon power and a pathway to negative emissions. We will establish CCUS in two industrial clusters by mid 2020s, and aim for four of these sites by 2030, capturing up to 10 Mt of carbon dioxide per year. Developed alongside hydrogen, we can create these transformative "SuperPlaces" in areas such as the heart of the North East, the Humber, North West and in Scotland and Wales. Our £1 billion CCUS Infrastructure Fund will provide industry with the certainty required to deploy CCUS at pace and at scale. These clusters will be the starting point for a new carbon capture industry, which could support up to 50,000 jobs in the UK by 2030, including a sizeable export potential. Alongside this, we will bring forward details in 2021 of a revenue mechanism to bring through private sector investment in industrial carbon capture and hydrogen projects, to provide the certainty investors require."*

3.6.7 The Proposed Development will establish CCS within an industrial cluster on Teesside. It will not only capture $CO_2$ from industrial emitters and power generation but, as referred to above, will also support the future development of hydrogen production on Teesside. It will therefore support the delivery of Points 2 and 8 of the Ten Point Plan and the creation of the type of 'hub' or 'SuperPlace' envisaged by the Plan where renewable energy, CCUS and hydrogen technologies will congregate and generate significant numbers of jobs.

## 3.7 National Infrastructure Strategy: Fairer, faster, greener (HM Treasury, November 2020)

3.7.1 The National Infrastructure Strategy (the NIS) was published on 25 November 2020, only a week after the Prime Minister's Ten Point Plan. The NIS sets out the Government's plans to deliver an infrastructure revolution in the UK, while *"levelling the country up"* and achieving its net zero target by 2050. It also provides the Government's formal response to the National Infrastructure Commission's recommendations on infrastructure provision in their National Infrastructure Assessment (July 2018).

3.7.2 Chapter 2 'Levelling up the whole of the UK' (page 27) highlights how the Government wants to use infrastructure to unite and level up the UK by prioritising those areas that have received the least support in the past and to create 'regional powerhouses'. One of the measures identified to achieve this is backing new green growth clusters in traditional industrial areas such as Teesside, with investment in CCS, offshore wind, port infrastructure and low-carbon hydrogen production.

3.7.3 A key theme of the NIS is 'Decarbonising the economy and adapting to climate change' and this is dealt with in Chapter 3. The Government recognises (page 48) that new technologies and skills will need to be developed to continue decarbonising and that it will have a role to play in driving both the development and deployment of such technologies, including:

*"Carbon Capture and Storage to remove up to 90% of the carbon dioxide emissions from gas-fired power stations and industrial factories, including those making hydrogen, as well as to support greenhouse gas removal technologies to offset some emissions from the hardest to decarbonise sectors.*

*Investment in these areas, where the UK has competitive advantage, can create the knowledge and skills needed for a green industrial revolution, driving leadership in the industries of the future, reducing national and global emissions, as well as providing the platform for significant economic growth. Where these investments are brought together to create place-based industrial clusters they can transform local economies, creating productive jobs, developing specialist skillsets, and attracting private investment. For example, the North East of England could become a home of choice for companies delivering carbon capture and storage; making hydrogen power a part of daily life; and designing, building and maintaining offshore wind turbines."*

3.7.4 The future role of CCS in contributing to the net zero target is further underlined in Chapter 3 (pages 50 - 53). In terms of power, it is recognised that even by 2050- given the intermittent nature of renewables- there will still be a requirement for more reliable sources of power, from nuclear or power stations that burn hydrogen or gas with CCS. Power stations with CCS could provide valuable low carbon electricity when renewables are not generating, by capturing the emissions from biomass or gas-fired generation. CCS is also seen as essential to decarbonising large parts of industry, producing low carbon hydrogen and delivering GHG removal technologies that permanently store $CO_2$.

3.7.5 Importantly (page 53), the NIS recognises that CCS/CCUS technology has not yet been delivered at scale and that there is a key role for Government to play in bringing this forward. Consistent with the Ten Point Plan, it therefore sets out the Government's increased ambition to support CCS with £1 billion of funding (up from £800m) to bring forward four CCS clusters by the end of the decade, with construction to begin on two by the mid-2020s with the aim of capturing 10mtpa of $CO_2$ by 2030.

### 3.8 The Energy White Paper (HM Government, December 2020)

3.8.1 'The Energy White Paper – Powering our Net Zero Future' (EWP), was presented to Parliament in December 2020 and builds on the Prime Minister's Ten Point Plan. At the core of the EWP is the commitment to achieve net zero and tackle climate change. The EWP seeks to put in place a strategy for the wider energy system that transforms energy, supports a green recovery and creates a fair deal for consumers (page 4). As with the Ten Point Plan, the EWP confirms the Government's support for CCUS (drawing upon the resource provided by the North Sea) and new hydrogen technologies.

3.8.2 The Government estimates (Introduction, page 15) that the measures in the EWP could reduce emissions across power, industry and buildings by up to 230Mt $CO_2$ in the period to 2032 and enable further savings in other sectors such as transport. In doing so, these measures could support up to 220,000 jobs per year by 2030. These figures include the energy measures from the Ten Point Plan as well as additional measures set out in the EWP. However, the EWP recognises that more will need to be done to meet key milestones on the journey to net zero.

3.8.3 The EWP (pages 16 - 17) provides an overview of the Government's key policies and commitments to put the UK on the course to net zero. These are grouped under many headings, including 'Transform Energy', 'Support a Green Recovery from Covid-19' and 'Creating a Fair Deal for Consumers'. Those of particular relevance to the Proposed Development are:

***"TRANSFORM ENERGY***

*Supporting the deployment of CCUS in four industrial clusters including at least one power CCUS project, to be operational by 2030 and putting in place the commercial frameworks required to help stimulate the market to deliver a future pipeline of CCUS projects.*

***SUPPORT A GREEN RECOVERY FROM COVID-19***

*Increasing the ambition in our Industrial Clusters Mission four-fold, aiming to deliver four low-carbon clusters by 2030 and at least one fully net zero cluster by 2040.*

*Investing £1 billion up to 2025 to facilitate the deployment of CCUS in two industrial clusters by the mid-2020s, and a further two clusters by 2030, supporting our ambition to capture 10Mt per year by the end of the decade.*

*Working with industry, aiming to develop 5GW of low-carbon hydrogen production capacity by 2030."*

3.8.4 Chapter 2 of the EWP deals with 'Power' with the stated goal being to use electricity to enable the transition away from fossil fuels and decarbonise the economy cost-effectively by 2050. Figure 3.2 'Electricity demand, Net Zero scenarios' (page 42) highlights how electricity demand could double by 2050 as electricity replaces the use of petrol and diesel in transport, and to some extent, gas for heating. This would require a four-fold increase in clean electricity generation, with the decarbonisation of electricity being required to underpin the delivery of the net zero target.

3.8.5 Despite the push to increase clean electricity generation and decarbonise the power sector, the EWP states that the Government is not targeting a particular generation mix by 2050, and its view remains that the electricity market should determine the best solutions for very low emissions and reliable supply, at a low cost to consumers (page 42). While the EWP (page 43) states that a low-cost, net zero consistent system is likely to be composed predominantly of wind and solar, in order to ensure the system is reliable it needs to be complemented by technologies that can provide power, or reduce demand, when the wind is not blowing or the sun does not shine. This includes gas with CCS and short-term dispatchable generation, providing generating capacity which can be flexed as required.

3.8.6 Figure 3.4 of the EWP (page 44) details different potential electricity mixes to 2050, and, notably, gas with CCS is an important component of those mixes. Furthermore, linked to the commitment to support the deployment of at least one power CCUS project, the EWP (page 47) recognises that:

*"In the power sector, gas-fired generation with CCUS can provide flexible, low-carbon capacity to complement high levels of renewables. These characteristics mean that deployment of power CCUS projects will play a key role in the decarbonisation of the electricity system at low cost.*

*We will support at least one power CCUS plant to come forward and be operational by 2030 and will put in place a commercial framework which will enable developers to finance the construction and operation of a power CCUS plant and stimulate a pipeline of projects. This will enable at least one power CCUS project to be developed in one of the four industrial clusters as part of our mission to decarbonise them …"*

3.8.7 Chapter 3 'Energy System' of the EWP addresses 'The Role of Natural Gas' in a net zero world (page 84). It confirms that natural gas currently represents almost 30% of final energy consumption, and 40% of electricity generation (page 84), and notes that the UK will continue to rely on natural gas for some years, even as it works to largely eliminate carbon emissions from the energy system- including those from gas. It goes onto state:

*"We will therefore make sure the natural gas markets and networks evolve in a way which enables continued investment and ensure secure supplies but also promotes the use of low-carbon options, wherever possible. This will reduce emissions now and help build the networks of the future which will need to accommodate technologies such as hydrogen and Carbon Capture, Usage and Storage. We will need investment in the gas network to support the ambition set out in the Prime Minister's Ten Point Plan for a potential Hydrogen Town before the end of the decade."*

3.8.8 The challenge of decarbonising industry is covered in Chapter 5 'Industrial energy' of the EWP, in particular, the need for emissions from industry to fall by around 90% from today's levels by 2050 if the net zero target is to be met (page 118). The EWP (page 120) highlights how about half of all emissions from manufacturing and refining are concentrated in the UK's major industrial clusters (Figure 8.1). These *"hubs"* are seen as critical drivers of local and regional economic activity and a vital component of the UK's national economy. This includes Teesside with 3.9mtpa $CO_2$ emissions. It goes on to state (page 122):

*"Improved efficiency in the energy performance of buildings and industrial processes will lay the groundwork for the transformation of industrial energy. <u>But we cannot rely on energy efficiency alone to reduce emissions in line with our 2050 goal. Manufacturing industry will need to capture their carbon for onward storage and switch from using fossil fuels to low-carbon alternatives</u>."*

3.8.9 The actions identified by the EWP to decarbonise industrial emissions (page 124) include, in line with the Ten Point Plan, to increase the 'Industrial Clusters Mission' to support the delivery of four low-carbon clusters by 2030 and at least one fully net zero cluster by 2040. The EWP states that the Government will focus on the UK's industrial clusters:

*"… centres where related industries have congregated and can benefit from utilising shared clean energy infrastructure, such as CCUS and low-carbon hydrogen production and distribution. Decarbonisation in clusters will enable economies of scale, reducing the unit cost for each tonne of carbon abated, while clusters provide high quality jobs which tend to pay above the UK average wage."*

3.8.10 The EWP notes (page 124) that many clusters are located in regions in need of economic revitalisation, and that decarbonising those clusters can act as a driver of prosperity for the surrounding areas. Furthermore, that investments in key technologies like CCUS and hydrogen will be crucial to enhancing local economic growth and creating jobs and prosperity.

3.8.11 CCUS is dealt with in detail in pages 125 and 126. The EWP confirms that the deployment of CCUS is fundamental to the decarbonisation of energy-intensive industries such as steel, cement, oil refining and chemicals. It highlights the role of CCUS in helping secure the long-term future of these industries and enabling the production of low-carbon hydrogen at scale. It reaffirms the Government's commitment to invest £1 billion (up from the £800m promised in the CCS Infrastructure Fund) up to 2025 to facilitate the deployment of CCUS in two industrial clusters by the mid-2020s, and a further two clusters by 2030, supporting its ambition to capture 10mtpa of $CO_2$ emissions by the end of the decade. It stresses how the UK is in a strong position to become a global technology leader in CCUS, with the potential to store 78 billion tonnes of $CO_2$. Deployment of CCUS could create new markets for UK businesses, at home and abroad, as other countries look to meet their emissions reduction commitments and could support 50,000 jobs in the UK by 2030.

3.8.12 The important supporting role of CCUS in the production of clean hydrogen is underlined in pages 127 and 128 of the EWP.

3.8.13 The Proposed Development will help deliver key Government policies and commitments on CCS/CCUS and hydrogen set out in the EWP. It combines power with CCS at commercial scale, and with its industrial $CO_2$ gathering network, will provide the necessary infrastructure to make a low-carbon industrial cluster on Teesside a reality by the mid-2020s. The Proposed Development will also help create the right conditions to support the production of low-carbon hydrogen on Teesside and act as a driver for growth and jobs within the local and regional economy.

## 3.9 Industrial Decarbonisation Strategy (HM Government, March 2021)

3.9.1 The Industrial Decarbonisation Strategy (the 'IDS') is the first strategy published by a major economy that sets out how industry can be decarbonised in line with net zero, while remaining competitive and without pushing emissions abroad. It builds on the Ten Point Plan and sets out the Government's vision for a prosperous, low carbon UK industrial sector by 2050 and aims to provide industry with the long-term certainty it needs to invest in decarbonisation.

3.9.2 Ministerial Foreword (page 6) emphasises that the 2020s will be crucial to industrial decarbonisation, with the UK needing to deploy key technologies such as CCUS while beginning the journey of switching from fossil fuel combustion to low carbon alternatives such as hydrogen.

3.9.3 Chapter 1 'Why we need a strategy and our approach' sets out the Government's ambition for decarbonising industry in line with net zero. The expectation is that emissions will need to reduce by at least two-thirds by 2035 and by at least 90% by 2050, with 3 Mt $CO_2$ per annum captured through CCUS and a significant switching to low carbon fuels by 2030. Significantly, the IDS (page 18) recognises that government should play a key role in the delivery of large infrastructure projects for key technologies such as CCUS and hydrogen networks where there is a sharing of benefits and the risk or cost is too great for the private sector.

3.9.4 Chapter 2 'Getting investors to choose low carbon' confirms the Government's commitment (Action 2.2) to put in place funding mechanisms to support the deployment and use of CCUS and low carbon hydrogen infrastructure. It states that (pages 29-30):

*"CCUS will be crucial to reaching net zero, and low carbon hydrogen has the potential to play a key role in enabling the economic transformation of the UK's industrial regions. With both technologies at early stages of development, government will need to play an active role in overcoming market failures; sharing the risk and costs of scaling up deployment of both CCUS and low carbon hydrogen.*

*…. We have already committed to a £1 billion CCS Infrastructure Fund to provide industry with certainty to deploy CCUS at pace and scale, alongside a £240 million Net Zero Hydrogen Fund. Later in 2021 will bring forward further details of the revenue mechanism to support business models for both industrial carbon capture and low carbon hydrogen projects."*

3.9.5 Chapter 4 'Adopting low-regret technologies and building infrastructure' sets out support for the deployment of CCUS on industrial sites in clusters to capture and store around 3mtpa $CO_2$ by 2030 as well as increasing amounts of fuel switching to low carbon hydrogen during the 2020s. The aim (page 48) is by the mid-2020s that there will be two industrial clusters connected to CCUS infrastructure, with another two clusters by 2030, as well as low carbon fuels being tested and adopted across many industrial users.

3.9.6 Chapter 4 confirms (page 48) that the UK's six industrial clusters (Teesside alone accounts for 3.9mtpa of $CO_2$ - mainly from chemicals production), account for half of industrial emissions and are well placed for early deployment of low carbon infrastructure as costs and risk can be shared between multiple industrial sites. The aim (Action 4.1, page 51) is to support the deployment of CCUS on industrial sites in clusters to capture and store around 3mtpa of $CO_2$ by the mid-2020s and between 8 -14mtpa of $CO_2$ by 2050. Chapter 4 stresses that without CCUS, emissions from current industrial processes cannot be reduced to levels consistent with net zero. Reference is made to government planning for where and when infrastructure should be built, with the potential approach to this detailed in the CCUS Cluster Sequencing Consultation (February 2021). This sets out a potential two-phase process. The first phase would determine which cluster locations would be prioritised; the second phase would allocate CCUS programme support, including the

CCS Infrastructure Fund and revenue support, to individual projects within the clusters. The IDS confirms that this approach will be refined in response to consultation feedback.

3.9.7 With regard to fuel switching (Action 4.2, pages 51 and 52), Chapter 4 of the IDS confirms that the Government is committed to developing a low carbon hydrogen economy in the UK. The Government sees it as critical to demonstrate fuel switching to hydrogen in industrial sites in parallel to ramping up low carbon hydrogen production.

3.9.8 Chapter 6 'Accelerating innovation of low carbon technologies' recognises (Action 6.2, page 71) the need for government support to accelerate progress in demonstrating CCUS from a wide range of industrial sources.

3.9.9 Chapter 8 'Levelling up' (Action 8.1, page 84) highlights the significant potential, particularly across the UK's industrial clusters, to create new jobs through the deployment of low carbon infrastructure and technologies.

3.9.10 The Proposed Development clearly supports a number of the key actions set out in the IDS, not least to decarbonise one of the UK's industrial clusters and capture and store around 3mtpa of industrial $CO_2$ emissions by the mid-2020s, rising to between 8 - 14mtpa $CO_2$ by 2050.

## 3.10 North Sea Transition Deal (Department for Business, Energy & Industrial Strategy and OGUK, March 2021)

3.10.1 The North Sea Deal is a transformational sector deal for the offshore oil and gas sector in recognition of the key role that it can play in helping the UK meets its net zero commitments. The document recognises (Foreword, page 6) that with the declining output of hydrocarbons from the UK Continental Shelf (UKCS) and a projected decline in domestic demand, there is a clear need for determined action to be taken to build on the proven capabilities and skills within the existing sector to support the transition to net zero. It continues:

*"The UK already has the capability and skills within the existing sector to lead in new and emerging energy technologies such as Carbon Capture, Usage and Storage (CCUS) and the hydrogen economy as well as to support the growth of new sectors such as offshore wind.*

… *Delivering large-scale decarbonisation solutions will strengthen the position of the existing UK energy sector supply chain in a net zero world, securing new high-value jobs in the UK, supporting the development of regional economies and competing in clean energy export markets."*

3.10.2 The Executive Summary (page 8) states that the North Sea Deal is aimed a delivering on the commitments set out in the oil and gas chapter of the EWP and is closely aligned with the Prime Minister's Ten Point Plan. It does this through the implementation of several commitments and measures, including supporting up to 40,000 direct and indirect supply chain jobs in decarbonising UKCS production and the CCUS and hydrogen sectors.

3.10.3 The Deal is built on five key outcomes. These are seen as being closely interlinked, meaning that they must be delivered as an integrated whole for the Deal to achieve its full potential. These include:

- CCUS – a commitment to deploy two CCUS clusters by the mid-2020s and a further two by 2030. This commitment aims to unlock investment of £2-3 billion in CCUS transport and storage infrastructure from the sector to underpin the wider CCUS roll out. The sector's experience and capabilities offshore will enable efficiencies and cost reductions to be achieved as new CCUS projects are executed.
- Hydrogen – this is essential to meet the net zero commitment. The UK has unparalleled CCS sites that it can maximise to scale up low hydrogen production. The oil and gas sector is positioned to enable the production of low-carbon hydrogen at scale as part of a long-term competitive market, supporting the UK's ambition to deliver 5GW of low carbon hydrogen production capacity by 2030 and which would support up to 8,000 jobs.
- Supply chain transformation – the Deal will focus on supporting the transformation of the oil and gas supply chain to service low-carbon energy sectors. The UK's energy supply chain should be competitively positioned to seize the opportunities present by offshore electrification, CCUS and hydrogen both in the domestic market and internationally.
- People & skills – the Deal will support up to 40,000 high-quality direct and indirect supply chain jobs. Many of the skills present in the oil and gas sector are transferable across the wider energy sector. Offshore renewables, as well as the future CCUS and hydrogen industries, will rely heavily on many of the current skillsets in the oil and gas industry.

3.10.4 The Proposed Development clearly aligns with the commitments and intended outcomes of the North Sea Transition Deal. It is being promoted by a partnership of companies that have significant experience in the oil and gas sector, and who can draw upon their offshore capabilities and skills to deliver CCS/CCUS at scale in Teesside, which in turn would support the potential for low carbon hydrogen production in the area. The Proposed Development will therefore, consistent with the Deal, make a positive contribution to the transformation of the oil and gas sector.

## 3.11 Summary

3.11.1 Recent UK energy and climate change policy has established clear objectives for decarbonising the power and industrial sectors and the transformation of the oil and gas sector in order to achieve the Government's legally binding commitment to achieve net zero in terms of greenhouse gas emissions by 2050. This policy is both important and relevant to decision-making in respect of the Proposed Development.

3.11.2 It is evident from the Applicants' review of energy and climate change policy that the Government sees CCS/CCUS as playing a key role in delivering the commitment of net zero by 2050. In particular:

- The Government and the CCC have confirmed that new gas-fired generating capacity with CCS/CCUS will be required to provide vital backup for less flexible renewable generation to ensure the security of UK electricity supplies and that the system can meet peak electricity demand. The Government has also committed to support the delivery of at least one power CCUS plant by 2030.

- The deployment of CCS/CCUS technology is seen as fundamental to the decarbonisation of the UK's energy intensive heavy industries such as steel, cement, oil refining and chemicals and securing the long-term future of these industries within the wider economy. Teesside alone generates 3.9mtpa of $CO_2$ emissions, mostly from these industries.
- The Government has committed to invest £1 billion to facilitate the deployment of CCS/CCUS in two industrial clusters by the mid-2020s, and a further two clusters by 2030, to support its ambition to capture 10mtpa of $CO_2$ emissions by the end of the decade. Teesside, with its concentration of heavy industries, including chemicals and access to North Sea storage sites, is identified as one of the key potential locations for a decarbonised industrial cluster.
- There is Government support for the large-scale production of hydrogen for use in the power sector and for domestic heating, including a £240m fund. Gas reforming (the use of natural gas to manufacture hydrogen) is likely to be the cheapest source of hydrogen, at least initially, compared to electrolysis. Pairing gas reforming with CCS/CCUS is critical to delivering low carbon hydrogen production.
- The Government is supporting the transformation of the oil and gas sector through the development of technologies such as CCS/CCUS and low carbon hydrogen production. These technologies will be able to draw upon the proven capabilities and skills within the oil and sector, its existing infrastructure and private investment potential, thereby helping to support its supply chain and skilled workforce.

3.11.3 The Proposed Development will contribute toward the delivery of key energy and climate change policy objectives – most importantly net zero by 2050. It includes a high-efficiency gas-fired electricity generating station with CCS/CCUS at a commercial scale, while the $CO_2$ gathering network and other $CO_2$ infrastructure would underpin the establishment of a decarbonised industrial cluster on Teesside by the mid-2020s. This will not only facilitate the decarbonisation of existing heavy industries in the area, capturing 4mtpa of $CO_2$ with the opportunity to increase this to 10mtpa of $CO_2$ in the future, but also providing the enabling infrastructure to support the potential for future large-scale production of low carbon hydrogen, acting as a driver for growth and jobs within the local and regional economy. Furthermore, it would make a very positive contribution to the transformation of the oil and gas sector.

3.11.4 The Proposed Development is clearly in accordance with current and emerging UK energy and climate change policy and this should be afforded significant weight in the determination of the DCO Application.

# 4.0 THE NEED FOR NEW LOW CARBON MID-MERIT (DISPATCHABLE ON DEMAND) ELECTRICITY GENERATING CAPACITY

4.1.1 Energy, including electricity, is vital to economic prosperity and social well-being, and as such, it is important that the UK retains secure and affordable electricity resources to guarantee uninterrupted delivery of power to the UK consumer. Mid-merit generating capacity adjusts to respond to fluctuating demand throughout the day.

4.1.2 By 2050, it is forecast that electricity could provide over half of final energy demand, as it displaces petrol and diesel in cars and light vehicles, and gas for heat in homes. This means that electricity demand will likely double from today's 346TWh[6] to 594TWh (or greater) by 2050[7] in order to reach net zero in the UK.

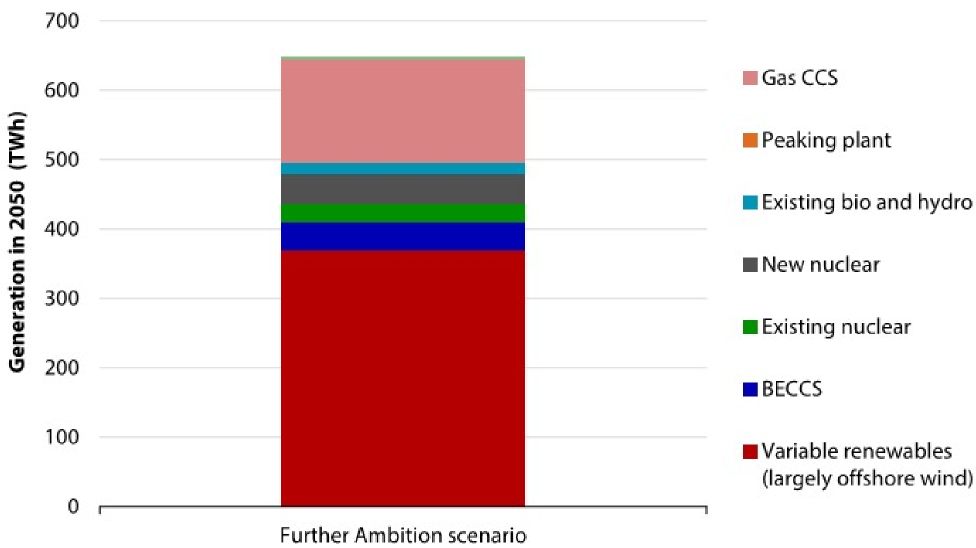
4.1.3 The UK continues to make significant progress in reducing electricity demand through efficiency measures, but this alone will not be enough to eradicate the need for new capacity[8] [9]. In addition, the majority of the UK's 9GW of nuclear power plants are set to retire by the early 2030s.

4.1.4 To make the expected contribution toward net zero emissions reduction goals, new electricity generation capacity must be low carbon. This is widely expected to be a mix of nuclear, renewables and CCS/CCUS equipped gas or biomass thermal power stations, as shown in a CCC scenario in

4.1.5 .

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904805/DUKES_2020_Chapter_5.pdf
[7] https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-Technical-report-CCC.pdf
[8] https://www.nationalgrideso.com/document/173821/download
[9] https://www.carbonbrief.org/guest-post-energy-efficiency-contributed-25-percent-of-uk-economic-growth-since-1971

**Figure 4.1: Illustrative generation mix for a low carbon power system in 2050[10]**




4.1.6 In 2017, 52% of UK electricity was generated from low-carbon sources, including 21% from nuclear power, 19% from variable renewable sources such as wind and solar, 9% was supplied by bioenergy and 2% from hydro power[11]. There are no CCS equipped thermal power stations in the UK at present so the current contribution of this technology to the electricity supply is zero. The government has ambitious targets to significantly expand low carbon generation's contribution further, including a target of 40 GW of offshore wind by 2030[12].

4.1.7 The demand for electricity must be simultaneously, exactly, and continuously, matched by supply. Consequently, electricity generation capacity connected to the system is continuously and actively managed by the 'System Operator', National Grid. A safety margin of spare capacity is required to accommodate both predictable annual and daily demand variation, and also unforeseen fluctuations in supply or demand (for example, those caused by the weather). Balancing supply and demand will become more challenging, and hence more costly, as the proportion of renewables on the grid continues to rise for a number of reasons:

- Most renewable generation is intermittent, generating electricity only when the wind blows or the sun shines[13], with seasonal fluctuations that are unrelated to demand. For example, wind turbines do not generate at very low wind speeds

---

[10] Figure 2.5, https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-Technical-report-CCC.pdf
[11] Page 23, https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-Technical-report-CCC.pdf
[12] https://www.gov.uk/government/news/new-plans-to-make-uk-world-leader-in-green-energy#:~:text=The%20UK%20has%20the%20largest,build%20back%20greener%20from%20coronavirus.
[13] Page 72, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

(when insufficient energy is transferred) or very high wind speeds (to reduce the risk of damage to the wind turbine).

- Nuclear capacity typically runs 'baseload' - it cannot readily be used to balance supply and demand. Turning nuclear power stations on and off or varying their output significantly may take several days for operational safety reasons.
- Nuclear and renewables are capital intensive installations with low marginal operating costs. There are limited operational cost savings to electricity generators if these assets reduce their generation; they simply lose out on the revenue required to recoup their investments. Consequently, when the System Operator asks for renewables or nuclear capacity to curtail their generation, the request typically incurs additional costs to consumers.
- The costs of transporting energy and managing the balance between supply and demand currently make up around 25% of an average household's energy bill[14].
- As we move towards a cleaner energy mix, the electricity system will comprise a more complex series of functions that it will need to discharge while keeping costs affordable to the consumer. Novel energy storage technologies show promising cost reductions, but many have yet to be demonstrated at scale[15]. These storage technologies typically work over hours or days, rather than the weekly and seasonal variations that are currently managed mainly through dispatchable gas-fired power generation.

4.1.8 The electricity generation system currently relies on the use of flexible generating capacity that can actively manage its output to instantaneously match supply with demand. This flexible capacity is typically referred to as 'mid-merit' and is actively managed to compensate for the inflexibility of 'baseload' capacity and 'intermittent' capacity. Further information is provided below:

- Mid-merit generating capacity adjusts to respond to fluctuating demand throughout the day[16]. Its generation capacity runs at a lower 'load factor' (annual output expressed as a percentage of maximum theoretical output) than 'baseload' capacity. Mid-merit generating capacity needs to absorb the total variability of demand net of both 'baseload' (typically nuclear) output and the variable output of renewables.
- Consequently, demand profiles for mid-merit generating capacity are highly variable with generating plant required to ramp up and down rapidly, turn down to a small proportion of rated capacity to provide 'spinning reserve' and may be turned off completely over 100 times a year. It provides "dispatchable" generating

[14] https://www.ofgem.gov.uk/data-portal/breakdown-electricity-bill data correct as of August 2020
[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/910261/storage-costs-technical-assumptions-2018.pdf
[16] https://blog.ucsusa.org/joseph-daniel/coal-is-no-longer-a-baseload-resource-so-why-run-plants-all-year

capacity that can be rapidly asked by the System Operator to adjust output to stabilise the electricity grid.

- Currently, mid-merit operation is largely provided by Combined Cycle Gas Turbine (CCGT) power stations, which can be turned down to a small proportion of their rated capacity to rapidly vary their output. They can also be safely started up and shut down, sometimes more than once a day.
- CCGTs are typically less capital intensive per GW of installed capacity than nuclear or renewables but incur significant marginal costs (e.g. for the natural gas fuel) per GWh generated. Consequently, turning off or down a CCGT saves the generating plant owner significant expenditure and so is less likely to incur a cost to the System Operator and hence the consumer.

4.1.9 Alongside the need to build additional low-carbon capacity, a particular challenge for the power sector is the decarbonisation of mid-merit generation.

4.1.10 Mid-merit generation will be critical to meet the net zero target and interim carbon budgets, whilst ensuring that there is always sufficient supply to meet demand[17].

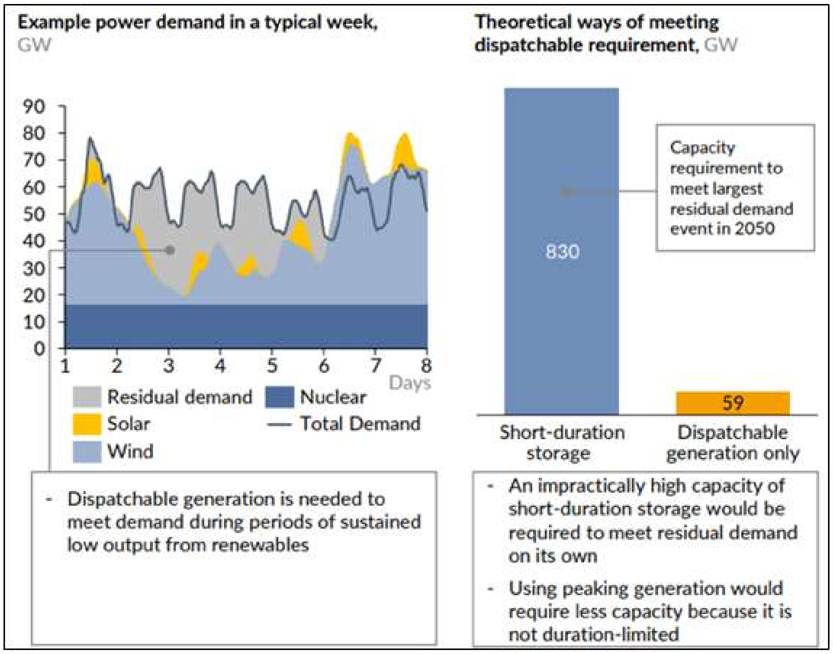
4.1.11 The two most commonly proposed solutions to grid flexibility in a deeply decarbonised future are either:

- mid-merit plant equipped with CCS; or
- large scale electricity/energy storage.

4.1.12 Aurora research predicts that, by 2050, to secure continued reliable electricity supply there could be a requirement for up to 59GW of dispatchable generation, or otherwise the UK could require 8.3TWhrs of short-term storage capacity (such as batteries) to achieve the same level of reliable electricity supply. The need for additional supply is demonstrated in Error! Reference source not found. below - see the grey shading in the left-hand diagram, with the right-hand diagram showing the difference between how this could be fulfilled by short-duration storage (blue bar) or dispatchable generation (orange bar)[18].

[17] https://www.nationalgrideso.com/document/173821/download
[18] https://stateraenergy.co.uk/wp-content/uploads/2019/10/20191024-Aurora-Statera-Gas-recips-v14.pdf

**Figure 4.2: The need for dispatchable power**[19]




4.1.13 The Energy Research Partnership (ERP) estimated[20] that to decarbonise the GB grid without using mid-merit CCGTs with CCS would require in the order of 1TWhr of energy storage (10GW operating for ~100 hours) to meet weekly variability. The UK's current energy storage capacity (dominated by pumped storage) is approximately ~4GW[21].

- Novel energy storage technologies show promising cost reductions, but many have yet to be demonstrated at scale. These storage technologies typically work over hours or days, rather than the weekly and seasonal variations that are currently managed mainly through mid-merit gas-fired power generation.
- Whilst the market for short term "demand-side response" and pumped hydro energy storage are established in the UK electricity system, there is no current market mechanism designed to support inter-seasonal energy storage.
- An approach is needed to manage the operation of the system, which is flexible and responsive, aligned to the demands of a net zero future and cost-effective to the consumer.
- In future scenarios that include the electrification of heat (rather than fuel switching to blue hydrogen produced with CCS) to replace natural gas-fired space heating, reliably supplying peak domestic heat demand of 170GW via inter-

[19] https://stateraenergy.co.uk/wp-content/uploads/2019/10/20191024-Aurora-Statera-Gas-recips-v14.pdf
[20] https://erpuk.org/wp-content/uploads/2014/10/52990-ERP-Energy-Storage-Report-v3.pdf
21 https://www.regen.co.uk/wp-content/uploads/ESN-Pathways-to-a-Net-Zero-Future.pdf

seasonal storage would be a significant challenge. Natural gas for domestic space heating consumes around 350TWhrs annually, mostly in the colder half of the year. Meeting this demand with stored electricity would require electricity to be stored efficiently in enormous newbuild capacity storage for months, to time-shift demand from summer to winter.

4.1.14 Decarbonising 'mid-merit' CCGT generation will require the deployment of carbon capture and storage technology to capture emissions from natural gas-fired CCGTs, or blue hydrogen production facilities. This is considered further in the following section.

# 5.0 THE ROLE OF GAS WITH CCS TO PROVIDE MID-MERIT ELECTRICITY GENERATING CAPACITY

5.1.1 CCGT electricity generating stations had a total UK installed generating capacity of 31.5GW in 2019. CCGTs accounted for 40.4% of generation capacity in 2019, representing the largest share in the UK, and representing an increase of their share from 2018[22].

5.1.2 CCGTs have the capability to start-up rapidly, thus being able to respond to peaks in electricity demand and fluctuations in supply. CCGTs therefore make a crucial contribution toward system operability and the security of national energy supply, providing much needed firm capacity to the UK's existing generation fleet.

5.1.3 It is estimated that emissions from generating stations accounted for 16.3% of the UK's total $CO_2$ emissions in 2019[23], with the CCGT generating stations emitting ~45Mte $CO_2$.

5.1.4 Adding carbon capture to CCGT generation would allow for over 90% of the $CO_2$ in the flue gas to be captured and sequestered (significantly reducing the $CO_2$ emissions), all whilst maintaining a CCGT's ability to respond to supply and demand fluctuations.

- CCGT generation with CCS can provide flexible, low-carbon capacity to complement high levels of renewables which mean that, according to the Energy White Paper (EWP), December 2020, *"deployment of power CCUS projects will play a key role in the decarbonisation of the electricity system at low cost"* [24].
- The objective of NZT is to deliver a First-of-a-Kind (FOAK) integrated flexible CCGT and CCS concept to provide between 750 MW and 860 MW of low carbon dispatchable power in support of decarbonising the UK grid. This adds dependable low-carbon thermal power to the GB power grid, complementing - but not competing with - other low carbon electricity sources such as intermittent renewables or baseload nuclear.

5.1.5 CCGT with CCS can play an important role in reducing the carbon intensity of the overall future energy mix of the UK. If all GB CCGTs were replaced with CCGTs with CCS, the carbon abatement potential is ~40Mte $CO_2$ per year. **Figure 5.1** (below) shows that increases in gas with CCS (from zero currently) in dark blue complements a large expansion of varied renewables generation, to bring the net carbon intensity of generation down to zero by 2050.

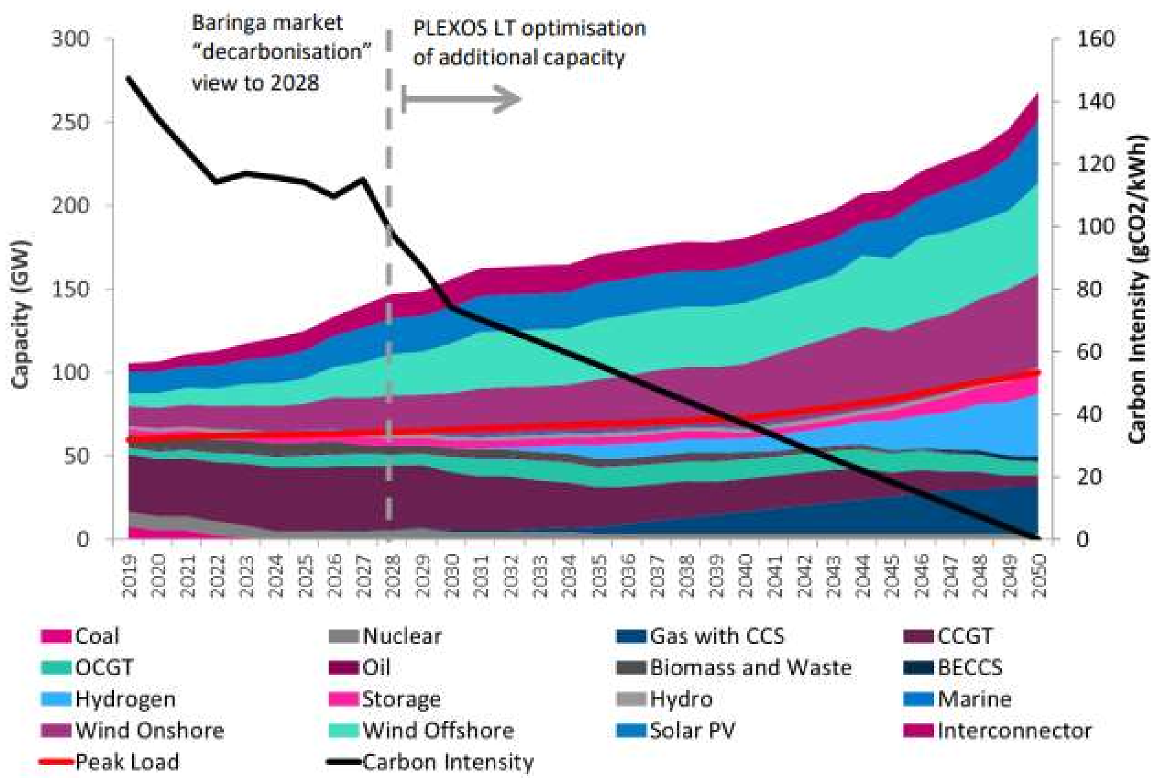
---

22 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904805/DUKES_2020_Chapter_5.pdf

23 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/875485/2019_UK_greenhouse_gas_emissions_provisional_figures_statistical_release.pdf

24 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

**Figure 5.1: Base case capacity mix evolution**[25]




- Gas power with CCS has been estimated as being capable of reducing the overall UK power system cost to consumers by £19 billion by 2050. This compares favourably to the alternative options of building out other more expensive technologies such as nuclear power, hydrogen, and the 'overbuild' of renewables combined with battery storage[26].
- Even considering a range of potential power market scenarios through to 2050, adding gas with CCS substantially reduces the overall cost of every perceived eventuality (refer to Error! Reference source not found.**.2** below).

[25] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/System_Value_to_UK_Power_Market_of_Carbon_Capture_and_Storage_June20.pdf
[26] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/System_Value_to_UK_Power_Market_of_Carbon_Capture_and_Storage_June20.pdf

**Figure 5.2: Extract Results of System Value of Gas with CCS[27]**

| Core scenarios and spot sensitivities | System value in 2030 (£/MWh) | System value in 2040 (£/MWh) | System value in 2050 (£/MWh) |
|---|---|---|---|
| Base_Case | -9 | -17 | -20 |
| HG_HN_HF | 37 | 1 | -16 |
| HG_HN_LF | 8 | -7 | -20 |
| HG_LN_HF | -4 | -15 | -20 |
| HG_LN_LF | 11 | -14 | -20 |
| LG_HN_HF | -13 | -18 | -18 |
| LG_HN_LF | -14 | -17 | -17 |
| LG_LN_HF | -14 | -19 | -20 |
| LG_LN_LF | -16 | -19 | -19 |

***Negative value indicates a benefit to the system from CCS***

- NZT forecast a deployment of between 15-39 GW of CCGTs with CCS, based upon sensitivities on gas price, nuclear favourability, and levels of system flexibility.
- The overall value enhancement rises to £47 billion when the benefits associated with CCS enabled Blue Hydrogen and Bioenergy with CCS (BECCS) are included[28].
- These estimates are in line with the BEIS forecast outlined in their recently published analytical report[29].
- Other independent studies have concluded that the most socially equitable energy system transition includes gas with CCS as a core technology[30].

5.1.6 Flexible gas power with CCS is a vital power decarbonisation technology, enabling cross-economy decarbonisation and increased deployment of intermittent renewables.

5.1.7 In addition to maintaining supply, CCGT (and other forms of thermal power) provide an important service to the grid via the provision of spinning inertia which is crucial for maintaining adequate frequency response.

5.1.8 Frequency response is a term describing the various means that the System Operator uses to manage the system frequency of the grid, typically acting within a few seconds.

5.1.9 It is important to maintain system frequency at 50Hz (+-1%) to provide a safe and reliable electrical supply to users of electricity. Frequency is a continuously changing variable that is determined and controlled by the second-by-second (real-time)

[27] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/System_Value_to_UK_Power_Market_of_Carbon_Capture_and_Storage_June20.pdf
[28] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/System_Value_to_UK_Power_Market_of_Carbon_Capture_and_Storage_June20.pdf
[29] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/943714/Modelling-2050-Electricity-System-Analysis.pdf
[30] https://www.sciencedirect.com/science/article/abs/pii/S2542435120303287

balance between system demand and total generation. If demand is greater than generation the frequency falls, while if generation is greater than demand, the frequency rises[31].

5.1.10 Intermittent renewable generators connect "asynchronously" to the grid and store little kinetic energy, providing limited inertia to the electricity system. Whereas a gas turbine has large mass and rotates very fast, storing significant kinetic energy in the rotating equipment and providing essential stabilising inertia to the electricity system.

- If a CCGT does go offline there is still inertia or kinetic energy stored in the turbine, and therefore the generation output drops off relatively slowly. The result is that the grid generation provided by CCGT does not instantly cease, and thus the grid does not experience an instant drop in frequency which could result in multiple trips - or interruptions of supply - for users.
- This provides the System Operator time to actively manage the system by asking another dispatchable generator - typically another mid-merit CCGT - to provide frequency response services and increase output to compensate.
- As an example of the consequences of a fall in the system frequency; on the 9th August 2019 a lightning strike on the National Electricity Transmission system initiated a sequence of events that resulted in interruptions to over 1 million consumers' electricity supply[32]. As a result of a combined loss of generation, the system frequency fell off rapidly which in turn caused a large volume of distributed generation to disconnect from the system, compounding the reduced generation supply.

5.1.11 CCGTs can provide dependable mid-merit power generation with spinning inertia much more competitively than many alternative technologies.

5.1.12 As renewable generation (particularly wind farms) are intermittent in nature, it is necessary to ensure that there is infrastructure in place that can respond to fluctuations in supply. CCGT generating stations are well suited to this, having the capability to start up rapidly, thus being able to respond to peaks in electricity demand and fluctuations in supply. A CCGT generating station at the Site would therefore make a positive contribution toward the security of the national energy supply and provide much needed firm capacity to the UK's existing generation fleet.

5.1.13 The Proposed Development, which combines CCGT with CCS, has specifically been designed to retain the flexibility of a conventional mid-merit plant. It has been designed to accommodate:

- Capacity providing "spinning reserve" ready to ramp-up as required by the System Operator.

[31] https://www.nationalgrideso.com/industry-information/balancing-services/frequency-response-services
[32] https://www.ofgem.gov.uk/system/files/docs/2020/01/9_august_2019_power_outage_report.pdf

- Between 2 - 5 average number of starts per week, and between 100 - 350 starts per year. Up to 6,000 starts over the 25-year period (depending on the dispatch profile).
- Frequency response.

5.1.14 Low carbon power generation also provides an anchor to enable investment in infrastructure and the capture of carbon emissions from existing third-party industrial sources, discussed in the next chapter.

# 6.0 THE ROLE OF CCS IN REACHING NET ZERO

6.1.1 The net zero pathway in the UK depends on decarbonisation beyond just the power sector. CCS/CCUS is a technology that can support decarbonisation across multiple sectors, all of which are significant contributors to the UK's total carbon emissions:

- Power - Providing low carbon mid-merit generation capacity, that supports and complements an increasing proportion of renewables in the national generation mix.
- Industry - Provides infrastructure to capture emissions at source, and thus support their long-term competitiveness. For industrial emitters, there are few credible decarbonisation options - beyond CCS or fuel switching to clean hydrogen- that will enable energy-intensive industries such as steel, cement, glass, and fertiliser production to continue to operate in a net zero economy.
- Heating - CCS infrastructure also enables the production of blue hydrogen which can be used to decarbonise heating.
- Transportation - By supporting the further decarbonisation of the grid that powers electric vehicles and electrified rail, plus enabling the production of blue hydrogen that may support decarbonised freight and shipping, CCS supports the decarbonisation of both light and heavy transport.

6.1.2 As set out in Section 3, the deployment of CCS/CCUS at a commercial scale is a priority for UK energy and climate change policy and critical to efforts to tackle climate change over the coming decades, as follows:

- CCS/CCUS makes a positive contribution to mitigating greenhouse gas emissions, given that the technology can capture more than 90% of the $CO_2$ produced by the combustion process.
- It is widely recognised that there will be substantially lower delivery costs to meet carbon reduction targets with CCS/CCUS technology as part of the energy infrastructure mix.
- CCS/CCUS is identified as crucial to decarbonising the UK's industrial clusters and retaining their competitiveness.
- The Proposed Development would represent the first major step of deploying commercial-scale CCS in the UK.

6.1.3 CCS/CCUS will form a critical backbone of industrial decarbonisation, as outlined in the Industrial Clusters Mission[33], which aims to establish the World's first net-zero carbon industrial cluster by 2040 and at least one low-carbon cluster by 2030. The

[33] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/803086/industrial-clusters-mission-infographic-2019.pdf

Proposed Development is well aligned with the ambitions outlined in the Industrial Clusters Mission, by:

- Deploying large-scale low-carbon infrastructure in the mid-2020s (pipelines, capture facilities and compression installation 2024-26).
- Supporting cross-sector industrial decarbonisation during the 2030s.
- Attracting private-sector match funding, to enable significant future project capital for onshore infrastructure investment.
- Supporting the safeguarding of 35 - 70% of existing manufacturing jobs in Teesside, with an annual gross benefit of up to £450m and up to 5,500 direct jobs[34]. It would support the regional transition to net zero plus a growing low-carbon UK CCS domestic industry potentially worth £1.6 billion in direct GVA, and 18,000 jobs annually by 2030.
- Developing local skills and engineering capability in low-carbon technology, enabling further national and global investment.
- Accelerating cost-effective decarbonisation through established supply-chain relationships, deploying novel low-carbon technologies, and creating a mature, repeatable, and standardised design, which together would place the UK at the forefront of the global shift to clean growth.
- Supporting the development of the CCS business models and mobilising the market, whilst drawing upon the UK's expertise in the public sector (BEIS and HMT), Universities and local communities.

6.1.4 The Project will support the emerging CCS sector within the UK, which has the potential to deliver substantial benefits for the UK economy in terms of exporting CCS expertise and services to other countries in future.

6.1.5 CCS/CCUS can play a significant role in achieving decarbonisation of the UK economy both at least cost and whilst maintaining the security of supply.

[34] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/20200508_NZT_Economic_Benefits_Report_Edited_Clean_web.pdf

# 7.0 THE DESIGN AND SCALE OF THE PROPOSED DEVELOPMENT

7.1.1 The Proposed Development will enable the UK's first decarbonised industrial cluster as early as 2030 in line with the ICM, designing the necessary low-carbon infrastructure required to enable large scale decarbonisation of current and future industries.

7.1.2 The Proposed Development will support the UK's industrial strategy by helping otherwise hard to abate carbon-intensive industries in Teesside to decarbonise, which will allow them to continue operating whilst significantly reducing their carbon footprint. As already mentioned, it is estimated that the Proposed Development could support and safeguard between 35% and 70% of existing manufacturing jobs in Tees Valley[35]. It is considered that the potential for otherwise hard to abate industries to connect to the network will help to attract new business and investment in low carbon industries to the region, from both the UK and across the world.

7.1.3 Captured $CO_2$ will be collected via an onshore pipeline gathering network that includes multiple tie-in points for current and future industries. The Proposed Development will also ensure that individual components are scalable and replicable, to maximise opportunities for learning and cost reduction.

- The power element includes one CCGT train and one carbon capture unit, but with tie-in points and adjacent land area that could enable rapid deployment of two additional units utilising the same designs.
- The gathering network is designed to allow expansion to further emissions sources through targeted pipeline capacity oversizing, and with modular compression facilities that can be expanded cost-effectively by copy to serve the entire cluster. This will be done through pre-engineering and targeted pre-investment during the project design stages.

7.1.4 The chosen scale of the Proposed Development:

- will make a meaningful contribution to climate change objectives;
- will make a more meaningful contribution to system operability objectives and ensuring the security of supply;
- is optimised for economic and electrical efficiency, for example, the larger H class turbines have a lower cost per installed capacity when compared to a smaller F class turbine. Reflecting the economies of scale that come from a larger size.

7.1.5 Learnings from NZT will support future regional low-carbon projects and deployment of CCS/CCUS at scale across the UK during the 2030s.

7.1.6 National deployment of CCS/CCUS, which the Proposed Development will be a catalyst for promoting, could support £1.6 billion in direct GVA and up to 18,000

[35] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/20200508_NZT_Economic_Benefits_Report_Edited_Clean_web.pdf

direct jobs by 2030 and position UK firms to win further CCS/CCUS contracts internationally[36]. The skills, labour and expertise developed through NZT will enable the UK to export low carbon technologies as showcased in the UK's low carbon toolkit[37]

7.1.7 NZT has fed into the UK government's Green Jobs Task Force, as part of a wider bp submission, and will work with multiple partners to develop and deliver an action plan for green jobs. NZT will also continue to seek targeted interventions to reduce the local labour shortfall and skills gap in consultation with TVCA and other local stakeholders, to devise a long-term action plan and build local skills through specialised vocational training.

7.1.8 By coordinating development with the neighbouring NEP project, which will provide an offshore pipeline system and >1,000Mt of potential North Sea storage capacity, NZT connects local industry with many decades of carbon storage capacity.

7.1.9 NEP which links both NZT and ZCH to a joint store, will allow decarbonisation of nearly 50% of the UK's total industrial cluster emissions, enabling clean hydrogen production and creating a pathway for growth.

[36] https://www.netzeroteesside.co.uk/wp-content/uploads/2020/06/20200508_NZT_Economic_Benefits_Report_Edited_Clean_web.pdf
[37] https://www.gov.uk/government/publications/low-carbon-export-toolkit

# 8.0 LOCATION OF THE PROPOSED DEVELOPMENT

8.1.1 With the potential to store more than 78 billion tonnes of $CO_2$, the UK[38] has excellent access to $CO_2$ storage in the North Sea.

8.1.2 The UK is in a strong position to become a global technology leader in CCS/CCUS. It has the opportunity to develop a domestic supply chain by utilising the expertise of the existing oil and gas industry.[39]

8.1.3 Teesside is a prime location to demonstrate CCS/CCUS at a commercial scale, for a variety of reasons:

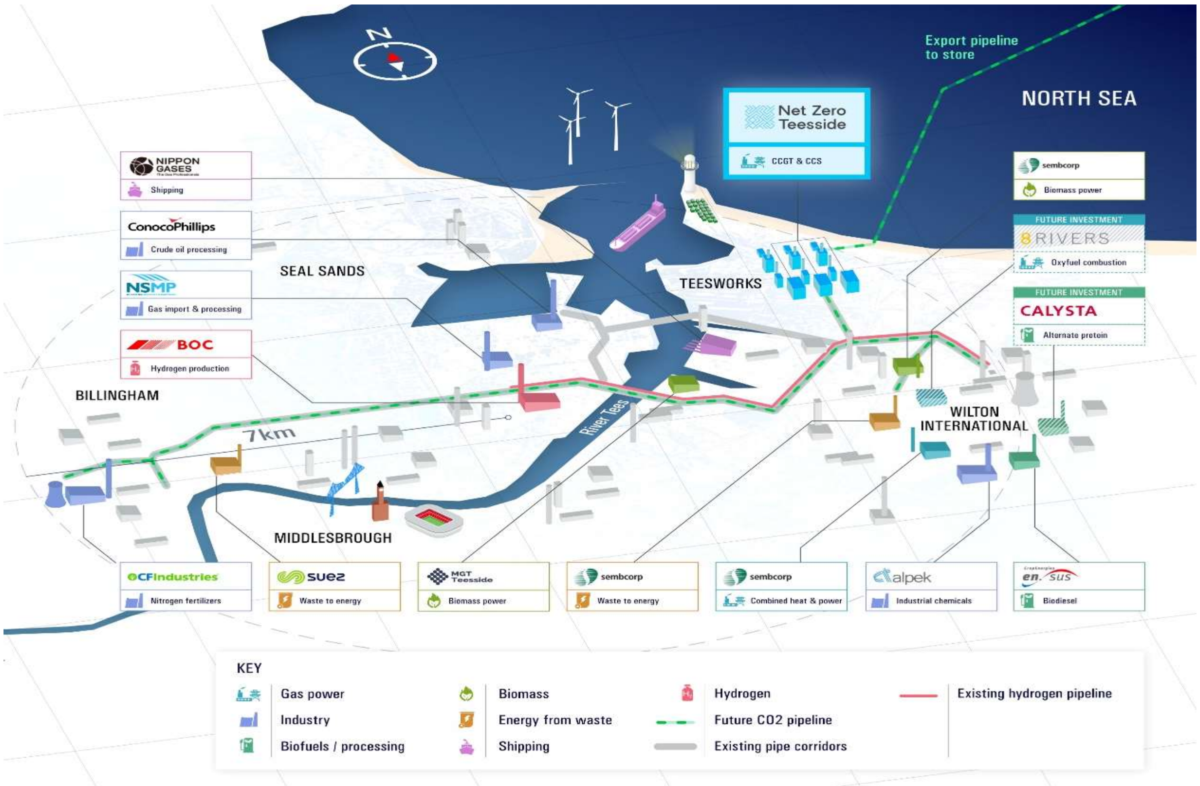
- As identified in the Industrial Decarbonisation Strategy[40] as one of the six main industrial clusters, Teesside industries account for 5.6% of industrial emissions in the UK and the area is home to five of the top 25 $CO_2$ emitters.
- The existing concentration of heavy industries in a compact cluster means that captured $CO_2$ can be gathered and transported to the storage sites relatively easily and at low cost.
- The use of existing pipeline corridors where possible also minimises the footprint of the infrastructure required to deploy the CCS network.
- The area benefits from existing experience in handling and transporting hydrogen and $CO_2$ and therefore has a distinct capability advantage. In combination with the use of existing pipeline corridors, the capital cost and execution predictability will be advantageous.
- The Site will maximise available grid capacity versus alternative development options; the proximity and availability of gas, electrical, and water utility connections mean it is an appropriate location, with less construction scope and cost (ultimately a saving that will be passed down to consumers), and with reduced construction impacts.
- There are multiple industries in close proximity (see **Figure 8.1** below), including those operated or managed by CF, BOC, Suez, MGT, Ensus, Sembcorp, Alpek, Conoco Philips and North Sea Midstream Partners which together form the most compact industrial cluster in the UK. This makes the construction and operation of a $CO_2$ pipeline gathering network much more cost-effective due to the shorter distances involved.

[38] https://www.eti.co.uk/library/taking-stock-of-uk-co2-storage

[39] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

[40] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970229/Industrial_Decarbonisation_Strategy_March_2021.pdf

**Figure 8.1: Cluster of industries on Teesside with potential to link into NZT**




- CF Fertilizers produces pure $CO_2$ as a by-product of their production, with a very low cost of capture, provided a $CO_2$ transportation and storage network is made available as proposed by the NZT project.
- BOC produces over 50% of the UK's industrial hydrogen that entails the by-product of concentrated $CO_2$, which if captured through the NZT $CO_2$ network, would enable the production of clean 'Blue Hydrogen'. With spare capacity in the plant, a ramp-up of production would enable the option of fuel switching for certain industries in Teesside, as another decarbonisation option.
- The completed project can increase its utilisation, and expand further upon its infrastructure, in future developments to connect additional sources of emissions. Together the Teesside industries constitute approximately 3mtpa of recordable industrial emissions.
- Future expansion also has the opportunity to connect to and make local biomass and energy from waste power generation net negative in carbon emissions; with their processes ultimately removing carbon from the atmosphere and NZT sequestering them. $CO_2$ capture from bioenergy emitters, such as MGT and several other energy from waste plants, enables a potential world-first large-scale Bioenergy with Carbon Capture and Storage (BECCS) in Teesside through the NZT $CO_2$ network. By connecting them, a further 3mtpa of industrial emissions could be eliminated.

- The compact nature of the Teesside industrial cluster, plus the strategic industries contained therein, thus provide the perfect canvas on which to pilot carbon capture, blue hydrogen, BECCS and dispatchable low carbon power to complement renewables at scale, all enabled by the $CO_2$ transportation and storage network proposed by NZT.
- Teesside has several existing industrial parks which could attract new business entrants to build upon an initial infrastructure investment.
- Teesside benefits from close access to Manufacturers (OEMs), Engineering Procurement and Construction (EPC) contractors, Universities, Research Institutes, and other clusters which will support enhanced execution performance.

8.1.4 The Site is uniquely well positioned to deliver essential energy infrastructure with limited environmental impact:

- The Site comprises previously developed land and situated in an industrial setting with few immediate receptors;
- The existing grid and transport infrastructure mean less construction work than might otherwise be required;
- Re-use of pipeline corridors where possible mitigates the potential impact of building through non-purposed land.

8.1.5 NZT intends to be the catalyst for expanding $CO_2$ capture into other industries within Teesside, with a clear path to achieve net negative emissions (sequestering more $CO_2$ than reported, using BECCS for example) before 2040. The Proposed Development has the potential to attract new industry keen to take advantage of the onshore T&S system and green products market.

# 9.0 THE EXPERIENCE OF THE PARTNERSHIPS

9.1.1 The Partnerships benefit from significant access to expertise in the field of power and carbon capture. Relevant experience is set out below:

- bp operated the In Salah CCUS in Algeria and developed the concept of the first UK Peterhead demonstration project.
- ENI operate multiple power projects and are partners in other CCS projects.
- Shell contributes a wealth of CCUS project and operational experience through leading the previous Peterhead UK CCUS demonstration project and operating demonstration projects such as Quest in Canada.
- Equinor lead the Northern Lights project and are currently Europe's only CCUS commercial operator with the Sleipner and Snøhvit facilities in the North Sea.
- Total are partners in multiple UK and international CCUS projects.
- National Grid Ventures operate the current UK onshore pipeline transmission system and advanced the Yorkshire and Humber CCS pipeline to support the White Rose UK CCS demonstration project.

9.1.2 The Partnerships are highly experienced in designing, building, and operating large-scale complex major projects and are best placed to support the delivery of the UK's first significant step forward in CCUS. The Proposed Development can utilise bp's Major Projects common process (MPcp), which:

- spans the entire lifecycle of a project in a stage-gate approach from concept development to operation;
- defines the requirements at each gate, driving standardization and promoting integrated multi-disciplinary team working, and;
- ensures a rigorous verification process is implemented at each gate to drive successful project delivery.

9.1.3 The Partnerships have extensive experience managing supply chains, with subcontractors held to delivery and quality requirements through a detailed approach, including the following:

- building the required fundamentals pre-contract award through robust pre-qualification and competitive bidding processes, including evaluation of contractor execution plans, proven track-record executing similar projects at scale and availability of resources;
- effective post-award contract management through clear communication on scope, schedule and other key obligations, along with rigorous performance monitoring against the contract requirements and agreed KPIs;
- employment of a Quality Manager as part of the organisation; and
- implementation of Non-conformance and Management of Change (MoC) procedures.

9.1.4 The procurement approach will seek to maximise local capability and use appropriate contract and integration models to drive value, leveraging existing agreements where appropriate, and bp's experience executing large-scale, complex projects.

- Value will be optimised using a bias for competitive tendering, commercial mechanisms to allocate risk appropriately, and longer-term incentive mechanisms.
- NZT will engage with the market early, including robust technology pre-qualifications and transparent assessment against pre-agreed criteria.
- The approach will seek supplier-led solutions to identify areas to unlock differential value for NZT and the UK.

9.1.5 The Partnerships will deploy experienced personnel who have previously developed and operated gas processing facilities, pipeline networks, power stations and industrial facilities around the world.

9.1.6 The Partnerships will also have access to subject matter experts to address knowledge gaps, with the partnership representing a high proportion of global CCUS expertise which will be actively deployed into the team (already evidenced through partner secondees from ENI, Total and Equinor within the bp led team). This is important because:

- cost to Government and ultimately consumers is kept down;
- it offers excellent risk management (a cost, safety, and environmental benefit);
- it promotes a high likelihood of successful delivery to NZT's schedule and budget;
- therefore there is a high chance of success in achieving NZT's benefits (see earlier sections).

9.1.7 NZT will also share knowledge, to ensure lessons learnt and best practice are shared and adopted across UK and international projects.

# 10.0 CONCLUSIONS

10.1.1 UK Government policies are clear in their support for CCS/CCUS as a contributing solution to achieving net zero emissions nationally, and acknowledge its role in supporting power and industrial decarbonisation, including supporting emerging industries such as hydrogen production.

10.1.2 Teesside is one of the industrial clusters highlighted in the Industrial Decarbonisation Strategy for its concentration of industry, and with a need for CCS/CCUS to decarbonise. NZT will fulfil the strategies goal of developing a low-carbon industrial cluster by 2030, as well as supporting the development of a UK CCS/CCUS industry.

10.1.3 Under high renewable generation future scenarios, overall electrical grid stability is more challenging and costly to maintain, so dispatchable low carbon generating capacity will be required. NZT includes a CCGT with CCS/CCUS, that is designed to be operated as a mid-merit dispatchable plant. It will provide a competitive and low carbon contribution to a reliable decarbonised national generation mix.

10.1.4 NZT's proposed CCS facility can support the decarbonisation of power generation, local industry, transport, and heating.

10.1.5 NZT will revitalise brownfield land and is in close proximity to a large variety of existing industry. The infrastructure provided by NZT enables the decarbonisation of these existing industries, supporting their future competitiveness, and attracting new investment locally. There is significant potential for the NZT facilities to be further expanded to connect additional emissions sources in future.

10.1.6 The NZT Partnerships are highly experienced, with significant relevant expertise in CCS/CCUS, power, and major projects delivery. Their combined skill sets and processes will support the safe and successful delivery of the UK's first decarbonised industrial cluster as early as 2030.