STRATEGIC SPATIAL PLANNING FOR LOW CARBON INDUSTRIAL CLUSTERS

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EXECUTIVE SUMMARY

The UK is committed to achieving Net Zero by 2050. Industrial Decarbonisation, Hydrogen and carbon capture, utilisation, and storage (CCUS) are important pillars to achieving Net Zero. The Environment Agency's Environmental Capacity Project investigates challenges to deploying carbon capture and hydrogen production to decarbonise three existing industrial clusters in the areas around Teesside, Humberside and the North West of England.

Clustering of projects around these existing industrial clusters provides substantial economies of scope and scale that improve overall carbon saving, cost-effectiveness, supply chains, economic benefits and resilience. The scale up of some carbon capture and hydrogen projects may have significant local impacts. Existing processes support sequential decision making around individual projects, but do not readily manage in a holistic way, the likely cumulative impacts on local resources that might be expected should all the future hydrogen and carbon capture projects in a cluster reach fruition. Further projects are frequently in competition for the same funding streams which may reduce the potential for a coordinated approach that might be better at identifying and mitigating risks earlier in decision making. This could reduce the risks that later projects find it difficult to secure environmental permits if the environmental capacity headroom is reached by earlier projects.

The previous three phases of the Environmental Capacity in Industrial Clusters Project recommended investigating if current approaches to *planning* for industrial clusters could be improved. Phase 4 of the project includes this short study to consider how strategic spatial planning can help industrial cluster decarbonisation better align with environmental capacity limits in these clusters. The approach taken is to:

- Review elements of planning and the extent to which local plans and other planning tools have been used to support the delivery of low-carbon industrial clusters.
- Review concepts and tools for strategic spatial planning, examining practices from other sectors and countries.
- Identify options for how strategic spatial planning could be applied to facilitate low carbon industrial clusters.

By analysing planning documents, stakeholder feedback, and case studies, the report highlights how improved coordination, proactive environmental assessments, and integrated planning frameworks can support low-carbon technology deployment, and safeguard natural resources. The focus is on identifying measures that promote sustainable development while balancing economic growth with environmental protection.

Local planning frameworks across the Teesside, Humber, and HyNet clusters broadly support industrial decarbonisation and the transition to a low-carbon economy. However, these frameworks seldom reference hydrogen, Carbon Capture, Utilisation and Storage technologies, low-carbon industrial clusters, and their associated environmental capacity constraints explicitly. Feedback received through stakeholder engagement highlighted a general awareness and often support for industrial cluster development from local authorities, particularly in established clusters like Teesside and Humber, which benefit from a history of collaboration. However, stakeholders across all three clusters – Teesside, Humber, and HyNet – reported that planning and permitting are frequently handled on a project-by-project basis, hindering the assessment of cumulative environmental impacts. Resource constraints within local authorities and a lack of specific planning regulations for technologies like CCS were also identified as challenges.

Concerns regarding the cumulative environmental impact of staggered project development were consistently raised, with stakeholders noting uncertainties around water abstraction limits, nutrient pollution, and air quality thresholds. There was a perceived lack of understanding within local authorities regarding the environmental impacts of new low-carbon technologies, such as amine-based carbon capture. To address these issues, stakeholders suggested the need for better coordination, clearer centralised guidance, and more proactive strategic planning at the cluster level, including Strategic Environmental Assessments to allocate environmental headroom and avoid displacing future projects. Effective stakeholder engagement was deemed crucial for building trust and streamlining project approvals through early and continuous involvement, transparent communication, and addressing local concerns proactively.

Subsequently, and with input from case studies in other sectors and countries, a number of good practices in planning for low carbon industrial clusters were identified:

- Effective stakeholder and regulatory engagement between project developers and public bodies is crucial for the success of complex infrastructure projects.
- Establishing Strategic Cluster Plans has been helpful for coordinating decarbonisation efforts across the UK's industrial clusters, ensuring that local planning and national strategies align with industry needs to support a coherent and investment-ready low-carbon future.
- Utilising integrated planning tools, such as Supplementary Planning Documents (SPD)s, Area Action Plans (AAPs) and centralised Development Corporations, created a robust framework for industrial transformation.

Finally, a number of potential ways forward were also identified:

- Strategic spatial plans could be developed for each cluster, aligning cluster-wide infrastructure, land use and environmental considerations.
- Scenario based analysis could be employed within the cluster plans to account for market uncertainties and evaluate different potential development pathways within the cluster.
- Cross-consideration between cluster-level spatial plans and local and national level policy priorities and planning could occur. The cluster-level spatial plans can therefore consider the objectives of local planning policy. Local planning policy documents, such as Local Plans, Area Actions Plans and SPDs, can also be updated to account for the cluster-level spatial plans, ensuring that priorities align and environmental capacity is considered.
- A focus should be made on addressing environmental impacts, including cumulative environmental impacts, within industrial cluster developments. The development of spatial plans for industrial clusters should include the requirement for SEAs of planned developments, including a stronger focus on cumulative environmental impacts.
- Developing and maintaining a registry of designated clusters and related projects could improve transparency and assist local authorities, statutory consultees, and developers. Such a resource may highlight interconnectedness of industrial cluster decarbonisation projects with each other.
- Development Corporations should be considered as a highly effective governance and delivery model for coordinating complex cluster planning and implementation. New Development Corporations could consolidate planning powers, secure dedicated funding streams, and enable accelerated delivery of critical infrastructure such as CCUS networks, hydrogen production hubs, and associated utilities. Development Corporations could integrate cluster-level spatial plans into their core mandates, ensuring that environmental constraints and cumulative impacts are addressed from the outset.

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ABBREVIATIONS

Abbreviation	Definition
AAP	Area Action Plans
BECCS	Bioenergy with Carbon Capture and Storage
BNG	Biodiversity Net Gain
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilisation, and Storage
CHP	Combined Heat and Power
CIA	Cumulative Impact Assessment
CO_2	Carbon Dioxide
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
DLUHC	Department for Levelling Up, Housing and Communities
EIA	Environmental Impact Assessment
EN	Energy Policy Statement
FCC	Fluid Catalytic Cracker
FEED	Front-End Engineering Design
LCR	Liverpool City Region
LDF	Local Development Framework
MWe	Megawatts electric
NEWID	North East Wales Industrial Decarbonisation plan
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
PCC	Post-Combustion Carbon Capture
SDS	Strategic Spatial Development Strategy
SEA	Strategic Environmental Assessment
SPD	Supplementary Planning Document
SPA	Special Protection Area
STDC	South Tees Development Corporation
TVCA	Tees Valley Combined Authority

1. BACKGROUND AND CONTEXT

Low and zero carbon technologies such as carbon capture and hydrogen are a vital part of the UK's ambition to achieve net zero and limit the effects of climate change. The benefits and cost-effectiveness of carbon capture and hydrogen in decarbonising heavy industry and the wider energy system are maximised through a cluster-based approach that enables multiple sites to be decarbonised, with connecting transport infrastructure to enable transport of CO_2 and H_2 between emitters and storage sites. Scaling up these technologies is necessary to reduce the emissions of greenhouse gases, mostly notably carbon dioxide, however, may require risks to the environment and public health to be managed in a more strategic way. The previous UK Government set targets to establish at least four low carbon clusters by 2030 and the world's first net zero cluster by 2040. Teesside and HyNet, clusters in North East and North West England respectively, were assigned "Track 1" status. In the 2024 Autumn Budget, the Chancellor committed up to £22 billion investment to support associated CCUS and hydrogen deployment for Track 1 projects[1,2]. It is essential that benefits are maximised and risks are minimised for cluster-based developments.

The Environment Agency (EA) plays an important role in enabling society to meet emissions targets through regulation and advice in leading sectors, including industry, water, waste and agriculture. There is an important role for the EA in advising Local Planning Authorities on their decisions on new developments for matters within the EA remit, such as flood risk, water resources, and water quality. The EA also works with other stakeholders to share thinking about how low and zero carbon technologies and approaches may need to be regulated, and the evidence needed to do this.

This report represents an element of the work completed under the fourth phase of the EA's Environmental Capacity project. This project has explored challenges in managing the overall environmental capacity of decarbonisation projects in industrial clusters. Earlier phases of this project have highlighted environmental capacity risks, for example those associated with water and air quality. A recommendation from the previous phases was to study the opportunities from cluster-based planning to support strategic management of risks and maximise environmental benefits. An overview of the key findings of the Environmental Capacity project can be found in Table 0-1 below.

[1] GREAT BRITAIN. Department for Business, Energy & Industrial Strategy, 2019. *The Grand Challenge Missions* [Withdrawn] [online]. London: UK Government. Available from: https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/missions#clean-growth [Accessed 10 March 2025].

[2] GREAT BRITAIN. HM Treasury, 2024. *Autumn Budget 2024* [online]. London: UK Government. Available from: [Accessed 10 March 2025].

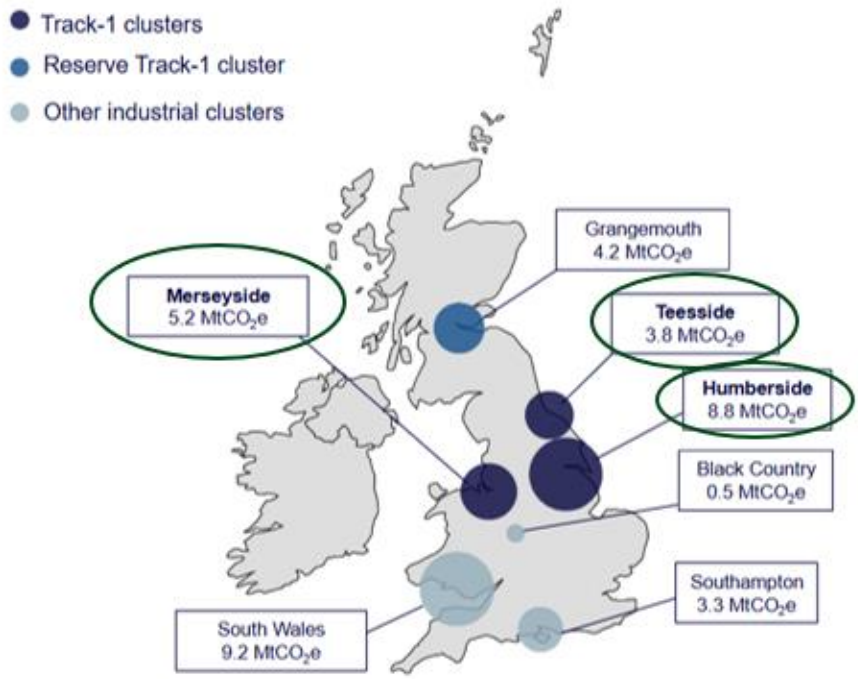
Table 0-1. Summary of findings from previous phases of the Environmental Capacity project

HUMBER	TEESSIDE	HYNET
• Water availability is a key challenge • Existing habitat protection designations, water quality and quantity concerns are already challenging environmental permit provision in some locations • There is a large flood risk – industry must ensure projects are resilient to current and future flood risk • Nitrogen nutrient deposition from reduced air quality is already impacting designated habitats • Unmitigated development risks are worsening local impacts, including further habitat degradation • Pollutants that will be the main challenge to developments are nitrous oxides (NOX), ammonia and PM10 alongside current ambient levels.	• Existing water quality concerns could challenge permitting additional discharges in a changing climate • Current habitat designations could affect development • Development could remediate historic contamination but must avoid mobilising contaminants • Additional treatment will need to be installed to meet stricter nitrogen nutrient loading limits • Groundwater availability may be affected in a changing climate due to significant reduction in summer recharge rates • There will be a need for reinvestment in water transfer infrastructure • Industry must share realistic estimates of their water needs	• Surface and groundwater availability may be a limiting factor for development around the south-west of the HyNet industrial cluster • Uncertainty exists around wastewater discharges from low carbon technology and the potential thermal, toxicological and ecological impacts around catchments in the region. (This is a risk regardless of whether wastewater discharges are direct to surface water receptors or indirect via the wastewater treatment network). • The need for a sustainable supply of water and the capacity for wastewater treatment needs to also consider innovative reuse options for wastewater • Pollutants that will be the main challenge to developments are nitrous oxides (NOX), ammonia and PM10. • Critical loads for nitrogen deposition are exceeded in some ecological receptors, raising concerns about cumulative environmental impacts.

GENERAL
• Low carbon technologies have the potential to emit previously unmonitored pollutants which may lead to air quality impacts – developers need actual baseline monitoring. • Current practice around the disclosure of emissions is likely to lead to a delay in capture plant operation. • Later deployments of low carbon technology may face more significant challenges when combined impacts with earlier projects are taken into consideration. • Industry needs to improve their understanding and response to environmental impacts of residual emissions from hydrogen and carbon capture. Understanding the cumulative impact of nitrogen dioxide emissions from hydrogen production and use on human health and habitats, as well as the impact of heat discharges from cooling processes on river and estuarine ecology and habitats. • Industry must also forecast future climate conditions and build resilience into their plant designs. • There is still a crucial role for industry to work together and to exchange information with the aim of developing combined plans and processes and to understand environmental capacity for industrial clusters. Information exchange with industry should include government agencies, local authorities, and utility companies. • Environmental permitting and water resource licensing takes a case-by-case, first come first served approach which will favour ‘first movers’ but might take up environmental capacity for later entrants, restricting deployment of new technology and limiting growth. • Much of the focus in spatial planning is on housing delivery and major infrastructure. The industrial zone is generally not subject to the same level of detailed spatial planning or strategic environmental assessment.

Considering the concerns raised in the first three phases of the Environmental Capacity project, this fourth phase of research reviews potential mitigation opportunities for industrial clusters through the planning system. An overview of the largest industrial clusters in the UK by carbon emissions are outlined in Figure 0-1 below, with the clusters of relevance to this study circled.

Figure 0-1. UK industrial clusters[3]



Hydrogen and CCUS project developers in these clusters apply for a wide range of authorisations, often independently of each other. Planning and environmental permit applications must satisfy regulators that potential environmental impacts have been considered, assessed and risks appropriately mitigated, across a wide range of scenarios.

The research for this project focused on planning for the development of hydrogen and carbon capture in industrial clusters around Teesside, HyNet (North West) and Humberside. These industrial clusters contain a diverse range of energy and manufacturing industries. Importantly, alongside decarbonisation strategies including efficiency, electrification and bioenergy, projects involving hydrogen and carbon capture infrastructure are well developed and seen by many as critical to enabling these regions to compete in a low carbon future and grow the local economy.

1.1 STUDY OBJECTIVES

This work aims to support the UK Government's Clean Power 2030 Action Plan and broader Net Zero Strategy to facilitate the successful development of low carbon industrial clusters that are environmentally sustainable. A key conclusion from previous phases of this work is that a study of 'cluster-scale' planning is needed to understand how this can support the long-term vision for low carbon industrial clusters. This specific phase of the work (phase 4) therefore aims to also highlight the opportunities within planning tools that could help inform a more strategic approach to cluster-based planning.

[3] **UK GOVERNMENT, 2024.** *CCUS Net Zero Investment Roadmap: Capturing Carbon and a Global Opportunity* [online]. Available from: https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-net-zero-investment-roadmap/ccus-net-zero-investment-roadmap-capturing-carbon-and-a-global-opportunity [Accessed 12 March 2025].

Specific aims of this study therefore include:

- To establish the extent to which local plans and other planning tools have been used to support the delivery of low-carbon industrial clusters in a strategic way.
- To identify how strategic spatial planning could work for industrial clusters, identifying how this might be delivered, setting out potential challenges, opportunities and benefits.
- To determine potential ways forward for how strategic planning and associated tools could work better to facilitate the delivery of industrial clusters.

1.1.1 Structure of this report

This report is organised as follows:

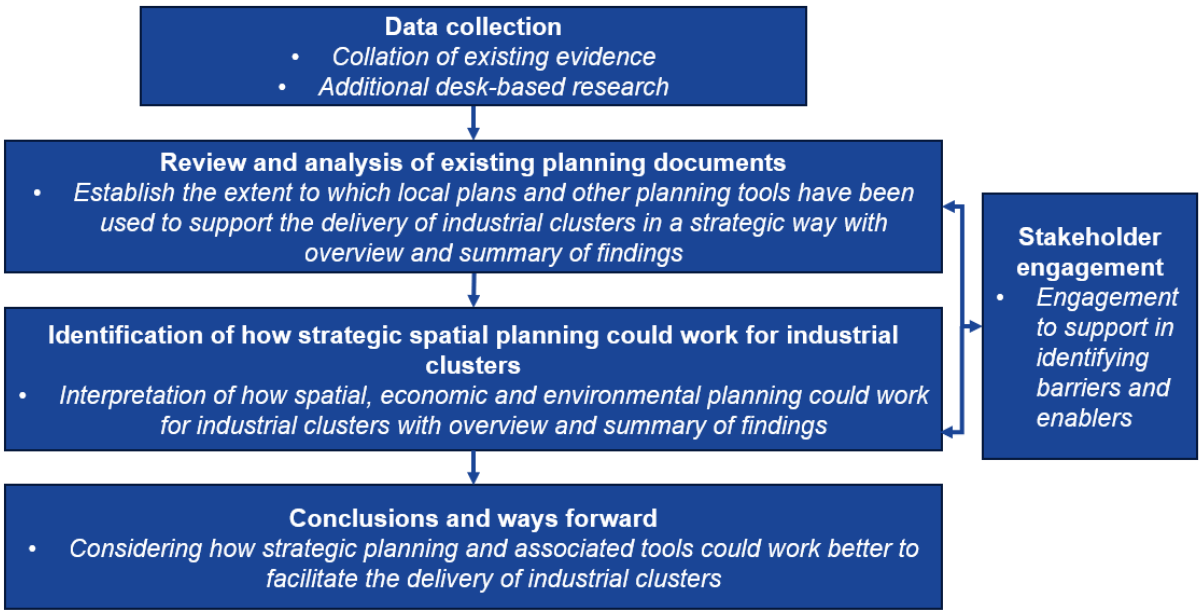
- **Section 2** provides an overview of the project methodology, covering the overall approach and details of the literature review and stakeholder engagement
- **Section 3** provides an overview of HyNet, Humber and Teesside Industrial Clusters
- **Section 4** provides an overview of the planning process in the UK
- **Section 5** provides an overview of the key findings within the HyNet, Humber and Teesside Industrial Clusters:
    - Identified through the literature review and stakeholder engagement
    - Case studies for each of these three clusters, identifying the planning routes taken, environmental capacity and barriers and enablers
- **Section 6** provides further details on the evidence review, covering:
    - An overview of Strategic Spatial Planning
    - Case studies from other countries and sectors detailing how Strategic Spatial Planning has been utilised
- **Section 7** details good practices identified in Strategic Spatial Planning in Industrial Clusters and potential ways forward
- **Section 8** provides the overall conclusions
- **Appendices**, highlighting further background on the stakeholder engagement, further details on planning in England and Wales, and Strategic Environmental Assessments

2. STUDY METHODOLOGY

2.1 OVERVIEW

The overall approach to this study is represented in Figure 2-1 below.

Figure 2-1. Overall project approach



2.2 LITERATURE REVIEW

For the literature review, evidence was gathered through a review of publicly available information. The literature review was broken down into the following key parts:

1. UK Industrial Clusters

A background literature review was undertaken for each of the three clusters, covering:

- Geographic regions within the cluster
- Relevant planning authorities for geographic regions within the cluster
- An overview of the existing facilities (e.g. industry, power generation)
- Low carbon technology and infrastructure plans (e.g. hydrogen, CCUS)
- Specific projects and their status
- Key stakeholders and partnerships
- Industrial cluster plans, funded by UK Research & Innovation

Additionally, an overview of the associated infrastructure for the low carbon technologies was also conducted, hence the literature review also covered:

- Documents identifying associated infrastructure (e.g. wastewater, water supply, waste disposal) required by industrial clusters from site based up to cluster level
- CCS and H_2 projects, including CO_2 and H_2 pipelines

2. Planning processes in the UK

A structured background literature review was undertaken to provide an overview of the UK's planning processes. Drawing on primary legislation, policy documents, and authoritative guidance (e.g., National Policy Statements (NPS), the National Planning Policy Framework, and Planning Policy Wales). The review explored how planning operates at three hierarchical levels —national, regional, and local. Specifically, the review was broken down as follows:

- National Level: examined the key policies and frameworks guiding planning at a national scale, including the legislation underpinning Nationally Significant Infrastructure Projects (NSIPs) and overarching policy documents (such as NPS and the NPPF).
- Regional Level: explored the roles of combined authorities, Metro Mayors, and other mechanisms past and present—such as Regional Spatial Strategies[4] and the Duty to Cooperate—that coordinate development objectives across multiple local authority areas.
- Local level: investigated how local planning authorities develop Local Plans and supplementary guidance, manage planning applications and engage communities. This includes the interplay with environmental permitting requirements, and infrastructure funding mechanisms.

The three-tiered approach allows for an understanding of how planning decisions are shaped by both top-down national policies and bottom-up local needs, highlighting the procedures, responsibilities, and legislative context at each governance level.

3. Planning for Industrial Clusters

This part of the literature review aimed to collect and review relevant planning documentation for local authorities relevant to the clusters. Key types of literature included:

- Local planning documents (spatial, economic, environmental, industrial) and documents related to wider suites of planning tools (supplementary plans, sustainability appraisals)
    - When reviewing Local Authority specific documentation, the key aim was to determine if and how local planning policy considered the industrial clusters, or prioritised industrial development in the geographies that make up the industrial clusters. Where this was considered, the environmental evidence base was then reviewed to determine how environmental capacity has been assessed.
- Existing planning and permitting applications for net zero technologies infrastructure in industrial clusters
    - Three case studies were undertaken, aiming to understand the planning routes taken, environmental capacity and barriers and enablers

4. Strategic Spatial Planning

This part of the literature review aimed to collate information on:

- The benefits and approaches to strategic spatial planning
- Lessons learnt from other sectors, undertaken through case studies

2.3 STAKEHOLDER ENGAGEMENT

Effective stakeholder engagement was essential to assess current planning practices and identify opportunities to strengthen planning for industrial cluster development. Although the engagement timeframe was limited, focus was on stakeholders with direct experience in and active involvement with planning for industrial cluster projects, including the EA, local and combined authorities, project developers, and research institutes.

Further details on the approach to stakeholder engagement can be found in Appendix 1. Feedback from stakeholder interviews were coalesced and incorporated into the analyses in Sections 5.1.2, 5.2.2, 5.3.2, and 5.5.1.

[4] Regional Spatial Strategies were abolished by the Localism Act 2011, and although the Duty to Cooperate is still active, there is provision in the Levelling Up and Regeneration Act 2023 to replace it.

3. OVERVIEW OF TEESSIDE, HUMBERSIDE AND NORTH WEST INDUSTRIAL CLUSTERS

This section provides an overview of UK industrial clusters, with a focus on the three clusters of interest in this study, namely Teesside, Humberside and HyNet (North West) industrial clusters, and associated infrastructure.

UK Industrial Clusters

Industrial clusters in the UK are particularly important for decarbonisation efforts and economic development. They are regional concentrations of energy-intensive industries, power generation, and gas storage sites, representing major employment hubs and contributing significantly to regional economies and UK exports.

Clusters in the UK produce a large proportion of industrial carbon emissions, making them crucial targets for reaching Net-Zero goals. Their concentrated nature allows for shared decarbonisation infrastructure such as carbon capture networks and hydrogen production and transport, and collaborative approaches within these clusters can significantly reduce costs through economies of scale.

UK Cluster Sequencing

The UK Government, through UK Research & Innovation, funded the development of a series of 'industrial cluster' plans, which set out the high-level vision for each cluster and acted as a catalyst for the formation of industrial cluster partnerships. As well as identifying potential projects, they also set out the challenges for the supply-chain, labour-market and research community. They were not however spatial plans, nor did they have any statutory or legal status, but provided a powerful statement of intent for each cluster-partnership.

Cluster Sequencing is the UK government's phased approach to supporting decarbonisation of industrial clusters. It was launched in 2021 as part of the Industrial Decarbonisation Strategy.

The process selects and supports CCUS and hydrogen production and transport projects in industrial clusters through a competitive process:

- **Phase 1**: Selection of initial "Track 1" clusters to be operational by the mid-2020s. These first selections were HyNet and the East Coast Cluster (Teesside and part of the Humber).
- **Phase 2**: From a long list of applications, 20 projects have been shortlisted for further development, though funding for their implementation has yet to be confirmed.

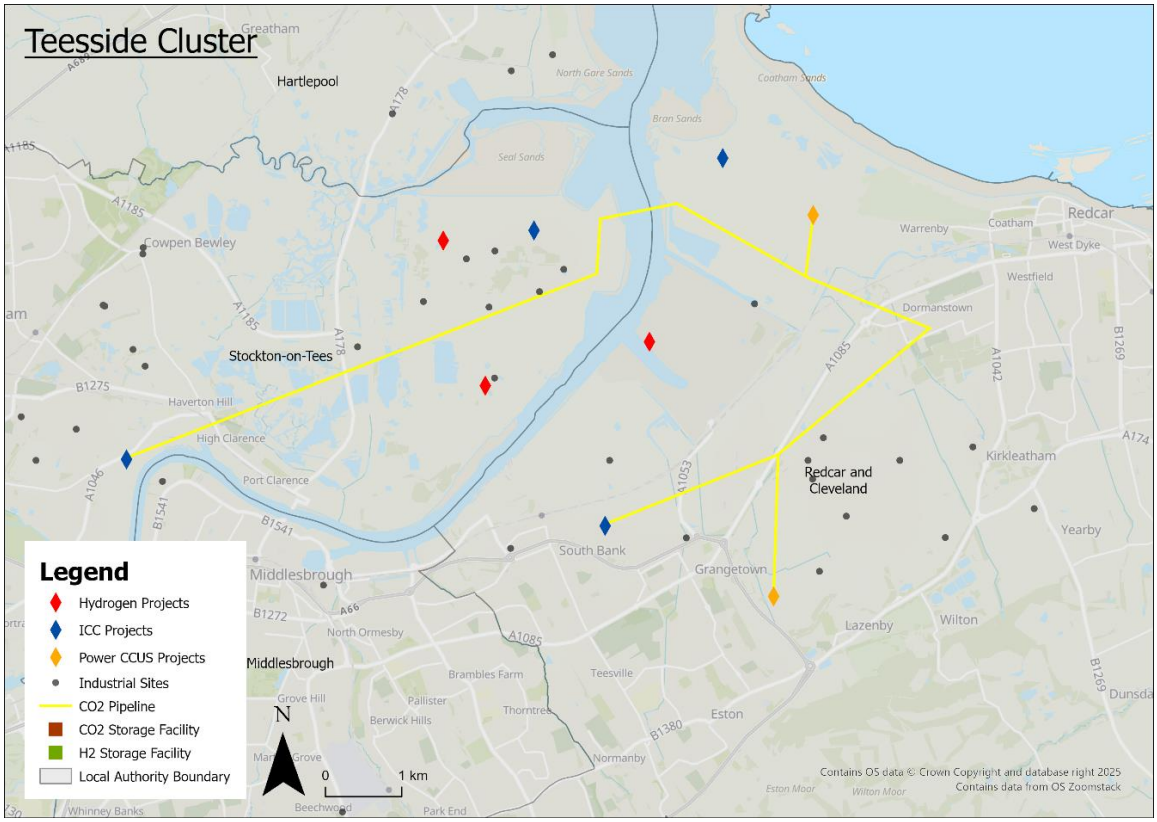
As of December 2023, the government has engaged with two transport and storage systems selected for "Track 2" of the Cluster Sequencing, Acorn in Scotland and Viking in Humber.

3.1 TESSIDE INDUSTRIAL CLUSTER (TEES VALLEY)

In 2021, UKRI funded the Teesside Cluster Plan as part of the Industrial Cluster Decarbonisation Industrial Strategy Challenge Fund. The Cluster Plan brought together a number of documents, including strategic economic assessment of impact of hydrogen and CCUS infrastructure.

This Teesside Cluster Plan aims to establish Teesside as the world's first Net Zero industrial cluster by 2040, with ambitious plans to store up to 10 $MtCO_2$/yr and develop low-carbon hydrogen production, renewable fuels, and circular economy infrastructure, supported by the strategic Teesside Freeport and Teesworks. An overview of the Teesside cluster is shown in Figure 3-1 below.

Figure 3-1. Teesside Cluster



Governance of the plan falls under the Tees Valley Combined Authority (TVCA), which includes Darlington, Hartlepool, Middlesbrough, Redcar & Cleveland, and Stockton-on-Tees. The cluster covers key industrial areas including Wilton, North Tees, and Billingham. Teesside serves as a major hub for decarbonisation, with potential for CO_2 imports from South Wales, Solent, and Medway, and hydrogen exports to South Wales, Southampton, and Grangemouth.

Stakeholders include BP, North East Process Industries Consortium (NEPIC), and TVCA, as well as over 40 major industrial emitters in the region. Infrastructure providers such as Northern PowerGrid (electricity) and Northern Gas Networks (gas and hydrogen) play a crucial role, alongside research partners such as Teesside University Net Zero Innovation Centre. Additional collaborations extend to the Carbon Capture and Storage Association (CCSA) and the Multi-Cluster Forum and Industrial Decarbonisation Research Innovation Centre (IDRIC).

The plan highlights key projects and infrastructure necessary for achieving Net Zero. The Net Zero Teesside, a gas-fired power station with CCS, is set to become the first commercial-scale facility of its kind. There are two Bioenergy with Carbon Capture and Storage (BECCS) plants in the cluster – MGT Teesside and Lynemouth Power. Other key power plants in the region include Whitetail Clean Energy, Alfanar CCGT Teesside.

The Northern Endurance Partnership is developing infrastructure to transport CO_2 from industrial emitters in Teesside and Humber to permanent offshore storage, with a capacity of up to 10 $MtCO_2$/yr. Hydrogen infrastructure is expanding through projects including H2Teesside and HyGreen Teesside, with existing hydrogen production, pipeline networks, and storage caverns supporting regional decarbonisation. The plan also explores opportunities for CO_2 import via Tees Valley's deep-water port facilities, enabling international decarbonisation collaboration[5].

[5] TEES VALLEY COMBINED AUTHORITY, 2023. *Tees Valley Net Zero Cluster Plan - Final Report* [online]. Available from: https://teesvalley-ca.gov.uk/business/wp-content/uploads/sites/3/2023/11/Tees-Valley-Net-Zero-Cluster-Plan-Final-FULL-REPORT-Modified-References-V2-Copy-1-2.pdf [Accessed 12 March 2025].

Teesside's industrial water supply benefits from historical investment in the Kielder Reservoir and the Keilder Water Transfer System. This provides resilience, though the expansion of hydrogen production and carbon capture facilities will require reinvestment in the transfer infrastructure[6].

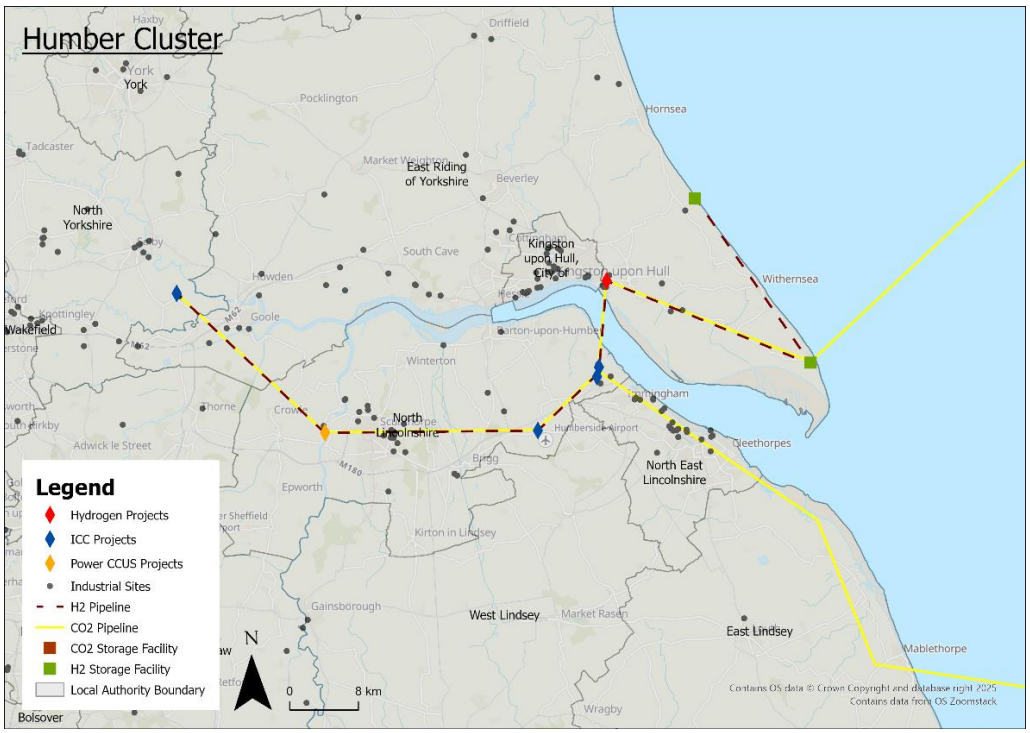
The Tees region is a nutrient-sensitive catchment area and is facing severe challenges with nutrient pollution. The region has an integrated industrial wastewater management system connecting multiple sites to shared treatment facilities. The integrated industrial wastewater system across the Wilton International site represents one of the most developed examples of shared infrastructure in UK industry. This system discharges to the Tees estuary through infrastructure designed to minimise environmental impact as historical industrial contamination requires ongoing remediation efforts alongside current wastewater management. The PR24 final determination enables Northumbria Water to invest in measures to prevent nutrient pollution including a long sea outfall from Bran Sands.[7]

Teesside's historical focus on chemical production has necessitated sophisticated waste handling systems for both hazardous and non-hazardous materials. The region has developed specialised treatment facilities for chemical waste streams alongside broader waste management infrastructure. Legacy waste issues from previous industrial activities remain a challenge.

3.2 HUMBER INDUSTRIAL CLUSTER (YORKSHIRE AND HUMBER)

The Humber Industrial Cluster aims to achieve full industrial decarbonisation by 2040, and encompasses a diverse geographic region including Grimsby, Hull, Beverley, Scunthorpe, and the surrounding Humber Estuary, spanning four unitary authorities: North Lincolnshire, Northeast Lincolnshire, Kingston upon Hull, and East Riding of Yorkshire. The region does not have a combined authority or elected mayor. In 2019, the Hull and East Yorkshire Local Enterprise Partnership and CATCH (Centre for Assessment for Technical Competence Humber) were successful in gaining UKRI funding for a feasibility study in the region. In 2021, alongside industrial partners, the Humber Industrial Cluster Plan was launched. An overview of the Humber Cluster is shown in Figure 3-2 below.

Figure 3-2. Humber Cluster



[6] ENVIRONMENT AGENCY, 2023. Environmental Capacity for Industrial Clusters - Phase 2 [online]. Available from: https://assets.publishing.service.gov.uk/media/65f6f5f350397e72ccc75593/ea-industrial-clusters-environmental-capacity-phase-2.pdf [Accessed 31 March 2025].

[7] OFWAT, 2024. Overview of Northumbrian Water's PR24 Final Determination [online]. Available from: https://www.ofwat.gov.uk/wp-content/uploads/2024/12/Overview-of-Northumbrian-Waters-PR24-final-determination.pdf [Accessed 31 March 2025].

The cluster now involves two Local Enterprise Partnerships - Hull and East Yorkshire and Greater Lincolnshire - and brings together a robust consortium of industrial partners. Key stakeholders include major energy and industrial companies such as Drax, British Steel, Phillips 66, and National Grid, collectively investing £15bn in decarbonization efforts.

The region is home to significant industrial and energy assets, including one-third of the UK's oil refineries, an integrated steelwork, and major facilities such as the Drax biomass power plant. The Humber ports of Hull, Immingham, and Grimsby collectively form the UK's busiest port complex and are essential for future CO_2 and hydrogen transport infrastructure.

The cluster's infrastructure and projects are extensive, featuring ambitious plans for carbon capture and storage (CCS), hydrogen production, and industrial decarbonisation, including the Humber Low Carbon Pipelines project, Zero Carbon Humber initiative, and V Net Zero Humber. These focus on developing parallel CO_2 and hydrogen pipelines to enable fuel-switching and CCS technology. Northern Endurance Partnership is working on offshore CO_2 storage in the Endurance saline aquifer, while the V Net Zero Humber project targets offshore CO_2 transport via the depleted Viking gas field. Key industrial sites involved include Drax bioenergy power plant, Triton Power Station, British Steel, Prax Lindsey Oil Refinery, and Saltend Chemicals Park.

With access to 80% of the UK's licensed CO_2 storage capacity, 35% of the country’s offshore wind capacity, and the potential to meet 50% of the UK's renewable energy needs, the Humber region is positioning itself as a critical hub for industrial transformation. The Humber cluster is closely aligned with Teesside, forming the East coast cluster[8].

The Humber cluster faces stringent discharge regulations into the Humber Estuary. Refineries and chemical plants operate sophisticated on-site primary treatment before releasing effluent to integrated networks connecting to large-scale secondary treatment facilities.

The cluster's industrial diversity creates opportunities for symbiotic relationships where waste from one process serves as input for another, though this requires infrastructure to facilitate material transfer and processing. Existing industrial processes may have waste streams or feedstock requirements that could improve the cost effectiveness of another process, such as treated wastewater effluent being used for electrolytic hydrogen generation, or Energy from Waste plants.

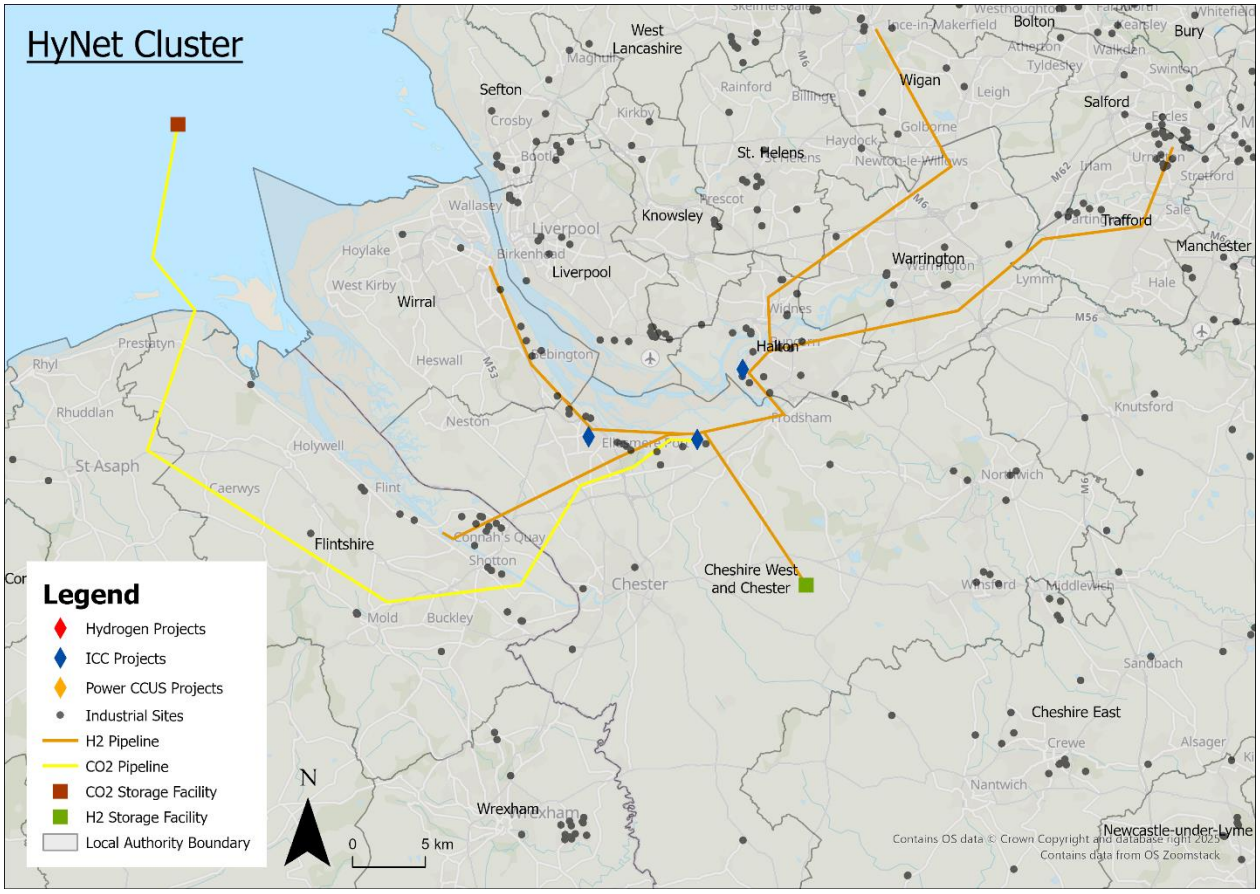
Historically, the Humber cluster created substantial amounts of solid waste, notably from steel production which produces significant quantities of slag and other byproducts. However, this is due to reduce, as some steel production will switch to electric methods of production. Large-scale waste management facilities already exist, supporting multiple sites, with growing emphasis on waste-to-energy and material recovery.

3.3 HYNET NORTH WEST CLUSTER (MERSEYSIDE–CHESHIRE/NORTH WALES)

HyNet is a key component of the Net Zero North West Cluster Plan, which outlines a strategic pathway for the North West of the UK to achieve net-zero industrial emissions by 2040. An overview of the HyNet Cluster is shown in Figure 3-3 below.

[8] CONFEDERATION OF BRITISH INDUSTRY, 2023. *Humber 2030 Vision - Final Report* [online]. Available from: https://www.cbi.org.uk/media/yvulac20/final_humber_2030_vision.pdf [Accessed 12 March 2025].

Figure 3-3. HyNet Cluster



The HyNet North West project encompasses several key regions with industrial and energy infrastructure, including Cheshire, Merseyside, Greater Manchester, and North East Wales. Additionally, the project will cover natural assets such as the Dee and Mersey estuaries, Liverpool Bay, and the East Irish Sea, which will serve as key transit and storage locations for carbon capture and hydrogen deployment.

HyNet is driven by a broad coalition of industrial, governmental, and private sector stakeholders. The local authorities involved in the project are: Greater Manchester Combined Authority, The Liverpool City Region Combined Authority, Cheshire East, and Cheshire West and Chester. Additional stakeholders include Net Zero North West consortium, The Crown Estate, the Local Enterprise Partnerships of Manchester, Liverpool, and Cheshire, alongside many private sector partners and supporters.

The initiative is designed to facilitate large-scale industrial decarbonisation through the deployment of hydrogen production, CCUS, and renewable energy integration. A blue hydrogen production facility by EET Hydrogen at Stanlow, Cheshire, with future expansion in Morecambe, is proposed to supply low-carbon hydrogen, which is planned to be stored in Cheshire's salt caverns by INOVYN. The hydrogen transport network proposed by Cadent is the first of its kind in the UK[9]. Captured CO_2 from industrial sources is to be transported via pipeline to the Point of Ayr gas terminal and stored in depleted gas fields, such as Hamilton and Lennox in Liverpool Bay by Eni.

Offshore wind developments, including North Hoyle and Burbo Bank extensions, will support renewable energy integration. There are plans for a Mersey Tidal Barrage, although consent has not yet been granted. Hydrogen produced will be utilised across industrial processes, transport applications (HyMotion, Project Vanguard), and residential heating networks (HyDeploy)[10]. Over 40 organisations have signed up to decarbonise through HyNet, with contracts awarded to EET Hydrogen at Stanlow for hydrogen production, and both Heidelberg Materials at Padeswood Cement Plant and Viridor EFW at Runcorn for carbon capture.

[9] The hydrogen storage and hydrogen pipeline are yet to be consented.

[10] HYNET, 2020. *HyNet North West Vision Document - Final Report* [online]. Available from: https://hynet.co.uk/wp-content/uploads/2020/10/HyNet_NW-Vision-Document-2020_FINAL.pdf [Accessed 12 March 2025].

Water demands and potential sources of water have been considered in detail by companies involved in HyNet. Companies have also explored technological processes that minimise water usage, however desalination does not currently appear to be part of company plans. Water Resources West and United Utilities had considered HyNet in their planning where details were available at the time of assessment. The United Utilities water resource management plan classifies the area as having "modest water stress" with periodic supply challenges during dry summers.

Regional waste management infrastructure already includes transfer stations, material recovery facilities, and treatment centres serving multiple industries. Decarbonisation may generate new waste streams requiring new disposal routes and technologies.

3.4 WATER MANAGEMENT IN INDUSTRIAL CLUSTERS

Water companies are increasingly adopting integrated long-term strategic planning to address emerging environmental, regulatory, and industrial challenges. This approach aligns with Ofwat's regulatory guidance, emphasising sustainable investment in infrastructure, environmental protection, and improved resilience.

The establishment and growth of industrial clusters, although central to the UK's Net-Zero strategy, bring together energy-intensive industries requiring significant water resources for processes including hydrogen production, carbon capture, cooling, and wastewater management. Effective water infrastructure and supply planning is therefore essential to support the successful development and operation of these industrial clusters. Coordination among water companies, industrial operators, and regulators is critical to prevent resource constraints or environmental impacts that could hinder progress towards national decarbonisation targets.

The recent Ofwat PR24 Final Determination for Northumbrian Water highlights these strategic priorities clearly, underscoring the need for long-term infrastructure planning that supports regional economic growth and environmental sustainability. Northumbrian Water's responsibilities include aligning water management strategies with regional industrial development, particularly around the Teesside area, a core component of the East Coast Cluster. Ensuring adequate water resources and efficient wastewater management will be integral to supporting industrial decarbonisation activities in this region

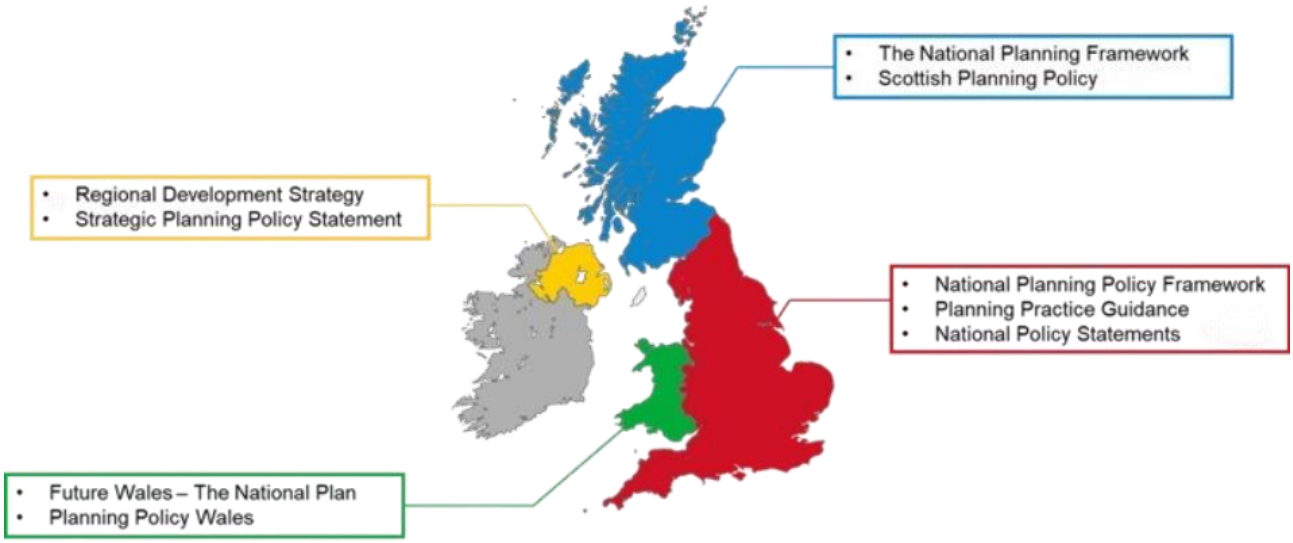
An example of such integrated planning is evident at Northumbrian Water's Bran Sands wastewater treatment facility. Bran Sands plays a significant role in managing nutrient pollution, particularly nitrogen and phosphorus, in line with environmental regulations such as the Water Framework Directive. Moreover, the facility employs advanced anaerobic digestion technology, generating renewable energy and contributing to resource efficiency and circular economy objectives.

4. OVERVIEW OF PLANNING

The UK planning system regulates development and land use through a multi-tiered hierarchical framework of national, regional, and local policies and processes. This structure looks to balance nationally strategic objectives, such as infrastructure provision, housing targets, and environmental protections, with local community needs and aspirations. Each level contributes distinct policies and guidance, underpinned by core principles of sustainable development, community engagement, and coordinated infrastructure delivery. Different legislative routes exist for projects ranging from nationally significant infrastructure to smaller, local developments.

Devolution has resulted in distinct legislative and policy frameworks in Scotland, Wales, and Northern Ireland, while maintaining broad similarities in approach and shared legal foundations. Some cities or regions also have local devolution deals. An overview of the key National Policies in the four devolved nations of the UK is outlined in Figure 4-1 below.

Figure 4-1. Overview of the key national planning policies in the devolved nations of the UK



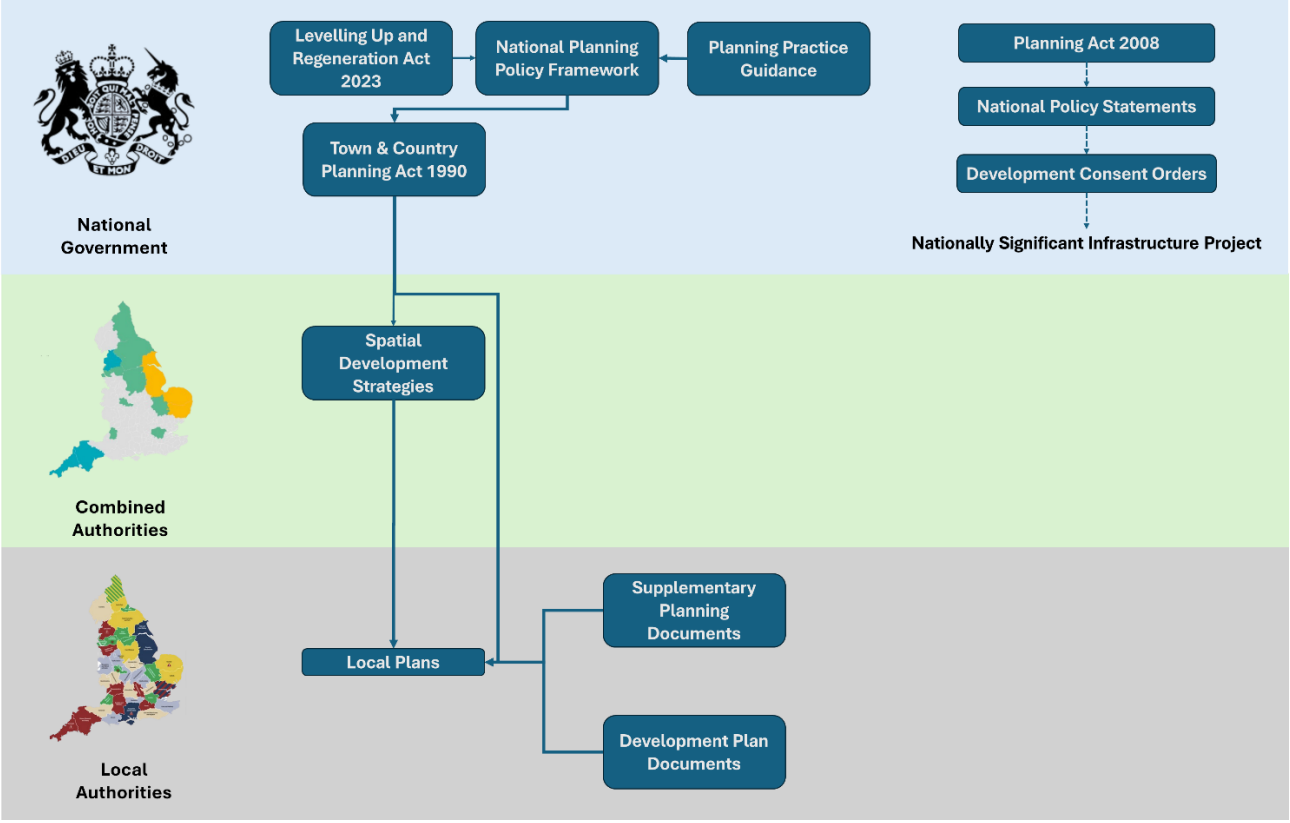
This section provides an overview of how development is planned and regulated in England and Wales, highlighting the multi-tiered framework of national, regional, and local policies. It outlines key planning legislation, explores the structures and responsibilities of various authorities (from national to local levels), and examines how major infrastructure projects are authorised. Attention is also given to how environmental considerations, particularly through permitting and capacity studies, are embedded in the planning process. Finally, the section discusses emerging reforms aimed at accelerating critical infrastructure delivery while maintaining the core principles of sustainable development and community engagement.

The subsequent sections further explore the planning policies and frameworks that shape development, identifying key legislation, strategic priorities, and guidance that influence planning decisions. Teesside and Humber industrial clusters are wholly located in North East England, while the HyNet cluster is largely in North West England with some elements located in Wales. The focus throughout the rest of this section will therefore be limited to England and Wales. Further details on planning in England and Wales can be found in Appendix 2.

4.1 OVERVIEW OF THE PLANNING LANDSCAPE IN ENGLAND

England's planning framework aims to be a comprehensive and dynamic system that integrates strategic policies, practical guidance and legislative measures to deliver sustainable development, economic growth and community well-being.

Figure 4-2. Overview of the planning landscape in England



At its core, the *National Planning Policy Framework (NPPF)*, first introduced in 2012, articulates the Government's overarching vision for the built environment, setting clear priorities that emphasise sustainable practices, community engagement and economic resilience. Complementing this framework, The *National Planning Practice Guidance* (PPG) provides detailed advice for local planning authorities, developers and stakeholders on how to interpret and implement national policies effectively.

Since its introduction, the NPPF has undergone several revisions to reflect evolving policy priorities and planning needs. In December 2024, the Government published a revised NPPF, reflecting the evolving nature of the planning landscape and addressing modern industrial requirements[11]. These revisions propose the allocation of land for emerging uses such as gigafactories and data centres, recognising their significance in supporting economic growth and technological advancement. Additionally, the concept of 'grey belt'[12] flexibility has been introduced, enabling local planning authorities to adjust certain Green Belt boundaries. This approach aims to balance the need for economic development with the imperative of maintaining environmental integrity. This flexibility may also have implications for where pipelines and other industrial sites can be located. By potentially influencing the siting of such infrastructure projects, the revisions aim to provide a more nuanced framework that supports both industrial growth and environmental protection.

While the revised NPPF does not explicitly mention industrial CCUS, or hydrogen projects, it reaffirms support for the broader transition to a low-carbon economy. The framework encourages planning policies that facilitate the development of renewable and low-carbon energy infrastructure, stating that planning policies should "support renewable and low carbon energy and associated infrastructure" and "help increase the use and supply of renewable and low carbon energy and heat"[11]. Although CCUS and hydrogen are not specifically named, their deployment is consistent with these overarching goals.

[11] **GREAT BRITAIN. Department for Levelling Up, Housing and Communities,** 2024. *National Planning Policy Framework (December 2024).* London: The Stationery Office. Available from: https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf [Accessed 6 March 2025].

[12] The 'grey belt' refers to areas within the Green Belt that are considered to have less environmental or amenity value and may be suitable for development.

In general, the NPPF adopts a supportive stance towards industrial development by promoting proactive planning for economic growth, job creation, and sustainable practices. It encourages local planning authorities to ensure sufficient land availability to accommodate industrial and commercial needs, giving priority to previously developed (brownfield) sites. The framework also emphasises the necessity of adequate infrastructure to facilitate and support sustainable industrial growth, advocating that plans should be "positively prepared" to meet infrastructure needs to support economic growth[11].

The statutory framework underpinning major infrastructure projects is established by the Planning Act 2008, which governs NSIPs in England. Through the mechanism of Development Consent Orders (DCOs), this Act streamlines the process of securing the necessary permissions for large-scale projects, thereby facilitating timely delivery of critical infrastructure. As part of this framework, sector-specific NPSs outline the Government's objectives for areas such as energy and transport, ensuring that decision-making is aligned with national strategic priorities. The Planning Act 2008 and the associated NSIPs are further described in Appendix 2.

A central policy document within this regime is the Overarching NPS for Energy (EN-1), which details the government's strategic objectives for the development of energy infrastructure. The updated draft of EN-1 explicitly reinforces government support for industrial decarbonisation, particularly through the development of industrial clusters. It clearly states the government's commitment to provide funding for the establishment of CCS projects in at least four industrial clusters by 2030. This explicit reference within EN-1 provides a strong policy direction, embedding industrial decarbonisation within the nationally significant planning framework and aligning NSIP processes with broader UK decarbonisation goals. Nevertheless, while the updated EN-1 highlights strong policy support for CCS and industrial clusters, detailed guidance for the practical implementation and delivery of these projects within the NSIP framework remains limited and could benefit from further clarification.

Alongside the Planning Act 2008 framework for NSIPs, Section 36 consents under the Electricity Act 1989 play a crucial role in authorising major power generation components central to many industrial clusters. These consents, required for constructing or extending onshore generating stations over 50MW, are particularly relevant for new-build gas power plants with carbon capture or significant retrofits such as BECCS. Like DCOs, Section 36 decisions are made at the national level by the Secretary of State, and the NPSs, including EN-1 with its support for industrial decarbonisation, form a critical part of the policy basis for these decisions. This highlights another key national consenting pathway operating parallel to the DCO system, specifically governing the large power generation assets that often act as anchor projects within the clusters.

The Town and Country Planning Act 1990 (TCPA) remains the foundational legislation guiding most developments, covering a broad range of sectors, including residential housing, industrial facilities, commercial projects, and transport infrastructure. Under the TCPA, local planning authorities are empowered to evaluate and manage planning applications across these sectors, considering environmental and marine concerns through supplementary consents issued by agencies such as the EA and the Marine Management Organisation. While the TCPA establishes a general framework rather than differentiating explicitly between sectors such as industrial, residential, or transportation developments; however, detailed considerations and conditions applied may vary based on the development type and potential impact of the development proposed.

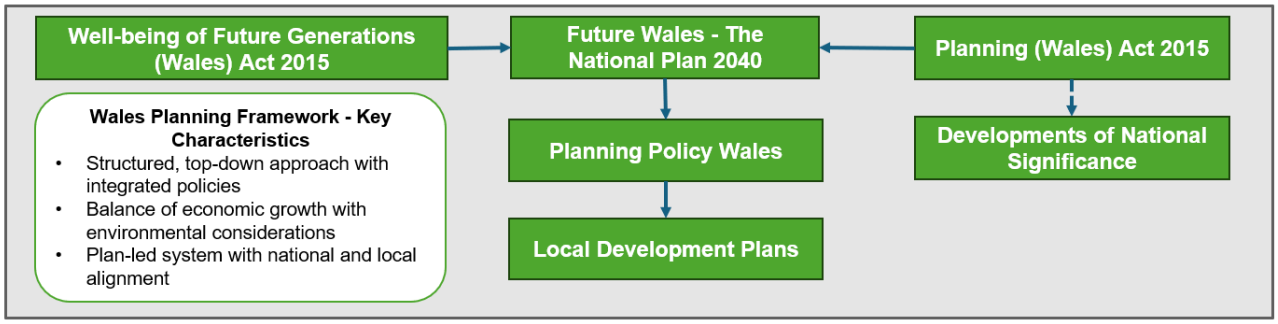
More recently, the *Levelling Up and Regeneration Act 2023* has been introduced as a legislative instrument to reduce regional disparities and stimulate economic growth in underperforming areas at both the national and local levels. Although this act represents a national policy, its implementation is largely focused on local governance and targeted regional development strategies. By streamlining planning processes, enhancing land use policies and strengthen local infrastructure, the Act seeks to foster local economic regeneration. It also reinforces local authority accountability, ensuring that public funds are deployed effectively to achieve long-term community benefits. While the Act does not explicitly reference the creation or development of industrial clusters, its broader objectives of economic revitalisation and infrastructure enhancement establish a conducive framework for supporting such regional initiatives. Collectively, these policies and legislative measures form an integrated framework to balances overarching national objectives with specific local requirements and aspirations.

4.2 OVERVIEW OF PLANNING IN WALES

Both Wales and England pursue sustainable development through plan-led structured, policy-driven planning system to guide development and robust regulatory oversight, but they employ distinct frameworks to achieve these objectives. While both nations share overarching principles of strategic planning, environmental protection, and economic development, Wales has developed a more integrated and top-down planning approach, whereas England's system remains more market-driven with local authorities offered more autonomy in interpreting policies.

Wales' planning framework is a structured system designed to integrate strategic policies, legislative instruments, and practical guidance to support sustainable development, economic planning, and regulatory oversight. The framework is underpinned by national and local policies that seek to balance economic growth with environmental considerations, ensuring a managed approach to development.

Figure 4-3. Welsh planning framework



At the national level, *Future Wales – The National Plan 2040* establishes the long-term spatial priorities for development across Wales. This plan aims to coordinate regional and local decision-making by setting overarching goals for land use, urban regeneration, and environmental management. It prioritises urban connectivity, infrastructure development, and the transition to a low-carbon economy. It also functions as a guiding document for local authorities in formulating Local Development Plans (LDPs), which provide the basis for localised planning decisions and ensure alignment with national and regional objectives. This plan specifically emphasises the importance of industrial clusters, stating, "We will support growth and regeneration that is based on local assets, including those related to the rural and foundational economy, and seek to support innovation and diversification. We will support the growth of innovation and research capacity, and the development of clusters in sectors such as high value manufacturing, energy generation and digital technology"[13].

Planning Policy Wales (PPW) serves as the primary national policy document outlining the principles that underpin planning decisions. It places emphasis on sustainability, natural resource management, and the enhancement of built environments. PPW is closely linked to the *Well-being of Future Generations (Wales) Act 2015*, which establishes legal requirements for planning authorities to consider long-term social, economic, environmental, and cultural impacts. The policy promotes urban density, improved transport networks, and protection of green spaces, with an overarching focus on climate resilience and public health.

The *Planning (Wales) Act 2015* introduced significant structural reforms aimed at streamlining the planning system and ensuring consistency in decision-making. One of its key measures was the establishment of the *Developments of National Significance (DNS)* process, allowing projects deemed strategically important to be assessed at the national level rather than through multiple local authorities. This process applies to major infrastructure projects such as energy developments and large-scale transport initiatives. The Act also encourages regional collaboration among planning authorities, promoting a more cohesive approach to spatial development across Wales. While the Act does not explicitly list CCUS or hydrogen projects, given the scale and significance of CCUS and hydrogen infrastructure, such projects could potentially qualify as DNS, subject to specific criteria being met.

[13] WELSH GOVERNMENT, 2021. Future Wales: The National Plan 2040. Cardiff: The Stationery Office. Available from: https://www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf [Accessed 28 March 2025].

The planning framework also incorporates sector-specific guidance and regulatory measures that ensure consistency with broader economic and environmental objectives. A plan-led approach underpins decision-making, meaning that strategic policies shape development approvals rather than case-by-case considerations. This approach is intended to provide greater certainty for developers, investors, and local authorities, ensuring a structured development pathway. However, the planning system remains subject to periodic reviews and legislative adjustments in response to evolving challenges, such as housing shortages, climate change adaptation, and infrastructure demands.

In addition to national policies, Wales' planning framework includes regulatory oversight mechanisms that ensure compliance with environmental standards and community impact assessments. Various statutory bodies, such as Natural Resources Wales and the Marine Management Organisation, play a role in overseeing environmental and marine planning regulations. These agencies provide input on projects that may have significant ecological or coastal impacts, ensuring that economic development does not occur at the expense of environmental sustainability.

4.3 PROPOSED PLANNING REFORMS

The UK government is undertaking comprehensive reforms to enhance the efficiency of local planning authorities and streamline the approval process for NSIPs. These initiatives are detailed in several policy papers and white papers, aiming to reduce delays and accelerate the delivery of critical infrastructure.

In the "Planning Reform Working Paper: Planning Committees" (published 9 December 2024), the government proposes key reforms to modernise planning committees. One significant proposal is the establishment of a National Scheme of Delegation, which seeks to standardise the decision-making process by delineating which planning applications are determined by officers and which require committee consideration. This approach aims to delegate routine decisions to planning officers, allowing committees to focus on significant or contentious applications, thereby expediting the overall decision-making process. Additionally, the paper advocates for the creation of dedicated committees for strategic developments, ensuring that large-scale or strategically important projects receive focused attention from members with relevant expertise.

To further enhance efficiency, mandatory training programs for planning committee members are proposed, aiming to improve their understanding of planning policies, legal frameworks, and development processes. These measures collectively strive to streamline local planning decisions, maximise professional expertise, and enable elected councillors to concentrate on the most impactful applications.

The "Planning Reform Working Paper: Streamlining Infrastructure Planning" (published 26 January 2025) addresses the NSIP approval process. This paper proposes legislative changes to reduce the complexity of the NSIP application process by streamlining requirements and eliminating unnecessary procedural steps, thereby shortening the time from application submission to decision. A notable proposal is the mandate for five-yearly reviews of NPSs, ensuring that infrastructure planning aligns with current government policies and strategic objectives.

Regular updates provide clarity and reduce uncertainties for developers, facilitating quicker application preparations and decisions. The paper also emphasises the importance of enhanced pre-application engagement, encouraging early and meaningful interactions between developers, local communities, and planning authorities. This proactive approach aims to identify and address potential issues before formal applications are submitted, leading to more robust applications and a reduction in objections or delays during the examination phase.

These reforms are part of the broader "Planning Reform Working Papers" collection, which consolidates various proposals by the Ministry of Housing, Communities and Local Government to improve the planning system. The collection includes papers on development and nature recovery, brownfield development, and other pertinent topics, reflecting the government's commitment to creating a more predictable and expedited planning environment.

The implementation of these reforms is expected to substantially reduce the timelines for both local and nationally significant planning applications. By delegating routine decisions, focusing committee efforts on major projects, ensuring members are well-trained, and simplifying application processes, the overall efficiency of the planning system will be enhanced. While specific time reductions will vary depending on the project and local context, the overarching goal is to accelerate the delivery of essential infrastructure and development projects across the UK.

The UK government's recent proposed reforms, particularly those outlined in the "English Devolution White Paper: Power and Partnership: Foundations for Growth," published on 16 December 2024, aim to decentralise power from Westminster to local regions across England. A central component of these reforms is the establishment of Strategic Spatial Development Strategies (SDS) to be implemented by Combined Mayoral Authorities (CMAs) or newly formed Strategic Authorities. As of May 2024, England had eleven combined authorities, each led by directly elected Metro Mayors with devolved powers. The 2024 White Paper seeks to extend devolution further, making mayoral governance more accessible throughout England, thereby enhancing regional autonomy and facilitating strategic spatial planning.

SDS provide essential frameworks for addressing critical regional issues such as housing, transportation, environmental sustainability, and infrastructure development. For further details on the Combined Authorities and Strategic Spatial Development Strategies, see Appendix 2.

5. PLANNING FOR INDUSTRIAL CLUSTER DECARBONISATION

Under the Town and Country Planning Act 1990, local and combined authorities play a pivotal role in shaping development proposals across the Teesside, Humber, and HyNet clusters. Guided by statutory development plans and national policies, these governing bodies are instrumental in supporting industrial clusters. This section therefore examines how various planning documents, including Local Plans, SPDs, and NPSs, help facilitate industrial cluster development while also highlighting the barriers that may hinder progress. Additionally, views from stakeholders are also reflected in this section.

The review has focussed on how local planning supports the deployment of CCUS and Hydrogen projects, as well as how wider local strategies – such as (non-statutory) net zero or climate emergency plans – provide further support for these projects. The review has not included how environmental planning policies have been considered alongside the decarbonisation projects, enabling the associated infrastructure to be developed in an integrated way.

5.1 TEESSIDE INDUSTRIAL CLUSTER (TEES VALLEY)

The Teesside Industrial Cluster (Tees Valley) is primarily located in Redcar & Cleveland and Stockton-on-Tees, within the Tees Valley Combined Authority.

5.1.1 Planning documents

Local planning frameworks here have proactively addressed large-scale industrial regeneration and decarbonisation.

- Redcar & Cleveland's Local Plan, adopted in 2018, introduced a dedicated policy for the South Tees industrial area (Policy LS4: South Tees Spatial Strategy) that promotes economic regeneration of the former steelworks and nearby industrial sites. This policy explicitly encourages new uses including energy generation, advanced manufacturing, and low-carbon industries, in collaboration with the South Tees Development Corporation (STDC)[14].
- To provide more detailed guidance, Redcar & Cleveland adopted the South Tees Area SPD in 2018, which steers redevelopment of the 1,800-acre Teesworks site. The SPD sets out a vision of a "world-class industrial business park" and includes defined zones such as a "Low Carbon Energy & Innovation zone." Its development principles (e.g. STDC6 Energy Innovation, STDC11 North Industrial Zone) directly support projects such as Net Zero Teesside, an example being the proposed gas-fired power plant with CCS, by identifying suitable locations and establishing land use parameters[15].
- The SPD's Objective 4 explicitly is to "Promote and support development uses aligned with a low carbon, circular economy, while delivering redevelopment within a framework of reduced energy costs and waste minimisation."This policy steers regeneration towards CCUS, hydrogen and other clean industries on Teesside. Likewise, the SPD's development principles support "energy generation…including power generation facilities utilising…renewable resources and CCS".
- This is a clear example of how local planning policy can facilitate cluster decarbonisation by effectively pre-zoning land for CCUS power and hydrogen facilities, smoothing the path for planning approval.
- Stockton's Local Plan (2019) takes a similar approach by safeguarding industrial riverfront sites at Seal Sands and Billingham for energy and chemical industry growth, which may host parts of the East Coast Cluster infrastructure, such as compressor stations or hydrogen plants.

Tees Valley's policy environment is further strengthened by a Climate Emergency and Net Zero Strategy (2022) developed by the TVCA, reflecting a region-wide commitment to industrial

[14] REDCAR & CLEVELAND BOROUGH COUNCIL, 2018. *Redcar & Cleveland Local Plan - Policies Map* [online]. Redcar: Redcar & Cleveland Borough Council. Available from: https://www.redcar-cleveland.gov.uk/planning/local-plan/redcar-and-cleveland-local-plan [Accessed 6 March 2025].

[15] REDCAR & CLEVELAND BOROUGH COUNCIL, 2018. *South Tees Area Supplementary Planning Document - Environmental Report* [online]. Redcar: Redcar & Cleveland Borough Council. Available from: https://www.redcar-cleveland.gov.uk/sites/default/files/2022-05/South%20Tees%20Area%20SPD%20Environmental%20Report.pdf [Accessed 6 March 2025].

decarbonisation, reinforcing local plan efforts[16].

- The TVCA has declared an ambition for the Teesside cluster to become the UK's first fully decarbonised industrial cluster by 2040. According to this strategy, 62% of Tees Valley's emissions originate from industrial sources and the cluster contains 5 of the UK's top 25 CO_2 emitters.
- The plan specifies a Cluster Decarbonisation Plan that collaborates with the 40 largest emitters on measures including carbon capture, fuel switching to hydrogen or electricity, and improved carbon efficiency.
- Key targets include the deployment of large-scale CCUS by 2030 and 4 GW of hydrogen production by 2030.
- Although this strategy is not a statutory planning document, it significantly influences local and regional policies.
- There is close coordination with the EA to understand the "wider environmental impacts of the scale and pace of change" as the cluster decarbonises, ensuring that the wider environmental impacts of rapid industrial transition are managed through SEAs.
- Each local authority within Tees Valley has its own climate action plan, such as Middlesbrough and Stockton, which aim for net zero in council operations while supporting industry decarbonisation. However, the cluster-wide plan at the Combined Authority level remains the most relevant for large-scale industrial initiatives.

Notably, Teesside's planning documents specifically address hydrogen and CCUS as integral to the region's economic future.

- Redcar's Local Plan policy "Promoting Economic Growth" (ED6) and the South Tees SPD both invite new energy industries to establish themselves in Teesworks, an earmarked area in the Teesside region. The Net Zero Teesside Power project's examination papers confirm that these local policies create a supportive backdrop, with no conflicts identified between the CCS power station proposal and local development objectives[14] [15].
- This alignment has been reinforced by the area's participation in the East Coast Cluster (in partnership with Humber), which has gained government support and prompted local authorities to facilitate essential infrastructure, including CO_2 pipelines. The planning frameworks have been bolstered by the creation of the Teesside Freeport, granted in 2021, covering Teesworks and port areas, offering tax and customs benefits alongside simplified planning processes, thus attracting further clean growth investment.

Strategic planning in Teesside has evolved through the TVCA's Strategic Economic Plan and the emerging Tees Valley Industrial Cluster Plan, led by bp and NEPIC[17] [18].

- Although these are not formally termed SPDs, they serve a similar purpose, identifying industrial sites and infrastructure requirements that inform local planning.
- For example, the cluster plan highlights the need for pipelines connecting major emitters to the Northern Endurance Partnership CO_2 storage site in the North Sea, alongside proposals for low-carbon hydrogen facilities.
- Local transport plans and utilities strategies are being updated to account for electricity grid upgrades and pipeline expansions.

5.1.2 Experience of public and private stakeholders

Local authorities

[16] TEES VALLEY COMBINED AUTHORITY, 2022. *Net Zero Strategy*. Tees Valley: Tees Valley Combined Authority. Available from: https://teesvalley-ca.gov.uk/business/wp-content/uploads/sites/3/2023/03/Net-Zero-strategy-Digital.pdf [Accessed 6 March 2025].
[17] TEES VALLEY COMBINED AUTHORITY, 2016. *Tees Valley Strategic Economic Plan 2016-2026*. Tees Valley: Tees Valley Combined Authority. Available from: https://teesvalley-ca.gov.uk/about/wp-content/uploads/sites/2/2023/03/TVCA207-SEP-Document-Full-WEB.pdf [Accessed 6 March 2025].
[18] TEES VALLEY COMBINED AUTHORITY, bp, and NORTH EAST PROCESS INDUSTRY CLUSTER, 2023. *Tees Valley Net Zero Cluster Plan*. Tees Valley: Tees Valley Combined Authority. Available from: https://teesvalley-ca.gov.uk/business/wp-content/uploads/sites/3/2023/11/Tees-Valley-Net-Zero-Cluster-Plan-Final-FULL-REPORT-Modified-References-V2-Copy-1-2.pdf [Accessed 6 March 2025].

Local authorities relevant to Tees Valley Industrial Cluster have a strong awareness and collaborate proactively to support industrial cluster development in Teesside. There are some resource constraints and environmental impacts create challenges, where additional support could help sustain future growth.

Local and combined authorities relevant to the Teesside cluster are aware of industrial cluster projects and their strategic importance. This is due to a long history of working with industry around the River Tees and there is alignment between the local development goals of the authorities and those of industrial clusters.

Those involved in the Teesside cluster have a legacy of collaboration across authorities. This culture of collaboration might be an enabler to existing industrial clusters such as around the Tees and Humber. Within Teesside, authorities acknowledge that current planning practices are conducive to industrial project planning. A master plan for Teesworks was helpful in the initial planning of the cluster, particularly with compulsory purchases, but has not been implemented as policy. Land allocations for industrial projects are part of Teesside's plans for the cluster and have helped developers.

Despite the conducive culture for industrial development, there are limited resources to process planning applications. For example, one of the local authorities re-allocated staff from the housing development division to the industrial cluster without replacement. Use of external consultants has been used to support assessments.

Areas where local authorities are familiar with industrial-type projects are quicker to give consent. For example, planning delays were experienced for a hydrogen refuelling station in Darlington, which is not an industrial hub, as opposed to another in Redcar which was quicker. To speed up the processes, a dedicated team member with technical expertise was assigned to process applications for the Teesworks and Wilton areas.

Environmental capacity, for example in relation to nutrient pollution, poses a risk to future project developments at Teesside. The TVCA recognises that the cumulative environmental impacts of the net-zero transition may be concentrated in the vicinity of the Teesside cluster, while its benefits are shared by the UK. The same was identified in Environmental Capacity for Industrial Clusters – Phase 2, which highlighted that without treatment there will be a potential for increased risk of impact on habitats due to high nutrification, coupled with unknown background levels of amine solvents used in CCS. The combined authority would benefit from support in addressing those impacts, so that the environmental capacity limits of the area do not hinder future developments.

Offshore regulation

CCS shares some similarities with oil and gas infrastructure, and some organisations traditionally responsible for regulating offshore oil and gas projects, also oversee offshore carbon transport and storage.

CCS development depends on synchronised onshore and offshore pipeline infrastructure. The interface between onshore CO_2 sources and offshore storage must be carefully managed, particularly at terminal points.

CCS site appraisal and storage screening remains challenging. Fewer surveyed sites are viable for CCS compared to oil and gas fields, requiring a more extensive evaluation process. Regulators conduct in-house screening for future storage clusters, balancing proximity to industrial hubs with competing offshore space demands, such as wind farms. Existing terminals play a key role in selecting storage sites, though uncertainties remain about future storage capacity needs.

A clear plan, with timetable, for how clusters will be expanded or new clusters supported and associated offshore storage capacity will help to ensure options are assessed in time and preferred options developed. Regulatory and commercial certainty reduces the financing costs for capital-intensive CCS projects. To meet the UK's Net-Zero targets, approximately 10s to 100+ CO_2 injection sites may be needed by 2050, requiring a consistent schedule to build a robust CCS network.

5.2 HUMBER INDUSTRIAL CLUSTER (YORKSHIRE & HUMBER)

The Humber cluster spans four local authority areas, including Hull, East Riding of Yorkshire, North

Lincolnshire, and North East Lincolnshire.

5.2.1 Planning documents

Local planning documents across these authorities consistently highlight the importance of low-carbon energy development, recognising that the Humber's future economic competitiveness hinges on adopting clean technologies.

- Across the estuary, large industrial sites (refineries, power stations, chemical parks) are recognised in planning policy as employment zones where new low-carbon technologies can be sited. Local planning policies safeguard land for energy and port uses, anticipating growth in offshore wind manufacturing and decarbonisation infrastructure.
- For example, North Lincolnshire's Local plans highlight major industrial sites, including the South Humber Bank and the Able Marine Energy Park as a strategic site to *"develop as an energy cluster".* These sites benefit from significant public investment and a Freeport designation granted in 2021, which simplifies planning permissions through Local Development Orders and provides attractive incentives for inward investment[19].
- Similarly, the East Riding Local Plan supports renewable energy and industrial expansion in the Humber Estuary area (e.g. at Saltend Chemicals Park). This strategic approach is specifically intended to advance renewable energy, carbon capture, and hydrogen production, reflecting local authorities' resolution to achieve net zero in the coming decades and bolster the Humber's role as the "UK's Energy Estuary"[20] .

Local planning policies increasingly emphasise the importance of integrating new low-carbon technologies into existing industrial contexts.

- North Lincolnshire's draft Local Plan, for instance, explicitly mentions carbon capture and re-use, hydrogen networks, and renewable energy infrastructure[21].
- Hull's Local Plan and port city strategy focus on renewable energy (such as wind turbine production) and industrial innovation. This signals a policy environment that actively encourages emerging clean energy solutions rather than simply safeguarding traditional industrial land uses. Such support is exemplified by recent planning decisions[22].
- In East Riding, approval was granted for a £250 million, 100 MW green hydrogen production facility at Saltend, which will supply around 30% of the Saltend Chemicals Park's hydrogen demand and reduce carbon emissions by an estimated 125,000 tonnes per year. The facility is located on a brownfield site within the existing Saltend Chemicals Park, minimising environmental disruption and avoiding sensitive ecological areas.
- Meanwhile, North Lincolnshire consented (through the DCO process) to SSE/Equinor's Keadby 3 power station with carbon capture, one of the UK's first power-CCS projects to gain official permission. These examples reflect local and regional policy support. Councils see hydrogen production, carbon capture, and related pipeline infrastructure as enablers of industrial renewal rather than just novel proposals.
- Local plan policies on the South Humber Bank specifically anticipate such projects. For example, the draft North Lincolnshire Plan references developing "CO_2 and hydrogen pipeline networks" (the Humber Low Carbon Pipeline) as key to decarbonising industry and supporting growth.

Supplementary guidance and climate change strategies reinforce the region-wide decarbonisation and net zero ambition for the Humber area, even though most Humber authorities have yet to produce cluster or technology-specific SPDs. Instead, they rely on area-specific frameworks and industry-led

[19] **NORTH LINCOLNSHIRE COUNCIL**, 2021. *North Lincolnshire Local Plan - Final Version.* North Lincolnshire: North Lincolnshire Council. Available from: https://m.northlincs.gov.uk/public/localplan/stage_4_doc/North%20Lincolnshire%20Local%20Plan%20-%20Final.pdf [Accessed 6 March 2025].

[20] **EAST RIDING OF YORKSHIRE COUNCIL**, 2023. *East Riding Local Plan Strategy Document 2016-2031.* East Riding of Yorkshire: East Riding of Yorkshire Council. Available from: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/east-riding-local-plan/ [Accessed 6 March 2025].

[21] **NORTH LINCOLNSHIRE COUNCIL**, 2022. *North Lincolnshire Local Plan – Submission 2022* [online]. North Lincolnshire Council. Available from: https://m.northlincs.gov.uk/public/localplan/examination/North%20Lincolnshire%20Local%20Plan%20-%20Submission%202022.pdf [Accessed 6 March 2025].

[22] **HULL CITY COUNCIL**, 2017. *Hull Local Plan 2016 to 2032* [online]. Hull City Council. Available from: https://www.hull.gov.uk/downloads/file/101/Hull_Local_Plan_2016_to_2032.pdf [Accessed 6 March 2025].

initiatives to guide development.

- The Local Enterprise Partnership's Humber Energy Strategy and the Humber Industrial Cluster Plan (an industry-led strategy) are non-statutory but have proved especially influential, shaping council policies and climate action plans[23,24].
- East Riding's Climate Change Strategy (2022), for example, explicitly references the Humber Industrial Cluster Plan as a key collaborative initiative to achieve net zero in the region, signalling an alignment between local authority objectives and a broader, region-wide and cluster decarbonisation roadmap[25].
- East Riding's strategy notes the Humber emits more CO_2 than any UK region and stresses that decarbonising this "industrial powerhouse" is essential for net zero.

In tandem with these strategies, all Humber councils have declared Climate Emergencies, committing to achieve net zero between 2040 and 2050. These Climate Action Plans recognise decarbonising industry as critical.

- Collaborative bodies, such as the Humber Energy Board, a public-private partnership, works with councils and industry on implementing the Humber Industrial Cluster Plan, which aims to make the Humber "the world's first net zero industrial cluster by 2040". This exemplifies how councils and industry stakeholders work together to facilitate carbon capture, hydrogen, and renewables projects, translating policy visions into concrete outcomes that support industrial transformation.

The Humber Industrial Cluster Plan highlights the need for carbon capture, hydrogen fuel-switching, and renewable energy investment in the industrial sector[26].

- These documents, while not statutory, guide local authorities to proactively support cluster projects (e.g. through positive lobbying, partnerships, and aligning local development decisions with climate objectives).

Overall, the regional outlook is strengthened by strategic frameworks such as the Humber Freeport, which covers sites in Hull, Goole, Grimsby, and Scunthorpe, alongside designated enterprise zones supporting energy and offshore wind initiatives. Although there is no statutory regional spatial plan, the degree of cooperation among Humber authorities contribute to a strategic development context favouring low-carbon industry. A consistent thread in local and regional documents is a recognition that the Humber's future competitiveness hinges on decarbonisation and a realisation that offshore wind and other forms of clean energy will anchor the area's long-term economic resilience. Overall, policies generally *directly support* industrial cluster development, for example, by allocating land for clean energy manufacturing and setting criteria for low-carbon infrastructure.

5.2.2 Experience of public and private stakeholders

The experience of stakeholders at the Humber suggests that fragmented planning and resource constraints hinder industrial cluster development, delaying projects and impacting economic and environmental goals. Better coordination, clearer regulations, and proactive planning are needed for long-term sustainability.

Ambitious economic development targets in the UK lack coordinated, cross-sectoral, and interregional planning. This fragmented approach to cluster development results in inefficiencies, with the government setting broad ambitions, local authorities pursuing their own priorities, developers acting independently across locations and timelines, and service providers and regulators planning in isolation.

Water stress poses a direct threat to both the UK's Net Zero ambitions and industrial sector regeneration. One critical issue arising from this disjointed approach is water supply constraints. Local councils are mandated to deliver 1.5 million homes by 2030, yet water resources are already insufficient to

[23] **Humber Local Enterprise Partnership**, 2020. *Humber Local Energy Strategy* [online]. Humber Local Enterprise Partnership. Available from: https://energycentral.com/system/files/ece/nodes/435297/humber-lep-energy-strategy_1.pdf [Accessed 6 March 2025].
[24] **Humber Industrial Cluster Plan**, 2023. *The Humber: A 2030 Vision for Industrial Decarbonisation* [online]. Humber Industrial Cluster Plan. Available from: https://humberindustrialclusterplan.org/the-humber-a-2030-vision-for-industrial-decarbonisation.html [Accessed 6 March 2025].
[25] **EAST RIDING OF YORKSHIRE COUNCIL**, 2022. *Climate Change Strategy 2022-2030* [online]. East Riding of Yorkshire Council. Available from: https://www.eastriding.gov.uk/environment/sustainable-environment/climate-change/climate-change-what-we-do/ [Accessed 6 March 2025].
[26] **HUMBER INDUSTRIAL CLUSTER PLAN**, 2023. *Humber Industrial Cluster Plan – March 2023* [online]. Humber Industrial Cluster Plan. Available from: https://www.humberindustrialclusterplan.org/files/Cluster%20Plan%209%20March.pdf [Accessed 6 March 2025].

support housing, energy transition projects, and other industrial developments such as AI data centres. Consequently, reductions in abstraction rates were imposed by the EA under DEFRA. Moreover, as water utilities are regulated to prioritise residential consumers over businesses, industrial projects face additional challenges, such as Anglian Water's standard objection to usage exceeding 20,000 litres per day, as stipulated in their policy[27]. This water scarcity is not unique to the Humber cluster but is emerging as a nationwide bottleneck for industrial development.

In some cases, these restrictions have stalled projects, created business uncertainty and prompted companies to consider relocation due to unreliable infrastructure. Given the long lead times for desalination projects, constrained water abstraction poses a direct threat to both the UK's Net Zero ambitions and industrial sector regeneration. To mitigate these risks, local authorities propose both short and long-term measures. In the short term, temporary solutions for water abstraction are needed to ensure immediate project viability. For long-term resilience, strategic water supply assessments, improved coordination between industry, government, and utilities, and integration of water resource planning into local and national development strategies are essential.

Developers have experienced delays in planning and permitting. One developer noted that despite having a planning performance agreement with the local authority for dedicated resources, the planning process turned out to be unduly lengthy due to external factors and extended statutory consultation periods, mainly because both consultants and statutory consultees faced staffing and resourcing issues, further delaying progress. However, the local authority has historically been supportive of industry, including chemicals and refineries and industrial land is well-allocated and embedded in the regional culture. Although local authorities recognise that there is room for improvement in terms of the current planning and permitting processes, the more substantial issue is that of resource and infrastructure limitations and lack of coordination.

Planning consent was sometimes granted, but permitting led to additional scrutiny and the need for revisiting assessments. Permitting processes, such as noise impact assessments, took longer than planning. The planning process didn't fully consider the specific technologies involved in CCS, while permitting did, resulting in complications. Developers noted that increased coordination between planning and permitting processes is needed to streamline consultations and avoid repeating assessments. One developer suggested that local authorities should assess the planning and permitting needs of projects together to address common challenges, such as biodiversity requirements and resourcing constraints.

There is a need for clear, centralised guidance on navigating Biodiversity Net Gain (BNG) requirements and other CCS-specific planning challenge. A developer of a CCS capture project committed to achieving a +10% BNG on land. However, guidance on implementation was lacking, leaving developers to navigate the process independently. Separately, another industrial stakeholder working across HyNet and Teesside has engaged with Nature North on potential strategic approaches to BNG across a cluster.

There is no specific planning regulation for CCS. Local authorities generally have limited understanding of CCS technologies, necessitating developer-led educational initiatives during meetings. Some CCS developers see a need to advocate for CCS-specific planning regulations to provide clearer pathways for project approval. Local authority understanding of CCS technology should be improved through ongoing education and collaborative workshops. Platforms for direct knowledge sharing among developers and across clusters are needed to share best practices and expedite learning. Publishing environment assessment level for projects would help future developments manage that uncertainty.

5.3 HYNET NORTH WEST CLUSTER (MERSEYSIDE–CHESHIRE/NORTH WALES)

The HyNet industrial cluster spans parts of North West England and North East Wales, creating a multifaceted planning context involving multiple local authorities. In England, the key decision-makers include Cheshire West and Chester, which hosts the Stanlow oil Refinery and a proposed hydrogen production hub, as well as

[27] Anglian Water, n.d. *Non-domestic demand policy*. [online] Available at: https://www.anglianwater.co.uk/siteassets/developers/new-content/pre-dev/aws-non-domestic-demand-policy-sm-v2.pdf [Accessed 26 March 2025].

the six authorities of the Liverpool City Region (Halton, Liverpool, Sefton, Knowsley, St Helens, and Wirral). Greater Manchester is also included within HyNet's wider geographic scope for potential decarbonisation benefits and associated infrastructure. Across the border in Wales, Flintshire and Wrexham accommodate significant industrial sites such as Deeside Industrial Park and potential routes for a CO_2 pipeline.

5.3.1 Planning documents

Local plans in these areas have recognised the importance of major industrial sites and have set forth criteria for their ongoing development.

- For example, Cheshire West and Chester's Local Plan (Part One, 2015) designates Stanlow as "a site of national importance" for petrochemicals and related industries, while its Part Two plan further establishes a Stanlow Special Policy Area, safeguarding the refinery and adjacent land for energy and industrial purposes[28] [29].
- This policy foundation is now being leveraged to support Stanlow's transformation into a low-carbon hub (e.g. accommodating hydrogen plant development on the refinery site, which is consistent with the site's industrial land use designation).
- In the Liverpool City Region, local plans generally zone port and industrial estates (such as Ellesmere Port in Cheshire, or the industrial sites along the Mersey) for ongoing industrial use, which by extension supports new decarbonisation facilities.

Several authorities are also updating policies to make explicit references to hydrogen or CCS.

- For instance, the recently adopted Warrington Local Plan (2023), situated just beyond the immediate cluster core, now includes supportive statements regarding hydrogen fuel infrastructure as part of its broader low-carbon objectives[30].

Local authorities in the North West have demonstrated an active embrace of HyNet's objectives by incorporating decarbonisation priorities into climate emergency strategies and policy statements.

- Cheshire West and Chester Council Climate Emergency Strategy, although not statutory, has identified the HyNet project as central to transforming the North West into a low-carbon industrial cluster, emphasising that it will help meet both economic development and net-zero objectives and "help transform the North West into the world's first low carbon industrial cluster"[31].
- In line with this, the Liverpool City Region Combined Authority, supported by the North West Hydrogen Alliance, has championed HyNet as critical to achieving the city-region's ambition of becoming a net-zero economy, with the Combined Authority's climate action plans directly referencing the importance of replacing methane with hydrogen in industrial processes and notes the city-region *"has supported HyNet since its inception… [and is] vital for Liverpool to meet our target to replace all methane with hydrogen"* in industry and heating[32].

- This political and strategic consensus positions HyNet-related planning applications favourably, as they are increasingly viewed as vital components of local and regional climate goals. Similar support is evident in North Wales, where the Welsh Government's Net Zero Wales strategy, the creation of Net Zero Industry Wales, and the North East Wales Industrial Decarbonisation plan (NEWID) reinforce the case for advancing hydrogen and CCUS projects, particularly around the Deeside industrial area.

[28] **Cheshire West and Chester Council**, 2015. *Local Plan (Part One) Strategic Policies* [online]. Cheshire West and Chester Council. Available from: https://www.cheshirewestandchester.gov.uk/your-council/policies-and-performance/council-plans-policies-and-strategies/planning-policy/local-plan/local-plan-part-one [Accessed 6 March 2025].

[29] **Cheshire West and Chester Council**, 2019. *Local Plan (Part Two) Land Allocations and Detailed Policies* [online]. Cheshire West and Chester Council. Available from: https://www.cheshirewestandchester.gov.uk/your-council/policies-and-performance/council-plans-policies-and-strategies/planning-policy/local-plan/local-plan-part-two [Accessed 6 March 2025].

[30] **Warrington Borough Council**, 2023. *Warrington Local Plan 2021/22 – 2038/39* [online]. Warrington Borough Council. Available from: https://www.warrington.gov.uk/LocalPlan [Accessed 6 March 2025].

[31] **Cheshire West and Chester Council**, 2021. *Climate Emergency Response Plan* [online]. Cheshire West and Chester Council. Available from: https://www.cheshirewestandchester.gov.uk/your-council/councillors-and-committees/the-climate-emergency/documents/climate-emergency-response-plan.pdf [Accessed 6 March 2025].

[32] **Liverpool City Region Combined Authority**, 2022. *Pathway to Net Zero* [online]. Liverpool City Region Combined Authority. Available from: https://www.liverpoolcityregion-ca.gov.uk/pathway-to-net-zero [Accessed 6 March 2025].

The Liverpool City Region (LCR) Combined Authority has a robust climate and energy strategy that underpins local planning.

- The LCR's *Pathway to Net Zero by 2040* plan emphasises leveraging the region's "emerging strengths in wind, tidal and hydrogen" to lead a green industrial revolution.
- Metro Mayor Steve Rotherham has championed HyNet as a cornerstone project, noting it "was one of only two pilot schemes selected by the government" and highlighting its potential to reduce NW emissions by 10 Mt CO_2/year by 2030[32].
- The LCR's Five-Year Climate Action Plan (2023-2028) and "Manifesto for Net Zero" explicitly mention HyNet, describing how this *"pioneering carbon capture, usage and storage scheme"* will produce hydrogen, capture industrial carbon, and protect jobs in the region[33] [34].

North Wales offers a parallel layer of institutional backing for HyNet. Future Wales 2040, the Welsh Government's National Development Framework, designates the Deeside area as an industrial growth zone, complementing the cluster's low-carbon aims.

- The Welsh Government's Net Zero Wales strategy and the establishment of Net Zero Industry Wales further emphasise the importance of hydrogen and CCS in decarbonising heavy industry, with the NEWID setting out an aspiration for full decarbonisation by 2040.
- The NEWID initiative specifically highlights hydrogen and CCS as key technologies for achieving regional decarbonisation, focusing on retrofitting existing industries and developing new low-carbon infrastructure.
- NEWID's strategic approach includes significant collaboration across regional boundaries, particularly coordinating infrastructure and resources with industrial decarbonisation projects in North West England.
- The initiative is backed by substantial public and private investments, supported by funding from Innovate UK, aimed at developing the necessary hydrogen pipelines, CCS storage facilities, and electricity grid enhancements.
- The Welsh Government has expressed strong support for the NEWID initiative, recognising its potential to secure and create high-quality jobs while delivering prosperity for local communities. A key element of NEWID involves fostering innovation and workforce development through partnerships with academic institutions, such as Bangor University, ensuring that the region has the necessary skills and research capabilities to support long-term decarbonisation objectives.
- Local authority climate initiatives in Flintshire and Wrexham similarly highlight hydrogen's potential in fuelling industrial sites, illustrating the widespread policy momentum behind HyNet across the Welsh border.

Beyond these regional strategies, local climate emergency declarations from local authorities, notably in Cheshire and Merseyside, have served to reinforce the policy support for industrial decarbonisation schemes.

- Although these declarations do not confer planning permission in themselves, they establish a policy narrative that local planning committees and officers often take into account when reviewing proposals.
- Cheshire West and Chester Council's target of reaching net zero by 2045, which explicitly references cooperation with HyNet, is indicative of how climate pledges translate into practical endorsement of cluster-led decarbonisation.
- Flintshire County's climate plan calls for adopting hydrogen for industrial energy purposes by the late 2020s, reflecting a similar level of direct policy alignment with emerging low-carbon technologies.

[33] **Liverpool City Region Combined Authority**, 2023. *Five-Year Climate Action Plan 2023-2028* [online]. Liverpool City Region Combined Authority. Available from: https://api.liverpoolcityregion-ca.gov.uk/wp-content/uploads/LCRCA-Five-Year-Climate-Action-Plan-2023-2028-Digital.pdf [Accessed 6 March 2025].

[34] **Liverpool City Region All-Party Parliamentary Group**, 2024. *A Manifesto for Net Zero: Scaling Up Green Prosperity* [online]. Liverpool City Region All-Party Parliamentary Group. Available from: https://www.liverpool.ac.uk/media/livacuk/publicpolicyamppractice/reports/Net%2CZero%2CManifesto.pdf [Accessed 6 March 2025].

In North Wales, the devolved government's Net Zero Wales strategy and the formation of Net Zero Industry Wales also support the cluster.

- The Welsh National Development Framework (Future Wales 2040) identifies the Deeside area as an industrial growth zone, and there is an ongoing North East Wales Industrial Decarbonisation plan (NEWID) aiming for full decarbonisation by 2050– these initiatives complement local planning by providing a strategic impetus for approving cluster projects.

The planning regime applicable to HyNet is necessarily diverse, reflecting the different scales and types of infrastructure involved.

- The proposed hydrogen production plant at Stanlow, for example, did not meet the threshold for classification as a NSIP and therefore required planning permission from Cheshire West and Chester, coupled with Environmental Permitting and Hazardous Substances Consent[35].
- In contrast, the planned 85 km CO_2 pipeline for transporting captured emissions to storage sites in Liverpool Bay is being processed as an NSIP via a DCO application, given its strategic significance and cross-boundary reach.
- While local plans do not customarily map large-scale pipelines, they do feature policies encouraging brownfield redevelopment, the co-location of new and existing industrial hubs, and the safeguarding of infrastructure corridors. Siting the hydrogen plant within the long-established COMAH-regulated area of Stanlow helps avoid conflict with sensitive land uses such as the Green Belt, illustrating how leveraging existing industrial allocations can streamline planning and permit processes.

Over time, National Net-Zero policies, such as the UK's Net Zero Strategy and Hydrogen Strategy, combined with local and regional climate strategies, have converged to offer an increasingly supportive context for HyNet.

- An initial gap in local plans, which did not explicitly mention hydrogen or CCS due to the relative novelty of these technologies, is being addressed through local plan reviews, supplementary planning guidance, and material considerations that refer to national decarbonisation objectives.
- Planning officers and inspectors now routinely weigh these imperatives in favour of proposals such as hydrogen plants, CO_2 infrastructure, and other low-carbon projects. This has led to generally favourable outcomes for HyNet-related applications, reflecting broad recognition that cluster-led decarbonisation contributes substantially to economic revitalisation and greenhouse gas reductions.

5.3.2 Experience of public and private stakeholders

The experiences of local authorities and of a project developer at HyNet indicates that HyNet projects progress independently, with planning handled case by case rather than as a coordinated cluster. This fragmented approach complicates permitting, land use, and infrastructure planning, making cumulative impacts harder to assess.

Projects at HyNet are at different stages and planning applications are submitted separately. Consequently, local authorities at HyNet handle projects on a case-by-case basis rather than as part of specific clusters. Planning is also conducted on a project-by-project basis. It was noted that a cluster-wide view of projects is missing within the planning process, rather it is often developers who frame their projects as part of a cluster to highlight benefits. Moreover, separate planning applications for linked projects can also occur, e.g., solar farms with separate battery storage applications making the full picture of potential impacts less clear.

Councils are supportive of climate change mitigation but changing or conflicting priorities can limit focus on industrial clusters, e.g., where the priority has been flagged as housing. There is limited strategic steer on the types of projects which are favoured for decarbonisation, so reliant on developer's planning application content to justify project location and decarbonisation benefits. Developers have noted

[35] **GREAT BRITAIN. Planning Inspectorate, 2025.** Stanlow Hydrogen Ready Modular Combined Heat and Power Project (EN0110007): The Planning Inspectorate. Available from: https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN0110007 [Accessed 15 April 2025].

that securing "consentable" pipeline routes is challenging due to significant land use pressures, including housing, solar, and wind projects.

Net Zero technology development has outpaced planning documentation. An infrastructure project developer at HyNet noted that the Planning Act of 2008 is considered not fit for purpose for CCS and hydrogen projects, and guidance on those specific technologies would help with planning and permitting applications. Local authorities have indicated that there is currently no intention to use SPDs to incorporate industrial clusters or net zero technologies. Additionally, future updates of local plans face uncertainty about what to include due to unclear devolution impacts and uncertain project developments pipelines in their area. This makes it challenging to determine which project types to cover in the updated plan.

The major risk is not solely in consenting CCS equipment or hydrogen off-take projects, but ensuring effective connection between them, particularly via viable pipeline routes. The consent for the CO_2 pipeline at HyNet began long before any projects were selected to connect to it. Therefore, it was suggested that allocating land for infrastructure corridors could address interconnectivity issues. In that regard, a new consenting approach will be attempted at Peak Cluster wherein capture plants connecting to the pipeline could be considered "associated developments" under the NSIP, reversing common practice. Moreover, there is currently a lack of guidance on managing the priorities of local plans around housing and urban development with the requirement imposed by local and national decarbonisation targets.

5.4 NATIONAL POLICY AND THE NSIP/DCO FRAMEWORK

The industrial cluster projects benefit from a supportive national policy framework, particularly where they qualify as NSIPs.

- These projects benefit from the Government's commitment, set out in the NPSs for energy infrastructure, to accelerate decarbonisation in line with legally binding climate targets and energy security objectives.
- The overarching NPS for Energy (EN-1), in its updated draft (2024), explicitly reinforces support for industrial decarbonisation through cluster projects and references that the Government is "providing funding to support the establishment of CCS in at least four industrial clusters by 2030", a clear policy signal in a planning document of national importance[36]. This is an improvement on the previous version, which didn't mention clusters.
- This commitment is further strengthened by consumer subsidies and funding mechanisms for early carbon-capture power stations, which emphasise the national need for projects that help meet both net-zero and security of supply objectives.

Although the existing suite of NPSs did not originally cover CO_2 pipeline networks or hydrogen production in detail, policy is evolving to include these emerging technologies.

- The draft NPS EN-4 (Gas Supply Infrastructure and Pipelines) now addresses hydrogen and CO_2 pipelines, indicating a broader scope than before.
- Similarly, the Government has signalled that a dedicated NPS or related guidance for CCUS networks could be developed to provide more clarity as these technologies are deployed at scale[37].
- In the interim, cluster projects are consented under general provisions in EN-1, along with relevant technology-specific statements, as exemplified by the Keadby 3 CCS power plant in the Humber region. This power plant was examined against EN-1 and EN-2, and the Secretary of State granted consent based on the urgent need for low-carbon power generation.

The NSIP process requires a thorough assessment of local impacts and policies, but national policy is determinative where conflicts arise. In practice, local planning authorities have generally aligned with national objectives, given the overarching emphasis on climate action and industrial

[36] **GREAT BRITAIN. Department for Energy Security and Net Zero,** 2023. *Overarching National Policy Statement for Energy (EN-1).* Available from: https://www.gov.uk/government/publications/overarching-national-policy-statement-for-energy-en-1 [Accessed 14 March 2025].

[37] **GREAT BRITAIN. Department for Business, Energy & Industrial Strategy,** 2021. *Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4).* London: The Stationery Office. Available from: https://www.gov.uk/government/publications/national-policy-statement-for-natural-gas-supply-infrastructure-and-gas-and-oil-pipelines-en-4 [Accessed 6 March 2025].

transformation.

- For instance, Redcar & Cleveland Borough Council confirmed there was no significant conflict between its Local Plan and the Net Zero Teesside DCO project. This alignment is largely driven by NPPF[38], which directs local plans to support the transition to a low-carbon economy. Although the NPPF does not specifically name individual clusters, it provides a robust policy backdrop that encourages local authorities to approve renewable and low-carbon industrial developments, including hydrogen and CCS proposals.
- In parallel with the policy-focused assessment, additional detailed analyses were undertaken to address environmental and infrastructure considerations at the site. These further studies expanded the initial evaluation by examining critical issues such as land remediation and nutrient management. For example, the Preliminary Sources Study Report provided an initial assessment of ground conditions and potential contamination, emphasising the need for comprehensive remediation strategies to ensure the site's suitability for development[39].
- Moreover, subsequent analyses—including the Nutrient Neutrality Assessment and the Nutrient Nitrogen Briefing Paper—explored the potential impacts of nutrient discharges on local habitats and the broader water environment[40] [41].
- Although the initial submission was accompanied by supplementary studies—including the Preliminary Sources Study Report and the Nutrient Nitrogen Briefing Paper—that assessed ground conditions and potential nutrient discharges, additional environmental assessments are also required through the permitting process.
- Such issues may stem from the inherent complexity of large-scale industrial developments, where early-stage assessments—though robust—are often based on preliminary datasets and assumptions. Additionally, legacy contamination, evolving environmental baselines, and unforeseen implementation challenges can all contribute to environmental risks not fully captured during initial evaluations. This reinforces the importance of adaptive environmental management, ongoing regulatory engagement, and continuous monitoring throughout the development and operational phases.

National strategy documents, including the UK's Net Zero Strategy (2021) and the Industrial Decarbonisation Strategy developed under the previous Conservative Government appear ongoing priorities for the current Labour government. Green Industrial Strategy, continue to emphasise the critical role of industrial clusters—particularly on the East Coast (Teesside and the Humber) and in the North West (HyNet)—in achieving the UK's long-term emissions reduction targets.

- In designating the East Coast Cluster and HyNet as Track-1 projects for government support, and by allocating substantial public funding through mechanisms including the £1 billion CCS Infrastructure Fund, the previous Conservative Government indicated their interest in cluster decarbonisation.
- The Labour government has reaffirmed its commitment to these clusters, most notably through continued support for Track-1 CCS projects. In October 2024, the government announced a funding package of up to £21.7 billion over 25 years to advance CCS and hydrogen infrastructure, with direct benefits to the East Coast Cluster and HyNet regions.
- In December 2024, the Net Zero Teesside and Northern Endurance Partnership —responsible for CO_2 transport and storage for the East Coast Cluster—achieved financial close, marking a significant milestone in the cluster's transition to execution.
- Planning Inspectors, when examining these proposals, often cite both the pressing need for deep emissions reductions and the significant economic benefits of safeguarding industrial competitiveness

[38] **GREAT BRITAIN. Planning Inspectorate,** 2022. *NZT DCO 8.1 – RCBC Statement of Common Ground – August 2022 (D6)*. London: Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010103/EN010103-002065-NZT%20DCO%208.1%20-%20RCBC%20SoCG%20-%20August%202022(D6)%20-%20Final%20-%20Tracked.pdf [Accessed 6 March 2025].

[39] **GREAT BRITAIN. Net Zero Teesside**, 2021. Draft Environmental Statement – Volume III, Appendix 10A: Preliminary Sources Study Report (PSSR). London: Net Zero Teesside. Available from: https://www.netzeroteesside.co.uk/wp-content/uploads/2021/10/NZT-DCO-6.4.12-ES-Vol-III-Appendix-10A-PSSR-1.pdf [Accessed 6 March 2025].

[40] **GREAT BRITAIN. Infrastructure Planning Inspectorate, 2022. NZT DCO – 9.36 Nutrient Nitrogen Briefing Paper – Sept 2022 (D8)**. London: Infrastructure Planning Inspectorate. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010103/EN010103-002248-NZT%20DCO%209.36%20-%20Nutrient%20Nitrogen%20Briefing%20Paper%20-%20Sept%202022%28D8%29.pdf [Accessed 6 March 2025].

[41] **GREAT BRITAIN. Infrastructure Planning Inspectorate, 2022. EN070009 – 5.13 Nutrient Neutrality Assessment.** London: Infrastructure Planning Inspectorate. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN070009/EN070009-000227-H2T%20DCO%20-%205.13%20Nutrient%20Neutrality%20Assessment.pdf [Accessed 6 March 2025].

in regions reliant on heavy industry.

- Central to the Labour government's energy transition efforts is the Clean Power 2030 Action Plan, which brings forward the UK's commitment to a fully decarbonised power system by 2030. Backed by the creation of Great British Energy, a publicly owned energy company headquartered in Aberdeen, the plan accelerates investment in renewables, hydrogen, nuclear, and CCS, thereby reinforcing the energy infrastructure needed to sustain low-carbon industrial growth in cluster regions
- Despite these major developments and funding commitments, there remains no formalised national framework for coordinated infrastructure integration across multiple clusters, nor for collectively managing cumulative environmental impacts or shared permitting and planning constraints.

Overall, the national NSIP/DCO framework delivers strong support for individual net-zero projects within clusters, however it stops short of recognising clusters as integrated systems with the potential for expansion. National policy statements affirm the need for these projects to meet the UK's carbon budgets and net-zero obligations. While the recent inclusion of carbon capture readiness, hydrogen infrastructure, and CO_2 pipeline provisions in draft NPSs signals continued progress for individual initiatives, the framework does not fully promote clusters as dynamic ecosystems with the necessary environmental headroom for growth.

- The recent inclusion of carbon capture readiness, hydrogen infrastructure, and CO_2 pipeline provisions in draft NPSs points to continued progress. However, to strengthen the alignment between national objectives and local implementation, it is critical to address the remaining gaps.
- Providing clearer guidance for hydrogen pipelines, creating an NPS dedicated to CCUS networks, and developing mechanisms to coordinate interdependent project consents would improve certainty for developers and ensure that industrial clusters can be delivered on schedule. This approach would consolidate the existing supportive framework and help maintain the pace of decarbonisation required for the UK's long-term climate and energy security goals.

5.5 CUMULATIVE ENVIRONMENTAL IMPACT AND ENVIRONMENTAL CAPACITY

Industrial clusters have the potential to drive decarbonisation by co-locating low-carbon technologies and shared infrastructure. However, when multiple large projects converge in the same area, it is vital to address their combined environmental impacts rather than considering each development in isolation. Traditional planning and permitting processes often focus on project-by-project assessments, which can obscure wider regional impacts and make it challenging to ensure that essential environmental limits, such as air quality thresholds, water availability, and biodiversity protections, are not exceeded. By looking at a cluster holistically, regulators and planners can more effectively manage environmental risks while amplifying benefits.

Planning authorities carry out strategic assessments at the early policy-making stage, including Sustainability Appraisals and Habitats Regulations Assessments for Local Plans.

- These appraisals, in principle, examine cumulative effects when allocating sites for industrial use. These high-level assessments help ensure that issues such as floodplain constraints, wildlife site designations, and local air quality management boundaries are taken into account from the outset (e.g. the South Tees Area SPD emphasises redevelopment *"within a framework of reduced energy costs and waste minimisation"* and protection of environmental assets where possible), thereby shaping the vision for large-scale industrial redevelopment[15].
- For example, Redcar & Cleveland's Local Plan incorporated a Sustainability Appraisal that covered the expansion of employment land in the Tees estuary area, addressing potential implications for local ecology, air, and water.
- The plan includes policies aimed at promoting economic growth through the allocation of land for specialist employment uses in the South Tees area. Specifically, Policy ED6 of the Local Plan designates land within the STDC area for employment purposes, supporting uses such as heavy processing industries and port logistics.
- The Sustainability Appraisal evaluated the environmental implications of this strategic allocation, particularly in relation to local biodiversity, the Teesmouth and Cleveland Coast SPA and Ramsar site, and wider air and water quality impacts. It also addressed concerns around flood risk, contamination, and habitat loss. To mitigate adverse effects, the appraisal proposed a range of measures, including

ecological buffer zones, green infrastructure planning, habitat management, and the need for project-level Habitats Regulations Assessments before development proceeds.

- In tandem, SPDs such as the South Tees SPD have included their own sustainability assessments that guide overarching low-carbon objectives and environmental protections.
- The South Tees SPD adopts a cluster-based development approach, identifying defined zones for the co-location of complementary industries, including energy generation, advanced manufacturing, materials processing, and port logistics. The SPD notes that "a comprehensive development, with clustering of compatible businesses around principal infrastructure and existing industries, can be achieved," supporting ambitions to drive operational efficiency, reduce transport-related emissions through shared infrastructure, and enable innovation via industrial symbiosis. While the SPD does not specifically reference hydrogen or CCUS clusters, the wider South Tees Regeneration Master Plan identifies the Central Zone as suitable for energy-related uses—signalling potential for future low-carbon and hydrogen innovation. This spatial strategy underpins the area's ambitions to attract investment, support decarbonisation, and foster a high-value, sector-led industrial ecosystem.

At the project stage, developers typically undertake a scoping enquiry with the local authority to determine whether an Environmental Impact Assessment (EIA) is required—this depends on the project's scale and location (e.g., for a power plant with CCS, a hydrogen production facility, or a pipeline). When an EIA is deemed necessary, it provides a legal framework for assessing cumulative effects in conjunction with other proposed schemes.

- In Teesside, for instance, the Net Zero Teesside Power project considered potential additive effects alongside Teesside Hydrogen production and other Teesworks projects.
- Such EIAs formally require developers to review possible collective impacts on protected areas and regional air quality, and planning authorities can use this evidence to impose conditions that mitigate emissions or manage construction schedules (such as traffic management plans timed to avoid peak construction overlap). Coordinating developments within clusters also creates potential synergies: co-located projects can share pipelines and other facilities to reduce the physical and environmental footprint. Additionally, cutting greenhouse gas and pollutant emissions across a cluster can yield wide-ranging public health and environmental improvements, benefits that might be missed if each facility were planned in isolation.

Despite these advantages, several systemic barriers continue to hinder effective cumulative impact management. A key challenge is that regulatory and planning decisions are often made on a project-by-project basis. This fragmented approach can make it difficult to implement strategic, coordinated planning across entire CCUS clusters, reducing the potential for cohesive development and long-term impact mitigation.

- Although EIAs for individual projects do consider other known projects in their "cumulative impacts" section, this is often limited by uncertainty (each project EIA might not fully know the details of others if they're concurrent).
- Formal mechanisms to gauge the overall effect of multiple facilities—on, for example, regional water supply, air quality, or ecological receptors—remain limited before individual permit applications are submitted.
- Water Resource Management Plans (WRMPs) and Water Cycle Studies (WCS) are established instruments for assessing long-term water supply and local infrastructure needs. However, their broader application in strategic industrial planning remains limited. Despite capturing valuable data on industrial water usage and regional capacity, these tools are not routinely leveraged to inform decisions around the cumulative impacts of multiple developments or the planning of industrial clusters. As demand for integrated infrastructure planning intensifies—particularly in support of economic growth and net-zero objectives—there is a growing case for making more proactive use of WRMPs and WCS. Better utilisation of these existing frameworks can help identify emerging constraints earlier, enable more informed investment decisions, and enhance the resilience of future industrial strategies.
- The EA's "Environmental Capacity" pathfinder in the Humber region, published April 2022, demonstrated that without early cluster-level assessments, regulators frequently discover capacity constraints, such as water scarcity only when applications are already in progress, creating delays or conflicts. For instance, in the Humber, it was identified that *"there is no water available for new [surface or groundwater] abstractions on the South Humber bank"* due to existing climate and usage pressures. Whilst some estuary-based abstraction may still be possible, if multiple hydrogen or CCS plants all need cooling water, this becomes a shared constraint. Each project on its own might seem acceptable,

but in combination they could exceed the environment's ability to cope (whether that's water supply, emissions to air, or impacts on protected habitats)[42].

Furthermore, planning and environmental permitting often proceed as distinct processes. A project may pass the planning phase, only to face environmental permit refusals or additional mitigation requirements, such as stricter limits, later if collective impacts prove too large.

- Coordination issues have arisen from limited data sharing: many companies hesitate to reveal sensitive plans in advance, yet regulators need accurate information to evaluate overarching constraints.
- For example, outlined in the Humber Pathfinder Project, 94% of Humber industry stakeholders (mostly heavy water users) initially did not provide data to the EA's inquiry on water needs, limiting the ability to assess cumulative demand[42].

Practical attempts at managing cumulative impacts are already visible in cluster areas.

- As previously outlined, The South Tees SPD underwent a Sustainability Appraisal that considered redevelopment impacts for the entire Teesworks site, including how best to protect Teesmouth nature sites through buffering or habitat creation.
- Meanwhile, some planning authorities manage simultaneous construction activities by phasing developments, using planning conditions and Construction Environmental Management Plans, referencing other developments in the vicinity, to avoid detrimental overlap on local road networks or labour availability. Although such measures are positive, regulators themselves also need sufficient capacity to process multiple parallel applications.
- During the HyNet rollout, concurrent permit variations were identified as a potential strain on regulatory resources; early engagement helped mitigate this and ensured regulators were aware and could allocate staff. Furthermore, the site being an existing regulated facility (with known baseline conditions) further eased the process. This highlights the broader solution of proactively resourcing cluster-scale reviews, effectively treating a cluster as a single big project for staffing and review purposes.

5.5.1 Experience of public and private stakeholders

Stakeholders have expressed several concerns regarding the assessment and management of cumulative environmental impacts in industrial cluster development. Many of these concerns agree with published reports already summarised above.

The cumulative environmental impact of industrial clusters is obscured by piecemeal EIAs. Local and combined authorities in all three clusters recognise that planning and permitting are often conducted on a project-by-project basis rather than as part of a specific cluster. Separate planning applications for linked projects can obscure the full picture of potential environmental impacts.

There is an instance of two developers at Humber collaborating on a joint EIA for their carbon capture projects. The collaboration occurred due to the proximity of the projects and to work together to achieve the BNG requirements of their respective projects. There may be other instances of joint impact assessments, however, although joint assessments may provide a better understanding of the cumulative impact of the projects involved, they do not assess the broader cumulative impacts of cluster development, which could potentially include tens of other projects.

Local and combined authorities at Teesside noted that **piecemeal development is expected to have a cumulative impact on nutrient pollution,** which may hinder future developments if the environmental capacity is not available as the area approaches its environmental capacity limits. It was suggested that government support is needed to mitigate such negative externalities of industrial cluster development.

Local authorities at Humber highlighted that **water shortages are limiting the available abstraction rates and have hindered project development**, putting business certainty at risk. It was noted that water scarcity and cumulative water stresses are becoming a UK-wide bottleneck for industrial project development.

[42] **GREAT BRITAIN. Environment Agency,** 2024. *Industrial Clusters Environmental Capacity – Phase 1 Report.* Available from: https://assets.publishing.service.gov.uk/media/65f6f5d250397e72ccc75592/ea-industrial-clusters-environmental-capacity-phase-1.pdf [Accessed 6 March 2025].

Projects within clusters are often developed at different stages rather than collectively, thus environmental impacts of future developments are uncertain. Stakeholders are years away from knowing the environmental impacts of projects that have not yet been developed and it is difficult to reserve environmental capacity for future projects without knowing what they might be. For instance, a cumulative impact assessment (CIA) for the Teesside cluster was conducted, however, the assessment is expected to lose its relevance as additional projects are developed with their own environmental impacts. Moreover, several local authorities have noted that there is a lack of understanding regarding the environmental impacts of new low-carbon technologies, particularly air pollution associated with amine-based carbon capture equipment.

Stakeholders suggest a broader Strategic Environmental Assessment for clusters to avoid displacing future projects. This assessment could allocate environmental headroom, ensuring that early projects do not negatively impact later projects due to environmental capacity constraints.

5.6 CASE STUDIES

Case studies were undertaken with the aim of understanding how planned projects in industrial clusters materialised. This covers a selected of projects of different nature, including site specific projects such as hydrogen or CCUS, as well as infrastructure projects that span different areas, such as CO_2 and H_2 pipelines. The case studies cover an overview of the general project and planning steps, relevant policies, environmental capacity considerations, and enablers and barriers.

5.6.1 Progressive Energy – CO_2 pipeline

In 2022, Liverpool Bay CCS Limited submitted a planning application for a 20” underground pipeline to be installed from Ince to Stanlow, the construction of a new 36” pipeline between Stanlow and Flint and the repurposing of an existing 24” natural gas pipeline to the Point of Ayr Terminal at Talacre. This forms part of the HyNet North West Project, which is a hydrogen supply and CCS project. HyNet is an industrial decarbonisation project in the UK that will support the UK to unlock a low carbon future and by 2030, aiming to reduce CO_2 emissions by 10 million tonnes per year[43,44].

The project was designated as a NSIP under Section 14(1)(g) of the Planning Act 2008 due to the scale of the pipeline. This classification required a DCO under Section 37 of the Planning Act 2008, assessed by the Planning Inspectorate before a final decision was made by the Secretary of State.

Key steps leading up to and during the application timeline are outlined below:

- **Pre-Application Phase (2016–2022):**
  - HyNet originated as a feasibility study in 2016, with a full pre-FEED report published in 2018.
  - Initial engagement with industry stakeholders, government bodies, and local authorities took place from 2018 to 2021.
  - A non-statutory public consultation on the pipeline route was conducted from June to July 2021 and then a statutory consultation followed from February to March 2022, with additional targeted consultations in mid-2022, resulting in 35 design changes.

- **Application and Examination (October 2022 – March 2024):**
  - DCO application was submitted on 3 October 2022 and formally accepted in January 2023 following the appointment of the Examining Authority.
  - The examination process included hearings, site inspections, and consultations with statutory consultees.
  - A Marine Licence application was submitted to Natural Resources Wales in September 2023 for the River Dee crossing.

[43] HYNET, 2023. *HyNet DCO Consultation Report Rev A* [online]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN070007/EN070007-000150-D.5.1%20HyNet%20DCO%20Consultation%20Report%20Rev%20A.pdf [Accessed 12 March 2025].

[44] INFRASTRUCTURE PLANNING INSPECTORATE, 2025. *HyNet Carbon Dioxide Pipeline - Project Overview* [online]. Available from: https://infrastructure.planninginspectorate.gov.uk/projects/wales/hynet-carbon-dioxide-pipeline/?ipcsection=overview [Accessed 12 March 2025].

- The Secretary of State granted the DCO in March 2024, though a Correction Notice was issued in October 2024 to amend the final order.

A range of stakeholders played a role in the project's development, including national and local government agencies, industry bodies, infrastructure operators, and environmental groups. The Secretary of State for DESNZ was responsible for granting the DCO, while local authorities such as Flintshire County Council (FCC) and Cheshire West and Chester Borough Council (CWCC) were involved in consultations. Other key stakeholders included Natural England, the EA, Natural Resources Wales (NRW), Dŵr Cymru Welsh Water, National Highways, National Grid Gas PLC, and private industry partners such as Encirc Limited and Exolum Pipeline Systems Limited. Public consultations were also a significant part of the process, ensuring community input and addressing potential concerns[43].

Figure 5-1. Proposed route options at non-statutory consultation, Route I and Route G

The planning and approval process adhered to multiple national and local policies, ensuring alignment with the UK's climate goals and legal frameworks for infrastructure development. Moreover, the project aligns with regional commitments to reducing emissions, namely the Liverpool City Region Net Zero Action Plan.

Key Planning Acts and Regulations:

- *Planning Act 2008*: Established the NSIP process and DCO requirement.
- *Infrastructure Planning (Environmental Impact Assessment) Regulations 2017*: Required EIA due to the scale and nature of the project.
- *The Pipe-Lines Act 1962:* Defined the project as a cross-country pipeline, influencing legal classifications.
  - *"As the Proposed Development comprises the construction of a cross-country pipeline, with one end in Wales and the other end in England, which is not being constructed by a gas transporter (as defined in the Pipelines Act 1962), the Proposed Development constitutes a Nationally Significant Infrastructure Project ("NSIP") within s21 of the 2008 Act [ER 1.1.14]. Therefore, the Proposed Development meets the definition of an NSIP set out in s14(1)(g) of the 2008 Act and requires development consent in accordance with s31 of the 2008 Act [ER 1.1.14]"*
- *Marine and Coastal Access Act 2009:* Required a Marine Licence for the River Dee crossing.

National Policy Statements (NPS):

- *NPS EN-1* (Overarching Energy Policy, 2011): Supported decarbonisation and infrastructure resilience.
  - While the Proposed Development does not come under a specific NPS, the ExA took into account NPS EN-1 as an important and relevant consideration to the Proposed Development

as a policy reference document including overarching principles that support decarbonisation and diversity of energy supply [ER 3.3.3].

- *NPS EN-4* (Gas Supply Infrastructure and Gas & Oil Pipelines): Provided guidance on route planning, safety, and environmental impact.
    - The ExA considered NPS EN4 to be important and relevant to the Proposed Development as it provides guidance on technology specific considerations for pipelines, albeit gas and/or oil which include planning routes; pipeline safety; noise and vibration; biodiversity; landscape and visual amenity; water quality and resources; and soils and geology [ER 3.3.14].
- *UK Industrial Decarbonisation Strategy*: HyNet was awarded Track 1 Industrial Cluster status (2021), granting government backing for early decarbonisation initiatives.

Environmental Capacity and associated infrastructure:

A full EIA was conducted, as required for Schedule 1 projects under the EIA Regulations 2017. This assessment identified potential impacts on biodiversity and water resources, noise and air quality, and landscape and visual amenity.

The project's infrastructure includes a 60.4km CO_2 pipeline, 24km of which will be repurposed from a natural gas pipeline. It also includes above Ground Installations (AGIs) and Block Valve Stations (BVSs) for operational safety.

Barriers, Enablers, and Benefits

One of the key challenges associated with the project application process was the regulatory complexity. The cross-border nature of the pipeline required alignment between English and Welsh planning frameworks. The Welsh Government disagreed with the classification of Above Ground Installations (AGIs) and Block Valve Stations (BVSs), though the Examining Authority (ExA) ultimately sided with the applicant. This was made more challenging by the fact that there is a lack of an existing NPS for CO_2 pipelines.

Another challenge was the environmental constraints. The project initially proposed a trenched crossing for Alltami Brook, which was rejected by NRW due to Water Framework Directive concerns. This led to a design change incorporating an embedded pipe bridge.

Lastly, early consultations revealed concerns over land use, safety, and visual impact, which influenced route selection and design refinements.

Despite these barriers, the project presents significant benefits, namely, it supports the UK's Industrial Decarbonisation Strategy and net zero goals. The project establishes critical CO_2 transport infrastructure that can be expanded for wider carbon capture initiatives

HyNet was awarded Track 1 Industrial Cluster status by the UK Government in November 2021, allowing it to access funding and begin decarbonisation efforts by 2025. This designation was crucial in enabling the project to proceed through the planning process, as it demonstrated national priority status and alignment with the UK's Net Zero Strategy and Ten Point Plan for a Green Industrial Revolution.

Environmental Impact Assessment

The EIA for the HyNet CO_2 pipeline project has been undertaken following the UK Environmental Impact Assessment Regulations (2017), incorporating industry best practices and complying with relevant policy frameworks. This detailed assessment provides a valuable case study for future CCUS infrastructure developments, offering insights into effective environmental management and sustainable project implementation. The EIA addressed all stages of the project lifecycle—construction, operation, and decommissioning—examining key environmental aspects, including air quality, climate resilience, cultural heritage, biodiversity, water resources, land use, noise, and socio-economic factors. The significance of potential impacts was assessed based on receptor sensitivity and the magnitude of anticipated effects, with moderate or major effects typically regarded as significant.

A critical learning point from this project is the application of a comprehensive and iterative mitigation hierarchy. Primary mitigation involved proactive adjustments in project design or construction methodology upon initial identification of potentially significant impacts. If residual impacts remained significant, secondary or tertiary mitigations were introduced and subsequently reassessed, demonstrating the importance of flexibility and iterative planning. This approach was strongly supported by stakeholder engagement, including consultation

with statutory bodies and affected communities, which significantly shaped the assessment methodology, data gathering, and the overall scope of the evaluation.

The HyNet pipeline EIA demonstrates how a carefully planned mitigation strategy can effectively reduce most environmental impacts. Notably, there were negligible residual impacts on air quality and biodiversity during operations due to effective control measures like dust suppression and habitat reinstatement. Moreover, it was noted the project delivers significant climate benefits by capturing industrial CO_2 emissions, contributing positively to national net-zero goals,

Nevertheless, certain adverse effects were observed, particularly during construction. There was a permanent moderate adverse impact on soil resources resulting from the irreversible loss of high-quality agricultural land at sites for above-ground installations. Cultural heritage impacts were also significant due to potential disturbances of archaeological remains, including Bronze Age funerary sites. Through controlled archaeological excavation and documentation, these impacts were reduced from major to moderate, illustrating the effectiveness of careful planning and mitigation even in sensitive contexts.

Additionally, significant temporary impacts related to noise, vibration, and population disruptions were observed during construction. Residential properties and sensitive facilities experienced elevated disturbance, which remained significant despite mitigation efforts. These included best practicable noise management, clear public communications, and strategically timed construction schedules. Lessons from this experience highlight the importance of clear stakeholder engagement and robust management planning to minimise community disruption.

Impacts to water resources, particularly at sensitive crossings such as Alltami Brook, highlight the need for detailed hydrological assessments and careful construction practices. Despite effective mitigation, including limited working widths and rapid ecological restoration, temporary moderate adverse impacts occurred, indicating that careful site-specific planning is essential to minimise ecological disruption.

Landscape and visual impacts during the construction phase underline the importance of strategic site restoration and landscaping, which successfully mitigated impacts over time, ensuring negligible long-term visual disturbances.

The project's cumulative effects assessment was carried out following Planning Inspectorate Advice Note 17, assessing both inter-project (how the effects of the HyNet pipeline interact with other developments in the area) and intra-project effects (the interactions between different environmental aspects within the pipeline project itself). The assessment defined specific Zones of Influence (ZOI) for each environmental topic, typically within a maximum radius of approximately 10 km. Developments considered included major industrial installations (e.g., Vertex Hydrogen Production Plant), residential projects ranging from 130 to 483 dwellings, education infrastructure (such as the redevelopment of Argoed High School), and commercial facilities (including logistics parks and recycling centres). This assessment identified potential overlaps in construction schedules, shared receptors, and combined pathways of impact. It concluded mostly minor adverse cumulative effects during construction and negligible impacts during operation, demonstrating that thorough early-stage planning and effective coordination can successfully manage cumulative impacts.

Effective stakeholder engagement and transparent communication with local authorities, statutory consultees, and community groups emerged as critical success factors throughout the project. Ongoing monitoring during construction will facilitate compliance and adaptive management of unforeseen impacts, further supported by the future development of a Decommissioning Environmental Management Plan.

The HyNet CO_2 pipeline EIA provides valuable insights and lessons for future CCUS and infrastructure projects, showcasing the importance of proactive design adjustments, comprehensive stakeholder engagement, mitigation planning, targeted monitoring, and detailed cumulative effects assessment methodologies.

5.6.2 DRAX – BECCS project

In June 2022 Drax Power Limited submitted a planning application for Bioenergy with Carbon Capture and Energy Storage (BECCS), where 2 of 4 660 MWe biomass power generating units will be retrofitted with post-

combustion carbon capture (PCC) technology[45]. As the power output capacity is greater than 50 MW the application went through the NSIP planning process. The Drax BECCS application took 1 year 6 months from submission to receive approval from the secretary of state[46] in January 2024.

National and local policies relevant for Drax's application

National policies

For NSIP's, the primary planning policies considered by the decision-making authority (Secretary of State (SOS)) are NPSs, although Drax's application was also assessed against other national (National Planning Policy Framework (NPPF)) and local policies (Selby District Local Plan). July 2011 NPS EN-1 was the only relevant policy for Drax at the time of application, with EN-1 being the overarching policy relevant to all NSIP applications. However, during Drax's examination period draft NPS EN-3 was published providing specific policies relevant to renewable energy technologies, which was considered by Drax during the examination period in July 2023[47].

EN-3 supplements EN-1 with specific policies for renewable technology, but the overarching theme from NPS is stated in EN-1 with '*Given the level and urgency of need for infrastructure of the types covered by the energy NPSs set out in Part 3 of this NPS, the IPC should start with a presumption in favour of granting consent to applications for energy NSIPs. That presumption applies unless any more specific and relevant policies set out in the relevant NPSs clearly indicate that consent should be refused. The presumption is also subject to the provisions of the Planning Act 2008 referred to in paragraph 1.1.2 of this NPS*'. Given that Drax uses fuel (biomass) classed as renewable energy and features CCS, on this basis the SoS should be in favour of granting Drax's application planning permission unless any policies in the NPS indicate that consent should be refused. As a result, Drax will be compliant with many NPS policies which are too many to list in full, instead the scheme specific policies Drax is at risk of breaching have been highlighted to demonstrate the challenges and how these were weighed up against the benefits of the scheme:

- Paragraph 4.7.7 of the now superseded EN-1 states '*The most likely method for transporting the captured carbon dioxide is through pipelines. These will be located both onshore and offshore. There are currently no carbon dioxide pipelines in the UK and considerable future investment in pipelines will be required for the purpose of the demonstration programme. If CCS is deployed more widely, it is likely that these initial investments could form the basis of a wider carbon dioxide pipeline network, which is likely to require greater capacity pipelines. In considering applications the IPC should therefore take into account that the Government wants developers to bear in mind foreseeable future demand when considering the size and route of their investments and may therefore propose pipelines with a greater capacity than necessary for the project alone.'*
- Paragraph 4.2.1 of the now superseded EN-1 states an '…*Environmental Statement describing the aspects of the environment likely to be significantly affected by the project. The Directive specifically refers to effects on human beings, fauna and flora, soil, water, air, climate, the landscape, material assets and cultural heritage, and the interaction between them. The Directive requires an assessment of the likely significant effects of the proposed project on the environment, covering the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects at all stages of the project, and also of the measures envisaged for avoiding or mitigating significant adverse effects.*'

Drax was already operating a renewable biomass fuelled power station prior to this application, as such many of the policies Drax are required to meet in EN-3 have already been met, such as compliance with EN-1 policies regarding wastewater from the power station and materials storage and waste. As such the NPS policies at the crux of the Drax application are paragraph 4.2.1 of EN-1 which requires an environmental assessment of

[45] GREAT BRITAIN. Planning Inspectorate, n.d. **EN010120 – Proposed Tilbury Energy Centre Project**. Available from: https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010120 [Accessed 3 April 2025].

[46] GREAT BRITAIN. Department for Energy Security and Net Zero, 2024. **Drax Bioenergy with Carbon Capture and Storage Project: Decision Letter**. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010120/EN010120-001660-Drax_BECCS_SoS_Decision_Letter.pdf [Accessed 3 April 2025].

[47] GREAT BRITAIN. Drax Power Limited, 2023. **National Policy Statement Compliance Tracker (Clean) – Rev 5**. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010120/EN010120-001575-D10_Drax%20Power%20Limited_8.8%20National%20Policy%20Statement%20Compliance%20Tracker%20(Clean)%20-%20Rev%205.pdf [Accessed 3 April 2025].

Carbon Capture impacts on human health and environmental receptors. Since an outline of the transport and storage of carbon has been provided and will be assessed in full in an associated application, in this case Drax submitted on the basis that Northern Grid Ventures would explore a pipeline route to a North Sea saline aquifer. As of February 2025, a scoping report was submitted by the Humber Carbon Capture Pipelines to service the Humberside industrial cluster by transporting carbon to an offshore pipeline, where a connection is proposed for the North Sea saline aquifer known as the Endurance Store.

The latest national planning and policy framework (NPPF) guidance at the time of Drax's application was in 2021. This was reviewed for policies relevant to CCS, but no additional policies were found.

Local policies

As Drax is of significant economic importance to Selby District Council, the local authority Drax falls within, Selby District's Local Plan was reviewed for any policies that are specific to Drax. As of 2022 the relevant local plan was the 2008 Selby District Local Plan, which included the EMP10 policy:

'No additional industrial / business related development should be permitted at Drax Power Station if it results in significant adverse effect on residential amenity in nearby settlements. Proposals would have to be related to the existing development and integrated into its surroundings through mounding, off site planting and should not harm nature conservation or sites of archaeological importance'.

North Yorkshire Council are now responsible for producing a local plan for the area encompassing Drax and adopted a local plan in 2024. This was reviewed to identify any new policy developments from a council with the largest biomass power station in the UK, with SG10 'Low Carbon and Renewable Energy' being very similar to EMP10. However, EM2 has been introduced which includes Drax in 'Key Employment Areas' where development for industrial purposes is supported on the basis there is no impact on surrounding amenity and change of land use to non-industrial is supported under limited circumstances.

Analysis of how national, local policies and the NSIP planning process affected Drax's planning application

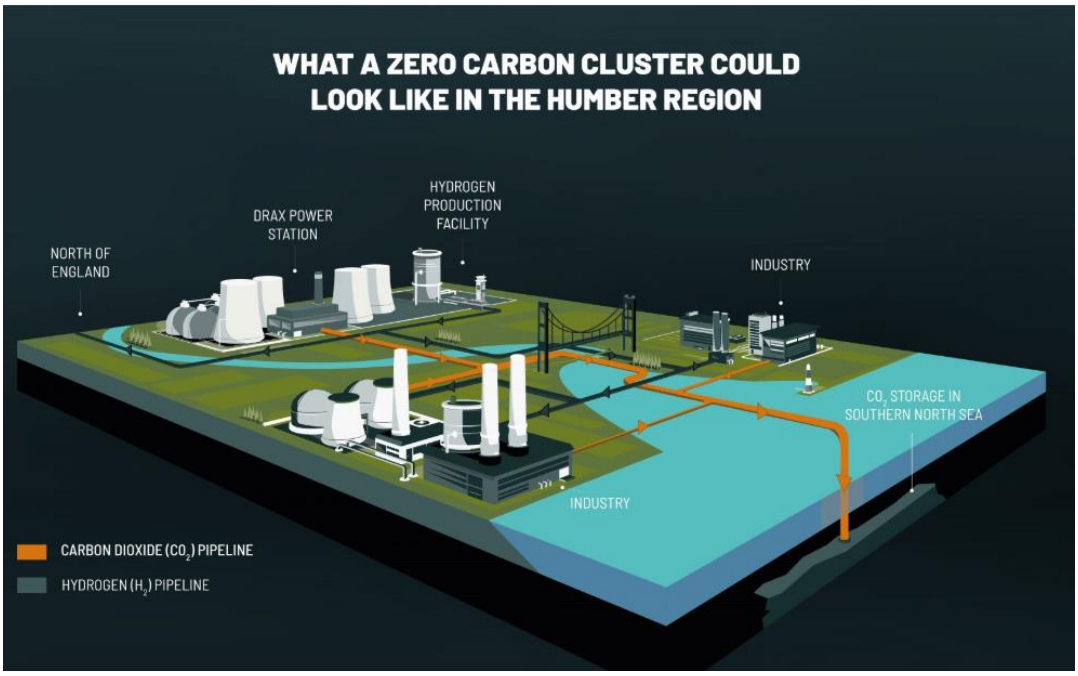
When a developer seeks planning permission for a scheme through NSIP, the NPS are given the greatest weight, however the Local Authority policies are also considered. As the local policies have not introduced any consideration above those in the NSIP, broadly that there are acceptable residual impacts on the environment, human health, amenity and infrastructure (roads, rail etc) the focus of this analysis will be on NPS.

Prior to Drax's BECCS application, the adopted NPS was the version issued in July 2011 required CCS applications to feature a complete chain, but not did provide reassurances over level of detail/maturity of transport and storage stages. This is particularly interesting as it did not inhibit Drax from submitting a BECSS application. During the ExA's review of Drax's application the NPS policy was updated in the September 2021 draft EN-1[48] and included policy 4.8.6 stating that *'…it is likely that development consent applications for power CCS projects may not include an application for consent for the full CCS chain (including the onward transportation and storage of CO_2). However, development consent applications for power CCS projects should include details of how the captured CO_2 is intended to be transported and stored, how cumulative impacts will be assessed and whether any necessary consents, permits and licences have been obtained.'*
As such a CC project does not have to include the full chain of transport and storage. This is a crucial reassurance for the DRAX BECCS application as the application was only for the biomass carbon capture aspect[49]. As demonstrated in Figure 5-2, Drax's BECCS plan is based on theoretical carbon capture routes.

[48] GREAT BRITAIN. Department for Business, Energy & Industrial Strategy, 2021. **Draft Overarching National Policy Statement for Energy (EN-1)**. Available from: https://assets.publishing.service.gov.uk/media/6132402cd3bf7f05b2ac1f4b/en-1-draft-for-consultation.pdf [Accessed 3 April 2025].

[49] GREAT BRITAIN. Planning Inspectorate, 2024. **Drax Bioenergy with Carbon Capture and Storage Project**. Available from: https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010120 [Accessed 3 April 2025].

Figure 5-2. Drax BECCS and integration into zero carbon cluster[50]



The general theme of NPS EN-1 planning policy is that there is support for the development on the basis there is no significant impacts on the environment, human health, amenities and infrastructure. Whilst Drax's operations have been managed to minimise impacts on the surrounding environment, Drax and the surrounding industrial areas in general will limit the surrounding areas capacity to absorb additional impacts.

Drax submitted an Environmental Statement to the planning inspectorate which is where compliance with planning policy 4.2.1 is demonstrated. The Non-Technical summary of Drax's Environmental Statement application[51] details the baseline and therefore environmental capacity surrounding Drax to absorb impacts from traffic and transport, air quality, noise and vibration, ecology, landscape and visual, heritage, ground conditions, water environment, materials and waste, population, greenhouse gases, health and socioeconomics and major accidents and disasters.

The environmental capacity for additional development at Drax is considered good across most of the topics listed above, with the exception of air quality due to acid and nitrogen deposition critical loads exceeding at nearby designated habitats. However, air quality and all other impacts compared to the baseline are considered to be acceptable. With some topics actually receiving a positive impact as a result of the proposed changes, most obviously carbon emissions decrease during the operational phase, with a positive impact on the socioeconomics and the BNG plan proposed achieving a beneficial impact on biodiversity and ecology.

Drax's application was open for consultation during the whole planning process to stakeholders and then underwent examination, with the Examining Authority reviewing the technical submissions compliance with national policy and local policy and considering any additional points raised during consultation phases. The ExA submitted their recommendation report[52] to SoS which was considered in the final decision on the application. Drax's BECCS proposal was approved given that there is significant benefit to carbon emissions, moderate positive socio-economic benefits and little positive impacts on ecology. With SoS and ExA finding there are neutral impacts for most topics, with the exception of historic environment, landscape and visual amenity, land use and ground conditions and air quality having little negative weight.

[50] DRAX, 2021. *Capture for Growth: Zero Carbon Humber Report* [online]. Available from: https://www.drax.com/carbon-capture/capture-for-growth-zero-carbon-humber-report/#chapter-1 [Accessed 12 March 2025].

[51] DRAX, 2023. *Drax BECCS Environmental Statement Vol 4: Non-Technical Summary* [online]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010120/EN010120-000247-6.4%20Drax%20BECCS%20ES%20Vol%204%20Non-Technical%20Summary.pdf [Accessed 12 March 2025].

[52] INFRASTRUCTURE PLANNING INSPECTORATE, 2024. *Drax BECCS Recommendation Report* [online]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010120/EN010120-001652-Drax_BECCS_Recommendation_Report.pdf [Accessed 12 March 2025].

With the SoS decision report[53] providing greater detail on the ecology and air quality impacts, due to additional detail required for ecology for construction mitigation and timescales to be achieved. For air quality impacts from nitrosamines and amines was queried due to on-going research in the field of carbon capture technologies. The SoS notes that due to CCS being deployed in clusters, applications are not expected to include the full chain of capture, storage and transport.

Conclusions of policy impact on planning and areas for improvement

The NPS makes it clear to developers that there is general support for energy infrastructure schemes if there are no adverse significant impacts. Consequently, Drax's application was submitted on the basis that impacts had been mitigated. Based on the SoS report, the key challenges to the decision-making process were weighing up the adverse and positive ecological impacts, and that developers should avoid adverse impacts during construction to streamline this decision-making process.

The benefit of the Town and Country and DCO planning processes is that EIAs are required for developments likely to cause significant environmental effects and captures the environmental capacity for additional developments taking into consideration existing pollution and upcoming from committed developments. A challenge for EIA in the planning process is that environmental assessment guidance lags behind the latest research of safe or harmful dose responses to ecological and human health receptors and monitoring methodologies. This means that proposed schemes such as Drax are approved on an ever-moving body of scientific research with the risk further research may retrospectively identify unacceptable impacts. The current mechanisms in place to implement best available technology for environmental standards at existing operators occurs through additional planning applications and regular review of permits. An example of this at Drax is nitrosamine/amine assessment, where the SoS considered the application based on current guidance of nitrosamines/amines and deferred consideration of current research to the EA in their review of the Environmental Permit application and periodic reviews. As the EA's research into amine/nitrosamine matures this will reduce uncertainty of these impacts in applications. The Environmental Permitting regime compliments planning as uncertainties of the environmental impact knowledge base in regulated processes can be revised in periodic reviews of the permit.

NPS EN-1 and SoS response provides reassurance to CCS developers that the application does not need to include final designs for the full chain and that reference to outline plans in associated applications is sufficient to gain permission. Whilst it is appreciated that planning policies for novel technologies will be reviewed on a regular basis, ideally planning policies should be finalised in advance of target industries being ready for implementation and this will streamline the consultation and planning process.

5.6.3 Humber Zero Project – CO_2 capture projects

The Humber Zero Project represents a significant initiative aimed at decarbonising industrial operations within the Humber region. This project consists of two major developments: the implementation of PCC technology at the Phillips 66 Limited Humber Refinery and the integration of PCC technology at the VPI Immingham LLP Combined Heat and Power (CHP) Plant. At the Phillips 66 Humber Refinery, PCC technology will be installed on the Fluid Catalytic Cracker (FCC) stack. Meanwhile, at the VPI Immingham CHP Plant, PCC technology will be integrated with two gas turbines and auxiliary boilers. The combined effect of these developments is expected to capture up to 3.8 million tonnes of CO_2 annually, preventing emissions from being released into the atmosphere. Instead, the captured CO_2 will be transported via pipeline to a designated site for permanent geological storage[54,55].

The planning process for the Humber Zero Project followed the requirements outlined in the Town and Country Planning Act 1990. Given that the project spans two separate sites, individual applications were submitted for each location. However, due to their interrelated nature, the environmental impact was assessed collectively through a shared EIA.

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[53] **INFRASTRUCTURE PLANNING INSPECTORATE, 2024.** *Drax BECCS Secretary of State Decision Letter* [online]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010120/EN010120-001660-Drax_BECCS_SoS_Decision_Letter.pdf [Accessed 12 March 2025].

[54] **NORTH LINCOLNSHIRE COUNCIL, 2022.** *Planning Application PA/SCO/2022/2* [online]. Available from: https://apps.northlincs.gov.uk/application/pa-sco-2022-2 [Accessed 12 March 2025].

[55] **NORTH LINCOLNSHIRE COUNCIL, 2023.** *Planning Application PA/2023/422* [online]. Available from: https://apps.northlincs.gov.uk/application/pa-2023-422 [Accessed 12 March 2025].

In March 2023, the application for planning permission was formally submitted. A comprehensive EIA was conducted to evaluate the project's potential effects. After a thorough review process, a final decision on the applications was reached on 5th August 2024. The entire process, from submission to approval, took approximately 1 year and 5 months.

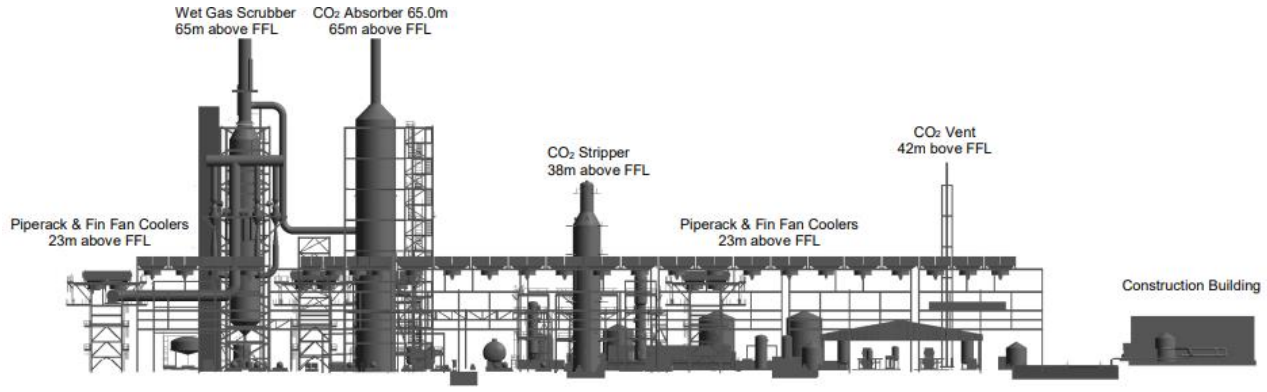
Several key stakeholders have been actively involved in the Humber Zero Project. The North Lincolnshire Council served as the local planning authority responsible for assessing and approving the applications. Environmental agencies conducted evaluations to assess the project's potential ecological impact and ensure compliance with environmental regulations. Additionally, local communities and businesses were engaged through consultations to assess social and economic implications. Network Rail was also involved in the project due to the need for permitting a pipeline crossing over railway infrastructure.

The Humber Zero Project aligns with several national and regional policies that support industrial decarbonisation and low-carbon energy developments. The project complies with the National Planning Policy Framework (NPPF, 2021), which emphasises the importance of sustainable energy initiatives. Furthermore, it adheres to the Overarching NPS for Energy (EN-1) and the Fossil Fuel Infrastructure Policy (EN-2), both of which support the implementation of carbon capture technologies. On a regional level, the project is guided by the North Lincolnshire Local Development Framework (LDF), ensuring that it contributes to environmental sustainability while fostering economic growth.

The successful implementation of the Humber Zero Project requires significant infrastructure development. At both sites, carbon capture and compression facilities will be constructed. These will include PCC units, absorption towers, solvent regeneration systems, and high-pressure CO_2 compression stations to facilitate efficient carbon capture and processing.

To enhance the efficiency of CO_2 capture, additional flue gas pre-treatment technologies will be implemented, including Selective Catalytic Reduction systems, wet gas scrubbers, and wet electrostatic precipitators. Captured CO_2 will then be transported via a dedicated pipeline network to a geological storage facility. In addition to these developments, new internal roads, electrical substations, and a new site access road from Eastfield Road will be constructed to support the project's operations.

Figure 5-3. Humber Zero: Phillips 66 FCC Post Combustion Carbon Capture[55]



The EIA for the Humber Zero Project was conducted by AECOM Limited. This assessment examined a wide range of environmental factors to determine the project's potential impacts.

One of the key findings of the EIA was that the project would significantly reduce air pollution through the capture of carbon emissions. Noise and vibration levels were also assessed, with mitigation measures identified to minimise potential disturbances during construction and operation. The study evaluated the impact on traffic and transportation, particularly in relation to construction-phase disruptions and long-term logistical considerations. Water resource management and flood risk assessments were conducted to ensure site drainage and water usage were handled effectively.

The ecological impact of the project was carefully considered, particularly concerning the nearby Humber Estuary, which is designated as a Site of Special Scientific Interest, Special Area of Conservation, Special Protection Area (SPA), and Ramsar site. The project was also evaluated in terms of its contributions to climate change mitigation and carbon reduction. Lastly, the EIA examined socio-economic factors, highlighting potential job creation and economic benefits for the region.

Barriers, Enablers, and Benefits
Several key factors enabled the project's progress. A clear policy direction from the UK government, emphasising industrial decarbonisation, played a crucial role in facilitating approval processes. Early engagement with stakeholders, including local authorities, businesses, and environmental groups, helped address concerns and streamline the planning process. The use of proven Post-Combustion Capture (PCC) technology provided confidence in the project's feasibility and risk management.

The Humber Zero Project offers several major benefits. It represents a significant step towards reducing carbon emissions on a regional and national scale, contributing to the UK's broader net-zero ambitions. Additionally, it strengthens the Humber region's position as a leader in clean energy and low-carbon industrial innovation. The project is also expected to generate economic benefits, including job creation and supply chain opportunities during both the construction and operational phases.

Despite the significant potential benefits of the Humber Zero Project, several challenges had to be addressed. One of the primary challenges was navigating the complexity of regulatory requirements, as the project required approvals from multiple agencies and compliance with a range of environmental and planning policies. Another challenge was ensuring that the new carbon capture infrastructure could be seamlessly integrated with existing refinery and power plant operations. Additionally, the financial viability of the project relied on government incentives and carbon pricing mechanisms to support long-term sustainability.

5.7 KEY TAKEAWAYS

Policy support for decarbonisation is strong across all levels where in which a clear finding is that from local councils up to national government, policy documents overwhelmingly support the principles of industrial decarbonisation in Humber, Teesside and HyNet clusters. Local Plans in these areas generally include relevant policies – either newly added or interpreted – that encourage low- carbon industrial developments. For instance, North Lincolnshire's Local Plan (draft) not only supports renewable energy generally, but specifically highlights carbon capture and hydrogen infrastructure as encouraged developments. Redcar & Cleveland's Local Plan allocates the former steelworks for new industry and innovations, which has been crucial for justifying planning approvals on that site. In practice, this supportive policy base has enabled projects to secure permissions: Keadby 3 (Humber) and Meld Energy's Saltend hydrogen plant are cases where local policy alignment and climate emergency declarations have been utilised to build the planning case. Likewise, the planning application for Net Zero Teesside was able to cite the South Tees SPD's vision as supportive evidence, and the council agreed the project fit with the Local Plan aims.

Climate emergency declarations and Net Zero strategies, though not as binding as Local Plans, still meaningfully influence decisions. They create a political mandate and a material consideration that often favours proposals reducing emissions. Tees Valley's Net Zero strategy, quantifying the cluster's emissions and setting a 2040 net-zero goal, reinforces the message that each major industrial application must be consistent with decarbonisation ambitions. This has led to consents including conditions requiring carbon-capture readiness or pipeline connections for new industrial facilities, effectively translating policy aspirations into practical requirements.

There are notable examples of planning tools enabling industrial transformation:

- South Tees SPD & Development Corporation: The South Tees SPD, developed in tandem with the STDC, stands out for offering clarity to investors by explicitly supporting energy innovation. The SPD also streamlined infrastructure improvements by calling for upgraded utilities and transport links, implemented through public-private partnerships. The SPD was developed with extensive consultation and an SEA, ensuring community and environmental considerations were incorporated. Other regions could replicate this model for large industrial sites.
- *Use of Existing Industrial Land (Brownfield First):* Another good practice is "brownfield first" development, seen across all clusters: HyNet's hydrogen plant at the Stanlow complex and Teesside's projects at Teesworks have minimised land use conflicts and environmental harm by reusing previously developed sites. This approach, which aligns with national and local policy and reduces public opposition. There is the potential for regulatory processes to be expedited, by avoiding extensive assessments and negotiations typically associated with undeveloped or greenfield sites. The existence of prior infrastructure, baseline environmental data, and fewer ecological constraints on these previously developed sites streamlines the planning and regulatory processes, allowing developments to proceed more swiftly and efficiently.

- *Early Regulatory Engagement:* Early regulatory engagement further supports decarbonisation projects by allowing developers and regulators to address potential hurdles before planning applications are finalised. For instance, the HyNet project team worked closely with the Health and Safety Executive and the EA during FEED to confirm compliance regarding hazardous substances and environmental permits, setting a precedent for a more efficient determination process. By scheduling multiple permit applications in parallel and giving regulators advance notice, the HyNet team avoided bottlenecks when the cluster's large pipeline of applications arrived simultaneously.

Despite broad support, there are some challenges where policy or process could be strengthened. A key issue is the policy lag: technology is advancing more rapidly than local plan updates, with many plans for the relevant authorities dating back to mid-2010s. These plans often do not explicitly mention innovations such as hydrogen or carbon capture, instead implicitly supporting them under broader categories like "industry expansion" or "renewable energy". Whilst this approach has sufficed until now, more explicit policies would remove any ambiguity. For instance, including policy that safeguard corridors for CO_2 pipelines or designates a "low-carbon infrastructure priority area" would proactively prevent conflicts (such as incompatible land uses along a planned pipeline route). As cluster projects progress, councils should update locals plans or produce targeted SPDs to address these specifics. North Lincolnshire's draft plan is an example to this as it directly references the Humber pipeline project. Both local authorities and developers recognised a lack of guidance on planning and permitting for CCUS and hydrogen projects. They also identified the lack of technological expertise as a contributor to application processing delays.

Permitting complexity can also slow down decarbonisation projects. In many cases, environmental regulations were not originally designed for large-scale CO_2 transport or hydrogen networks. Regulators are adapting by treating CO_2 capture as an emissions-scrubbing technology or by slotting hydrogen projects into existing permit categories, but this often creates uncertainty about what constitutes best available techniques for brand-new processes. Multiple permit requirements, from environmental permits and hazardous substances consents to marine licences for offshore pipelines, must align in a coordinated timeframe—especially for interdependent projects such as capture plants and shared CO_2 pipelines. The scheduling challenges can deter investors if there are risks of prolonged permit reviews or mismatched consenting timelines.

While permitting and consenting are bottlenecks, a greater risk to cluster development is not the approval process itself but the lack of a coordinated approach. Cross-boundary coordination is another challenge when clusters span multiple council areas, as in the Humber and HyNet regions. Although freeport boards and combined authorities help facilitate dialogue, there is limited formal collaboration—for example, through statutory joint plans or joint planning committees. A shared framework focused on decarbonisation infrastructure could standardise policies on pipeline routing, developer contributions, and environmental mitigation, preventing inconsistencies. The absence of an official joint spatial plan means reliance on ad-hoc cooperation, which can be a weak link if priorities diverge. In the Humber's case, the "single conversation" created by the Cluster Plan and Humber Energy Board is an informal but effective proxy– formalising such collaboration could be beneficial. Cross-sector coordination is also necessary to ensure that infrastructure and services are built up at a sufficient scale and at the right time to avoid jeopardising project development.

Although regulations mandate that EIAs consider other known projects, there is no overarching cap or integrated assessment framework. In the UK, developments typically need both planning consent (for land-use approval) and separate environmental permits under the Environmental Permitting Regulations (EPR) for emissions or discharges. Importantly, EPR itself does not mandate having planning permission beforehand, but in practice, large or complex projects usually require both. These permits are issued on a project-by-project basis, with each application evaluated against existing environmental quality standards. A significant shortcoming of this approach is that it lacks a formal mechanism to assess the cumulative impact of multiple permits in the same area. As a result, early projects may consume much of the available environmental "headroom," potentially limiting opportunities for subsequent developments—a challenge highlighted by the HyNet/Teesside environmental capacity study.

A fragmented approach poses particular challenges for industrial clusters, where multiple large facilities can contribute simultaneously to air emissions and compete for limited water resources. Efforts to study and manage cumulative impacts more effectively like the Plan for Water (adopting a catchment-based model) and the Flood Risk Management Plans (FRMPs) 2021–2027 (coordinating flood prevention strategies across different authorities), indicate a move toward more integrated environmental planning. However, these initiatives still operate within a fragmented legal framework that issues permits on a facility-by-facility basis, with no mechanism to treat an entire cluster holistically. This gap is problematic for broader environmental challenges such as nutrient neutrality, where diffuse pollution from multiple sources benefits from coordinated solutions. Addressing broad-scale concerns therefore requires targeted government support to ensure that cumulative impacts are managed comprehensively across multiple sites.

The Labour Government, in office since July 2024, has focussed on aligning infrastructure and planning policy with the UK's net zero ambitions. Central to this agenda is the Planning and Infrastructure Bill 2025, which introduces a series of reforms intended to streamline the delivery of NSIPs. Key measures include adjustments to the DCO process, provisions enabling local authorities to set their own planning fees, and the establishment of a Nature Restoration Fund. The Bill builds on the foundations laid by the previous administration, including the reforms under the Levelling Up and Regeneration Act 2023 and its proposals for the replacement of the existing EIA framework with a system of Environmental Outcome Reports[56] – the Planning and Infrastructure Bill reinforces this outcomes-based direction, with mechanisms such as the Nature Restoration Fund and supporting guidance from Natural England, including the development of Environmental Delivery Plans, helping to identify local environmental priorities and direct mitigation efforts more strategically. The Fund offers developers an option to make upfront contributions to fulfil environmental obligations, potentially reducing the need for project-specific mitigation activities.

Although these reforms reflect a strategic, outcomes-based approach to planning, the Bill continues to evaluate developments largely on a project-by-project basis. There is no strategic, mandatory, overarching legal or policy framework that requires the assessment of cumulative impacts at the scale of industrial clusters like the Humber or Teesside. While multiple developers are required to assess cumulative impacts for their individual projects, there is no legal obligation for a coordinated assessment across an entire cluster or region. Although SEA applies to plans and programmes, it only applies if such a plan or programme exists. In the case of these industrial clusters, there is currently not a legally required, overarching cluster-wide plan that would trigger a comprehensive SEA. Instead, developments proceed through mechanisms such as NSIPs, individual consents, or sector-specific plans for hydrogen, carbon capture, or offshore wind. Each of these may be subject to SEA or EIA separately, but there is no requirement for an integrated, cluster-wide cumulative assessment unless a formal programme is created that mandates it. This may be particularly significant in regions with high levels of industrial activity—such as the Humber, Teesside, and Mersey clusters—where major investments in hydrogen, carbon capture, and offshore wind are underway. In these areas, overlapping impacts from multiple developments could exceed local environmental carrying capacities, emphasising the importance of a robust framework for CIA to safeguard long-term environmental resilience.

In summary, the document review shows that while existing policies are broadly supportive of cluster projects—acting as an enabler in most respects—there are still key gaps to address. Many of the current hurdles are mostly procedural (timing, coordination) and can be alleviated through better integration and updates to guidance. The strong alignment from national to local levels, coupled with pioneering efforts like the South Tees SPD and the Humber environmental capacity study, indicate that the planning system is adapting to support these industrial clusters. Strengthening this support will involve keeping policies up to date with technology, explicitly planning for cumulative impacts, and continuing to share best practices (each cluster is learning lessons that the others can use). As these clusters progress, they provide a testing ground for how planning and permitting can evolve to meet the pressing challenge of industrial decarbonisation nationwide.

5.7.1 Priority Challenges to Address

This section outlines the priority challenges identified by stakeholders, as well as through the document review, and their implications for accelerating low-carbon industrial development.

A fragmented consenting and licensing process increases risk of delays

- A major barrier to efficient cluster development is the lack of a single, comprehensive consenting process that addresses all necessary permits and licences for interlinked projects.
- Currently, separate consents (e.g. planning permission, environmental permits, marine licences, hazardous substances consent) must be pursued for each component—such as capture plants, CO_2 pipelines, hydrogen facilities, or shared transport infrastructure.
- This fragmented approach can lead to prolonged timelines, higher costs, and increased uncertainty. Where one element is delayed, dependent projects may have to pause or adjust timescales, introducing risk for developers and local authorities alike.

[56] A system designed to simplify and expedite the environmental assessment process while maintaining protective standards, with Environmental Delivery Plans (EDPs) prepared by Natural England playing a supporting role. These EDPs aim to identify local environmental priorities and outline recommended mitigation strategies.

- Moreover, regulatory bodies often interpret national policy differently, which can result in conflicting or overlapping conditions. Stakeholders therefore advocate for either an “umbrella” consenting model (enabling multiple related projects to be processed together) or a well-coordinated set of parallel consent pathways, underpinned by consistent national policy guidance.

Lack of coordinated spatial planning undermines strategic land-use decisions

- The absence of a formal spatial framework for siting and routing decarbonisation infrastructure creates difficulties for both developers and local authorities.
- Projects are often handled on a case-by-case basis, hindering a strategic cluster-based approach. A coordinated spatial strategy and better alignment between government strategy, local authority priorities, infrastructure development, and utilities is crucial to ensuring a holistic approach to economic development that is not impeded by resource or infrastructure unavailability.
- Despite the urgent national interest in decarbonisation, there is no dedicated national spatial plan designating corridors or ‘low-carbon industrial zones’ for CO_2 pipelines, hydrogen production, or renewable power integration.
- Consequently, each cluster must reconcile its requirements with diverse local plans, which may prioritise housing or other forms of development.
- Securing viable pipeline routes for transporting CO_2 and hydrogen is currently a hurdle, as these routes often compete with other high-priority land uses such as housing, solar, and wind projects.
- Effective connection between carbon capture equipment and hydrogen off-take projects via these pipelines is also critical.
- Where multiple local authorities are involved, cross-boundary pipeline routes or industrial expansions risk siloed decision-making.
- Without a unified spatial vision, vital decarbonisation infrastructure, such as shared CO_2 networks, may be constrained by competing land uses, leading to suboptimal routes and potential project delays.
- Many stakeholders highlight the need for statutory or at least robust voluntary cluster-level planning guidance to streamline site selection and pre-empt land-use conflicts.

Uncertainty over cumulative environmental impacts jeopardises future projects

- There's uncertainty regarding the cumulative environmental impacts of projects developed in a staggered manner rather than as a cohesive cluster.
- Many industrial decarbonisation proposals are approved on a project-by-project basis, which can obscure the collective effects on environmental capacity.
- Stakeholders repeatedly mention water abstraction limits, nutrient pollution, and air quality thresholds as areas of concern: if too many developments in the same cluster make demands on the local environment, the combined effect may exceed regulatory thresholds.
- Current environmental assessments typically address only “known” or “committed” projects, lacking a strategic, long-term vision. This approach fails to account for the interconnected demands of broader sectors such as utilities, infrastructure, housing, and industry. For instance, existing water shortages may remain unresolved without a clear strategy, hindering future growth.
- It's also difficult to reserve environmental capacity for future projects with unknown specifications.
- However, these capacity constraints are seldom identified early, as environmental assessments generally focus on “known” or “committed” projects.
- As a result, early consents may “use up” scarce headroom, limiting or delaying subsequent proposals.
- Stakeholders recommend broader strategic assessments, such as cluster-level SEAs, to pre-emptively evaluate cumulative impacts, ensure balanced resource allocation (e.g. water licences),

identify strategies for freeing up additional headroom and avoid displacing future projects critical to net-zero goals.

Shortfalls in Local Authority capacity and technical expertise constrain decision-making

- Local authorities often lack the resources or specialist knowledge to assess novel, large-scale decarbonisation applications involving carbon capture retrofits, hydrogen production, and pipeline infrastructure.
- With limited budgets and high workloads, planning teams may not have in-house expertise on amine-based capture technologies, hydrogen safety, or emerging permit requirements.
- Furthermore, where multiple councils oversee one cluster, there is no statutory duty requiring them to coordinate or pool technical skills.
- This shortage can stretch application determination periods and sometimes lead to inconsistent decisions.
- Stakeholders stress the need for dedicated government funding or secondment programmes to upskill planning officers, enabling swifter reviews and more robust conditions.
- They also recommend establishing shared technical advisory services or formal cross-boundary working groups, ensuring each council's decisions align with a shared cluster strategy.

Policy instability complicates long-term project commitments

- Developers and local authorities face difficulties when national priorities—such as the balance between CCUS, hydrogen, and electrification—remain in flux.
- In some instances, councils hesitate to allocate land or fast-track planning if they are unsure whether government policy will shift, for example, placing greater emphasis on direct electrification or alternative decarbonisation routes.
- Developers similarly delay final investment decisions when funding mechanisms (e.g. industrial decarbonisation business models) or policy statements appear subject to change.
- This instability can undermine confidence, slow project pipelines, and inflate overall costs.
- Stakeholders have for a dedicated NPS for CCUS and hydrogen, offering clear, stable direction on technology pathways.
- Frequent, light-touch reviews of local plans could then be used to reflect fast-evolving guidance, ensuring policy keeps pace with decarbonisation innovation.

Limited mechanisms for formal cluster-wide coordination result in ad-hoc solutions

- Although freeport boards, combined authorities, and local enterprise partnerships can foster dialogue, they lack the statutory powers to enforce consistent planning and permitting approaches across multiple jurisdictions.
- As a result, clusters often rely on ad hoc partnerships or goodwill arrangements to manage interdependent projects.
- Such informal structures can break down when local priorities diverge or resources are stretched.
- Formal cluster boards or joint planning committees, by contrast, could align decision-making, consolidate land-use strategies, and offer a single point of contact for developers.
- Government-led guidance on how to create (and fund) these governance bodies would help ensure that all local authorities in a cluster move in step on decarbonisation objectives.

6. STRATEGIC SPATIAL PLANNING APPROACHES

This section evaluates Strategic Spatial Planning (SSP) as a fundamental policy instrument for addressing complex spatial development challenges in pursuit of sustainable growth. Drawing on national and international case studies, including the EU's Net Zero Industry Act and associated Hydrogen Valleys initiative, the UK's HS2 high-speed rail project, Freeports, renewable energy deployment frameworks in Germany and Denmark, large-scale industrial zones, and experiences from electricity grid infrastructure planning, the analysis highlights key opportunities and challenges inherent in SSP practices.

The objective is to inform on how SSP can enhance regulatory coherence, streamline permitting processes, encourage proactive infrastructure development, and foster inclusive governance, thus supporting resilient, equitable, and sustainable spatial development aligned with national and international net-zero ambitions.

6.1 WHAT IS STRATEGIC SPATIAL PLANNING?

Planning is a fundamental tool to manage competing priorities and constrained resources. Strategic spatial planning can be defined as the high-level process of guiding and shaping the future development of *places*, such as towns, cities, regions, and industrial clusters, in a sustainable, coherent, and coordinated manner. At its core, strategic spatial planning holistically addresses an area's social, economic, and environmental needs, establishing a clear vision and comprehensive policies to achieve these objectives across various timeframes.

Strategic spatial planning typically occurs through two phases, namely plan-making and plan-implementation. The plan-making phase is primarily concerned with establishing visions, setting clear strategic objectives, and developing decision-making frameworks that guide future development for specific spaces or zones. The main output of this phase is therefore a plan that reflects an overall development strategy, with a strategic focus on selected themes and locations, covering long-term visions and short-term actions[57]. The subsequent plan-implementation phase focuses on translating these strategic plans into practical steps, detailing necessary infrastructure, funding responsibilities, and the roles of various agencies to ensure that the plan is effectively put into action.

Effective strategic spatial planning necessitates active participation from diverse stakeholders, including individual citizens, public sector bodies, industry leaders, landowners, academic experts, and community or environmental organisations. This inclusive approach ensures that different perspectives are incorporated, building consensus and facilitating smoother implementation.

The scope and practice of strategic spatial planning have significantly varied across countries, time periods, and sectors. In the United Kingdom, for example, institutional forms of strategic spatial planning such as Structure Plans, Regional Planning Conferences, Regional Planning Guidance, and Regional Spatial Strategies were key components of the planning system from the late 1960s through to the 2010s[58]. During this period, entities such as the Regional Development Agencies, notably Yorkshire Forward in 2008[59] and One North East[60] in 2010 played a crucial role in assessing, catalysing and co-ordinating the alignment of public, industry, hydrogen, CCUS and infrastructure stakeholders with industry developers to forge early industrial cluster decarbonisation plans.

However, in May 2010, a significant shift occurred in England with the abolition of Regional Spatial Strategies under the Localism Act of 2011. This legislative change led to more fragmented and localised approaches to spatial planning, with varying degrees of coordination and effectiveness. Currently, spatial planning practices across England differ markedly. Some local authorities choose to adopt voluntary collaborative frameworks, such as Joint Local Plans, while others leverage devolved powers and produce more comprehensive Spatial Development Strategies, exemplified by London's strategic planning efforts led by the Greater London Authority.

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[57] **HERSPERGER, A.M., GRĂDINARU, S., OLIVEIRA, E., PAGLIARIN, S., and PALKA, G., 2019.** Understanding strategic spatial planning to effectively guide development of urban regions. *Cities*, **94**, 96-105.

[58] **ROYAL TOWN PLANNING INSTITUTE, 2024.** *Strategic Planning Research – Main Report, July 2024* [online]. Available from: https://www.rtpi.org.uk/media/18233/strategic-planning-research-_-main-report-july-2024.pdf [Accessed 12 March 2025].

[59] **NS ENERGY, 2024.** *Networking the Big Emitters of Yorkshire and Humber* [online]. Available from: https://www.nsenergybusiness.com/analysis/featurenetworking-the-big-emitters-of-yorkshire-and-humber/ [Accessed 12 March 2025].

[60] **SUSTAINABILITY INTELLIGENCE, 2010.** *One North East CCS Final Report* [online]. Available from: https://intelligence.sustainability.com/contentassets/553cd40a6def42b196e32e4d70e149a1/ee-one-north-east-ccs-final-report_2010.pdf [Accessed 12 March 2025].

Generally, implementation of strategic spatial planning involves several key elements, including a long-term vision, spatial distribution of development, location of strategic growth, an implementation framework, and shared metrics. The implementation framework should clarify how the strategic plan will be put into effect, including required infrastructure and funding responsibilities, with commitment from delivery agencies and infrastructure providers. Moreover, a 'systems' approach is needed to align strategic spatial planning with other plans and strategies across sectors and different geographies, facilitated by better data sharing between agencies. Ultimately, strategic planning should be embodied in a statutory document, but not be 'a big local plan'. It should maintain a sub-regional focus, validating existing structures and processes where possible.

Moreover, strategic spatial planning is often closely integrated with master planning, especially during the detailed design and implementation stages. Masterplans provide specific guidance on aspects such as physical layout, infrastructure provision, land use distribution, and development character. A notable example of this integration is the master planning process for the Olympic Park in Stratford, East London. The masterplan for the London 2012 Olympic Games transformed a historically deprived area into a thriving urban district by coordinating residential, commercial, leisure, and transportation infrastructure while emphasising sustainability, economic revitalisation, and social inclusion.

In the Tees Valley, a more targeted approach has been adopted. The South Tees Area SPD, introduced in 2018, sets out planning guidance for the regeneration of a major industrial site within Redcar and Cleveland. Rather than functioning as a masterplan for the entire cluster, the SPD provides a strategic framework to guide decision-making within the South Tees area—promoting sustainable economic growth, environmental stewardship, and infrastructure coordination. Alongside this, the Tees Valley Net Zero Cluster Plan outlines a roadmap to decarbonise local industry by 2040, supporting national climate targets and positioning the area as a hub for clean growth.

Together, these cases demonstrate how spatial planning instruments can be used to support place-based transformation, whether through short-term catalytic interventions or sustained regional development strategies.

6.2 CASE STUDIES

The National Infrastructure Commission's 2017 International Review of Infrastructure Governance illustrates that infrastructure planning is a long standing and global challenge[61], not confined to the UK. This section provides some recent case studies describe where and how strategic spatial planning is being used, and benefits and drawbacks.

6.2.1 EU Net Zero Industry Act – Hydrogen Valleys

The Net Zero Industry Act (NZIA)[62] is a legislative proposal by the European Commission, introduced in March 2023, to accelerate the EU's clean technology manufacturing and support its transition to net-zero emissions by 2050. As part of the Green Deal Industrial Plan, the NZIA aims to strengthen Europe's industrial competitiveness by reducing reliance on non-EU supply chains and boosting domestic production of key net-zero technologies, including solar, wind, batteries, hydrogen, carbon capture, and grid infrastructure. The act sets a target for the EU to produce at least 40% of its clean technology needs by 2030 and introduces measures such as faster permitting, investment incentives, and workforce training to achieve this goal. Additionally, it incentivises the development of CO_2 storage infrastructure by requiring oil and gas producers to contribute to a target of 50 million tonnes of CO_2 storage capacity per year by 2030. By promoting innovation, resilience, and sustainability, the NZIA aims to position Europe as a leader in the global green economy while ensuring energy security and industrial growth.

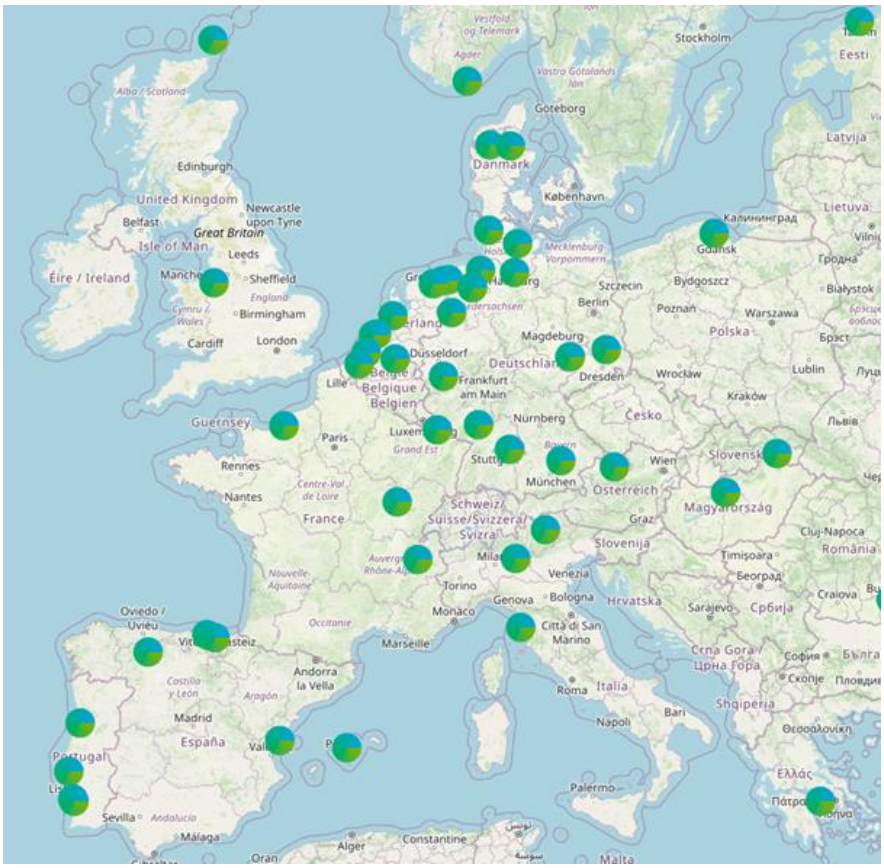
The NZIA highlights hydrogen as a key component of the EU's net zero strategy, particularly for sectors where direct electrification is challenging. The EU aims to expand Hydrogen Valleys and accelerate permitting to support industrial decarbonisation. A 'Hydrogen Valley' is a geographical area in which numerous hydrogen applications are combined together into an integrated hydrogen ecosystem that consumes a significant amount of hydrogen, improving the economies of scale of such projects. Hydrogen Valleys play a crucial role in reducing emissions from hard-to-decarbonise sectors, also supporting economic growth, technological

[61] **NATIONAL INFRASTRUCTURE COMMISSION, 2023.** *International Infrastructure Governance Report* [online]. Available from: https://nic.org.uk/app/uploads/NIC-International-Infrastructure-Governance-Report.pdf [Accessed 12 March 2025].

[62] **EUROPEAN COMMISSION, 2024.** *Net-Zero Industry Act* [online]. Available from: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/net-zero-industry-act_en [Accessed 12 March 2025].

innovation, and energy security through the reduced reliance on traditional fossil fuels. Under the REPowerEU plan, the goal is to produce 10 million tonnes of domestic renewable hydrogen and import another 10 million tonnes by 2030, with an expected 100 GW of installed electrolyser capacity. Significant investment and workforce development are needed, with an estimated 180,000 skilled workers required in the hydrogen sector by 2030. These efforts position hydrogen as a cornerstone of the EU's clean energy transition[62].

Figure 6-1. Hydrogen valleys in the EU[63]



On June 25, 2024, the European Commission reported progress toward establishing at least 50 Hydrogen Valleys by 2030. A Staff Working Document outlined strategic actions, including support for a 'Hydrogen Valley Facility' via the Clean Hydrogen Joint Undertaking to advance early-stage projects, and the launch of a Clean Hydrogen Knowledge Hub to facilitate data-driven decision-making. Additionally, the Commission has approved four waves of hydrogen Integrated Projects of Common European Interest (IPCEIs), aiming to mobilize over €43 billion in public and private funding for more than 120 projects involving nearly 100 European companies.

The European Hydrogen Academy, inaugurated in January 2024 with a €3 million EU contribution, is set to develop into a European Net-Zero Industry Academy, offering comprehensive training and reskilling programs. International collaboration on clean hydrogen deployment is also being intensified, particularly through the Clean Hydrogen Mission under Mission Innovation. To date, 67 Hydrogen Valleys are located within the EU, with 17 receiving €262 million in support from EU research and innovation programs. However, approximately three-quarters of these projects remain in early development stages, necessitating continued support to become fully operational[64].

Regarding permit-granting procedures and regulatory streamlining, the NZIA aims to simplify and accelerate administrative processes for net-zero technology projects. Firstly, the Act shortens approval timelines by capping the duration of permit procedures at 12 to 18 months, depending on the project's size and scope.

[63] **CIRCULAR PORTS, 2024.** *European Hydrogen Valley status for Flemish ports.* Available from: https://circularports.vlaanderen-circulair.be/european-hydrogen-valley-status-for-flemish-ports/ [Accessed 14 March 2025].

[64] **EUROPEAN COMMISSION, 2024.** *Repowering EU Hydrogen Valleys: Commission Presents Progress Towards European Hydrogen Economy* [online]. Available from: https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/repowering-eu-hydrogen-valleys-commission-presents-progress-towards-european-hydrogen-economy-2024-06-25_en [Accessed 12 March 2025].

Projects with an annual manufacturing capacity of <1GW must receive a decision within 12 months, whilst projects with a capacity of >1GW must be determined within 18 months. Although these timelines provide greater legal certainty, they may be extended in exceptional circumstances. Furthermore, Member States retain the flexibility to set shorter deadlines if they choose. Additionally, governments are required to provide administrative support to ensure the timely and effective implementation of net-zero projects within their territories[65].

To further streamline regulatory processes, the Act introduces several measures aimed at reducing administrative burdens. By 30th December 2024, every Member State must have established a single point of contact to oversee the permit-granting process and provide guidance on regulatory requirements for net-zero technology manufacturing projects[65].

Where an EIA is required, the single point of contact will provide guidance on the necessary scope and level of detail before the assessment begins. If multiple EU directives impose overlapping environmental assessment requirements, Member States must ensure that a coordinated or joint assessment is conducted, leading to a single environmental review. This approach also applies to planning applications and regulatory reviews, further reducing delays and administrative complexity. The Act specifies that any required EIA must be completed within 90 days from the receipt of all relevant information, a significant reduction compared to standard processing times[66]. More specifically, the determination of the scope of the assessment must be completed within 45 days, and public consultation within 30 – 85 days[67].

The NZIA also facilitates the creation of net-zero acceleration valleys, where multiple net-zero technology projects are grouped together in clusters. This approach is intended to streamline administrative processes and reduce regulatory burdens. By concentrating projects in designated areas, it may be possible to **conduct overarching EIAs that cover multiple projects at once, rather than requiring separate assessments for each individual initiative** [67].

Overall, these provisions are designed to accelerate project approvals, enhance legal certainty, and facilitate the development of net-zero technologies by reducing regulatory delays and administrative complexity.

6.2.2 Freeports

In March 2021 the UK government announced 8 locations as being successful in their bid to become freeports: Teesside, Liverpool City Region, Humber, East Midlands, Freeport East, Thames, Solent and Plymouth and South Devon[68]. Wales and Scotland have separate allocations for freeport applications and Northern Ireland is reviewing implementation of Freeports. The geographic coverage of Freeports in the UK is shown in Figure 6-2.

[65] **ASHURST, 2024.** *Getting Ready for the EU Net-Zero Industry Act* [online]. Available from: https://www.ashurst.com/en/insights/getting-ready-for-the-eu-net-zero-industry-act/ [Accessed 12 March 2025].

[66] **PAUL HASTINGS, 2024.** *The Net-Zero Industry Act* [online]. Available from: https://www.paulhastings.com/en-GB/insights/client-alerts/the-net-zero-industry-act [Accessed 12 March 2025].

[67] **TWOBIRDS, 2024.** *Aktuelle europäische Pläne zur Förderung von Wasserstoff-Technologien* [online]. Available from: https://www.twobirds.com/en/insights/2024/germany/aktuelle-europaeische-plaene-zur-foerderung-von-wasserstoff-technologien [Accessed 12 March 2025].

[68] **UK GOVERNMENT, 2022.** *UK Freeports Programme Annual Report 2022* [online]. Available from: https://www.gov.uk/government/publications/uk-freeports-programme-annual-report-2022/uk-freeports-programme-annual-report-2022 [Accessed 12 March 2025].

Figure 6-2. Location of UK Freeports

1. **East Midlands Freeport**
2. **Freeport East**
3. **Humber Freeport**
4. **Liverpool City Region Freeport**
5. **Plymouth and South Devon Freeport**
6. **Solent Freeport**
7. **Teesside Freeport**
8. **Thames Freeport**
9. **Forth Green Freeport**
10. **Inverness and Cromarty Firth Green Freeport**
11. **Anglesey Freeport**
12. **Celtic Freeport**

The Freeports initiative represents a form of strategic spatial planning, developed to enable '*create an attractive business environment with the aim of rebalancing local economies by building new clusters in sectors of the future'*. Freeport locations were established by private companies with business interests at air/sea ports applying to become Freeport locations and subsequently spatial planning is led by business interest rather than preferred locations from the UK government.

The mechanisms that Freeports use to encourage investment are fiscal and regulatory such as lower taxation through national insurance reduction for employers within Freeport designations and streamlined customs agreements for whole freeport locations[69]. This project has not identified whether Freeports also enable environmental capacity challenges to be managed holistically within a given Freeport, the main focus of studies on Freeports to date being on economic benefits.

Oversight in these zones can be provided by Mayoral Development Corporations such as the STDC which are empowered to coordinate development and infrastructure at scale.

The House of Commons Business and Trade Committee undertook a performance review of Freeports in 2024[70] and identified the following advantages and disadvantages.

Advantages

Freeports have attracted £2.8 billion of private investment as of April 2024. With part of this being a £400 million investment in the Teesside Freeport to manufacture offshore wind turbines, £1 million in Marine Autonomy at Plymouth and rare earth processing hub at Humber Freeport. Although there was some discussion around whether the investment is 'additional' and if investment has been redirected from other locations.

Disadvantages

Enterprise Zones created in 2011 caused a third of businesses in the UK to relocate and consequently not achieving the goal of creating 'additional' jobs. Clustering could have the opposite effect to desired as non-service industries require extensive floor space and may need to relocate due to limited suitable space in Freeports. Further to this advanced manufacturing may be reluctant to be so close to competitors due to confidentiality of intellectual property.

[69] **UK GOVERNMENT, 2024.** *UK Freeports Induction Pack* [online]. Available from: https://assets.publishing.service.gov.uk/media/6763f8854e2d5e9c0bde9b99/UK_Freeports_induction_pack.pdf [Accessed 12 March 2025].

[70] **UK PARLIAMENT, 2024.** *Parliamentary Committee Publication* [online]. Available from: https://committees.parliament.uk/publications/44455/documents/221158/default/ [Accessed 12 March 2025].

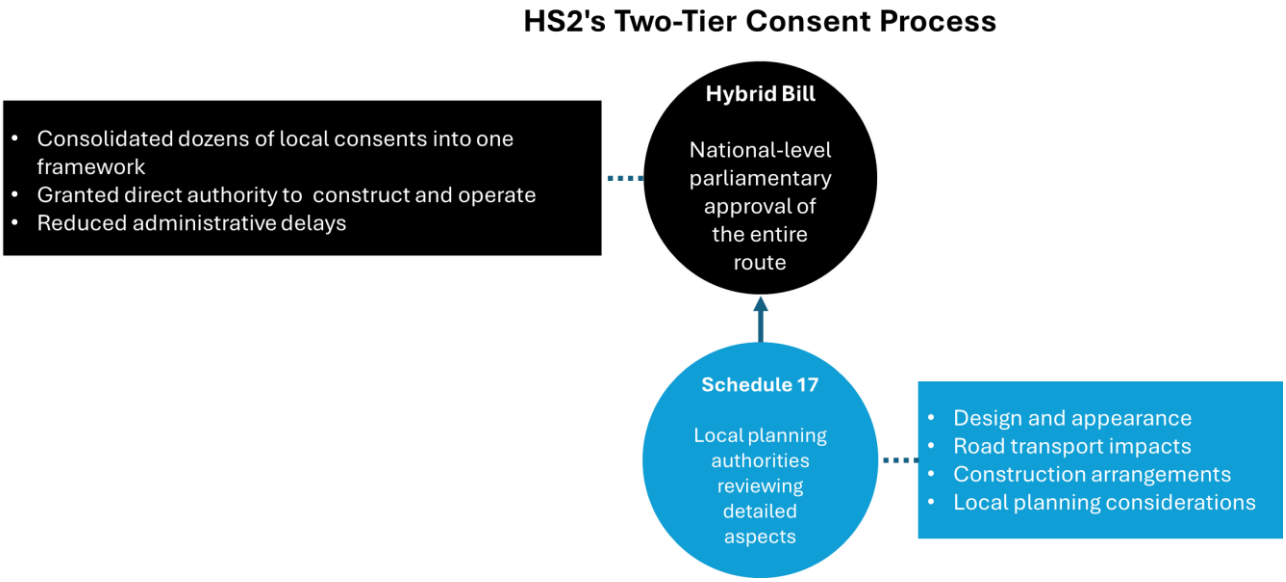
A total of four Freeports including Solent wrote to the Houses of Parliament inquiry raising that there was insufficient resource to process planning. In response the Department for Levelling Up, Housing and Communities setup a 'Planning Super Squad'. As of August 2024, Cambridge City Council have been chosen to review all areas of planning services and develop an accelerator model to be reviewed by central government with the intention of rolling this out nationally. The aim of the 'Planning Super Squad' is to build capacity and efficiency at a local level, such as within a local authority. At Teesside Port there have been reports that joint partnership between Teesside Valley Combined Authority and the private sector has not received the necessary scrutiny to deliver good value for public money. It was recommended that adoption of Nolan Principles of transparency during decision making and linking overall accountability of Freeports to a single regional leader such as a Metro Mayor[71] could resolve these issues.

Conclusion

Freeports are an economic designation aimed to drive investment. The area within a freeport can be large and the freeport operator will have decisions to make on inter-spatial planning within their zone on infrastructure such as transport, water and energy. Further analysis on freeport locations is recommended to understand how benefits on shared infrastructure are realised. Using fiscal and customs incentives to encourage investment within an existing industrial area is likely to drive growth within a specific area. However, decision making should be transparent and that there are sufficient local authority resources to determine planning applications. Whilst the Planning Super Squad aim to develop planning at a local level, it may be useful for a national pool of planners to be established that are experienced with spatial planning schemes such as Freeports or Industrial Clusters to increase depth and resilience of the resource pool to unlock growth potential.

6.2.3 HS2 High-Speed Rail (UK) – Special Planning Processes for National Projects

Figure 6-3. HS2 High-Speed Rail (UK) planning and approval framework



Major rail projects illustrate the value of *integrated long-term planning* and special consent processes. The HS2 rail project serves as an example to this and demonstrates how the UK can handle planning for nationally significant infrastructure in a streamlined, centralised way – though not without controversy. Traditionally, major infrastructure projects in the United Kingdom have been subject to local planning permission processes involving multiple consultations and inquiries. HS2 diverged from this approach by being authorised via a Hybrid Bill, The High-Speed Rail (London – West Midlands) Act 2017, in Parliament, a legislative instrument that amalgamates planning and enabling provisions into a single, comprehensive process, effectively granting upfront approval for an entire route. This mechanism granted the government direct authority to construct and operate the high-speed railway, between London and the West Midlands, including new stations at London

[71] **CAMBRIDGE CITY COUNCIL, 2024.** *Government Funding for Planning Supersquad Awarded to Greater Cambridge Shared Planning* [online]. Available from: https://www.cambridge.gov.uk/news/2024/08/23/government-funding-for-planning-supersquad-awarded-to-greater-cambridge-shared-planning [Accessed 12 March 2025].

Euston, Old Oak Common, Birmingham Curzon Street, and Interchange near Solihull, significantly reducing administrative delays associated with fragmented local consents and outlined the process that bundling an entire corridor into one consent mechanism can expedite delivery.

The Hybrid Bill procedure allowed for the consolidation of dozens of local consents into one legislative framework, offering legal certainty upon its passage. Instead of facing protracted and piecemeal approvals, the project benefitted from a national-level decision-making process that both expedited construction and reduced bureaucratic complexity. Stakeholders, including affected communities, retained the right to engage through petitioning and parliamentary Select Committee processes. However, while such engagement allowed for potential route adjustments and mitigation measures, it did not provide a veto power over the project. This structure underscores the importance of balancing expedited decision-making with avenues for local input. The hybrid bill approach compressed many consent approvals into one legislative process and provided legal certainty once passed.

While the Hybrid Bill provided the overarching consent for the railway and stations, it also outlined a process for obtaining approval of specific details related to the project's construction and delivery. For instance, High Speed 2 Limited (HS2 Ltd) must apply to local planning authorities for the approval of certain details associated with constructing and delivering the project. These submissions, known as 'Schedule 17 applications' (after Schedule 17 of the HS2 Act), pertain to aspects such as the design and appearance of structures, road transport impacts, and construction arrangements. Local planning authorities are responsible for reviewing these applications to ensure that the detailed plans comply with local planning considerations. This approach allows for both a streamlined, centralised authorisation and localised oversight of detailed planning aspects.

Additionally, rail network upgrades often benefit from *permitted development rights* and streamlined *Transport and Works Act Orders*, demonstrating how clear policy frameworks for linear infrastructure can accelerate permitting. Industrial clusters, which similarly involve linear pipelines and multiple sites, could benefit from a “corridor”-based planning approach akin to rail, where routes for CO_2 or hydrogen pipelines are safeguarded in local plans in advance. Early corridor designation (as done for rail lines) provides certainty and reduces later conflict.

For projects of strategic national importance (like a CO_2 pipeline network spanning regions), a special consent route can be beneficial. While CCUS clusters will mostly use the Planning Act 2008 NSIP process, the principle from HS2 is that *elevating decisions to a national level* can avoid fragmented local delays. For critical projects such as CO_2 pipeline networks, a special consent route may provide the necessary efficiency and legal clarity.

However, HS2 also teaches caution: strong stakeholder engagement and fair compensation are critical even under expedited regimes, as local opposition can still emerge. CCUS cluster planning should incorporate robust consultation (as HS2 did through its model of parliamentary petitioning and Select Committee reviews) to maintain public trust despite accelerated timelines.

6.2.4 Renewable Energy Deployment – Streamlining via Policy and Zoning

The renewable energy sector, particularly wind power, provides a compelling illustration of how robust policy frameworks and coordinated spatial planning can markedly accelerate the deployment of clean energy infrastructure. In the United Kingdom, for instance, the government’s early adoption of SEAs and the subsequent designation of offshore wind zones have proved highly effective in reducing investment risk by clarifying environmental constraints and identifying suitable areas in advance of formal applications. The Offshore Energy Strategic Environmental Assessment (OESEA) process, established initially in 1999 and updated through subsequent consultations, has helped safeguard marine and coastal ecosystems while guiding offshore developers toward optimal sites. This approach works in tandem with The Crown Estate’s leasing rounds—governed under the Crown Estate Act 1961—to further streamline project-level consents, ensuring that many potential ecological or navigational issues are addressed up front. By contrast, onshore wind development in the UK has historically faced more restrictive policies, partly due to provisions in the NPPF. These policies often limited the prospects for new wind projects unless local plans explicitly earmarked suitable areas. However, the most recent policy shifts signal a move toward relaxing these constraints,

reflecting a broader emphasis on diversifying low-carbon energy sources and accelerating progress towards net-zero[72].

Many of the most successful efforts to scale up renewable energy capacity hinge on policy and regulatory instruments that clarify planning and environmental obligations from the outset. The UK's Electricity Market Reform, underpinned by the Energy Act 2013, introduced Contracts for Difference (CfD) auctions, which require developers to secure planning permission prior to participation. Although primarily an economic mechanism, the CfD structure has, in practice, promoted more strategic site selection and reduced speculative projects. For offshore wind, a key enabler has been the coordination between CfD auctions, SEAs, and The Crown Estate's leasing framework, all of which ensure that permitted areas are well-aligned with ecological and technical considerations. This coordinated system fosters a more predictable investment environment and reduces protracted legal or permitting disputes. Similar principles extend across Europe, notably in the Renewable Energy Directive (Directive (EU) 2018/2001) and, more recently, the REPowerEU plan (COM(2022) 108 final), which encourages member states to designate "renewables go-to areas" with simplified permitting regimes. In such zones, renewable projects are deemed of overriding public interest, thereby narrowing the grounds for legal objections and helping to meet national and EU-wide decarbonisation targets under the European Green Deal.

Germany's experience offers a parallel illustration of how legislative reforms can catalyse faster renewables deployment. The Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG), introduced in 2000 and revised multiple times, has underpinned feed-in tariffs and auction systems for wind power. More recent legislation, such as the Windenergieflächenbedarfsgesetz (Onshore Wind Area Requirement Act), requires each federal state (Bundesland) to allocate around 2% of its territory for wind power. Noncompliance can curtail a state's ability to impose stringent setback distances, thereby compelling local authorities to proactively identify and designate suitable tracts of land. By mitigating conflicting land uses and overlapping regulations—from the Federal Nature Conservation Act to local Baugesetzbuch (building code) rules—this legislation reduces the typical five- to eight-year permitting timelines, ultimately helping Germany scale up its wind capacity more swiftly (Bundesministerium für Wirtschaft und Energie, 2021; Bundesrat, 2022).

Denmark, widely recognised as a pioneer in wind energy, has similarly relied on well-defined legislative tools to sustain long-term growth. The Danish Planning Act (Planloven), in combination with targeted government orders managed by the Danish Energy Agency, established the core framework for wind turbine siting as early as the 1980s. Denmark's emphasis on community ownership—through cooperative models and statutory requirements for public consultation—has helped maintain broad public acceptance. By mapping out land-use priorities in advance and involving local stakeholders in the design and benefits of wind projects, Danish authorities have avoided many of the confrontations seen elsewhere, thus ensuring shorter and more predictable consenting procedures.

Across these jurisdictions, the overarching pattern is that early identification of suitable zones (e.g., "go-to areas") and programmatic environmental assessments foster a high level of certainty for developers, financiers, and local communities alike. Stable, transparent policies also tend to lower the cost of capital, since financiers perceive reduced risk in projects that have already cleared—or partly cleared—key environmental and planning hurdles. This synergy between stable policy frameworks and industry confidence is particularly crucial for large-scale renewables, where high upfront costs can deter investment without predictable regulatory conditions. Measures such as local benefit-sharing mechanisms and inclusive consultation processes further enhance public trust, minimising the likelihood of legal challenges or social opposition.

In summary, government policies such as the England's NPPF and CfD system, Germany's EEG and Onshore Wind Area Requirement Act, Denmark's Planning Act, and EU-level directives and plans (including the REPowerEU strategy) illustrate how integrated legislation and spatial planning can drastically shorten permitting times, curb legal disputes, and accelerate the deployment of wind energy. These best practices—front-loading strategic environmental studies, committing to transparent site designation, ensuring community participation, and tying planning requirements to broader decarbonization objectives—can equally inform other clean energy projects (e.g., solar, CCUS, hydrogen) that require large-scale infrastructure. By drawing on the successes and lessons gleaned from wind development, policymakers can create the conditions necessary

[72] On July 8, 2024, the government issued a policy statement removing the de facto ban on onshore wind projects in England, placing them on equal footing with other energy developments within the NPPF. Subsequently, the NPPF was updated in December 2024 to reflect these changes

for rapid, cost-effective progress toward net-zero targets while maintaining robust environmental safeguards and securing high levels of community support.

6.2.5 Large-scale Industrial Zones – National and International frameworks

Large-scale industrial zones serve as a prime example of how coordinated master planning can streamline permitting processes while accelerating development timelines. Internationally, port-industrial complexes such as the Port of Rotterdam and Singapore's Jurong Island have adopted integrated planning models that not only establish pre-approved land uses, shared environmental thresholds, and common infrastructure requirements but also embed robust environmental protection measures. For instance, Rotterdam has incorporated biodiversity action plans and circular infrastructure initiatives, while Jurong Island utilises a centralised environmental management system that supports emissions monitoring and resource efficiency. Consequently, prospective projects in these areas can bypass the need for multiple, case-specific permits, expediting investment decisions and construction schedules. A similar principle is evident in Special Economic Zones and Free Trade Zones worldwide, where streamlined customs procedures and simplified planning rules are increasingly paired with environmental regulations that bolster investor confidence and align with national climate commitments[73] [74] [75].

Within the UK, policies such as Special Development Orders (SDOs) and Local Development Orders (LDOs) have been employed to give legal effect to overarching permissions for certain categories of development in predefined areas, effectively removing the need for separate planning applications. Building upon this framework, the UK Government introduced Freeports as part of its post-Brexit economic strategy. Details related to Freeports are outlined previously in the report.

The United States has seen moves toward more integrated and time-bound permitting processes, especially for large-scale infrastructure. Under the FAST-41 program (Fixing America's Surface Transportation Act, Title 41), a Federal Permitting Improvement Steering Council coordinates reviews among the various federal agencies involved in infrastructure approval. Accompanying initiatives, such as "One Federal Decision," set firm timelines and establish a single point of accountability for project reviews. Studies have indicated that these measures can shorten average permitting times by up to two years for covered projects. Furthermore, the U.S. has frequently employed programmatic Environmental Impact Statements (EIS) for sets of repetitive or similar projects—such as solar developments on federal lands—enabling common environmental impacts to be assessed once, rather than re-evaluated for each individual application. This concept could be replicated for industrial clusters, including CO_2 pipeline networks or hub-style developments, by addressing uniform technical and environmental issues in a single, overarching assessment.

Collectively, these examples highlight the importance of strategic master-planning, robust central coordination, and early stakeholder engagement in reducing approval times for large industrial or infrastructure projects. By combining clear national or regional targets with designated zones that benefit from streamlined permits and pre-clearances, governments can foster an environment where prospective developments face fewer administrative hurdles. Incorporating strict timelines and a one-stop permitting model may enhance efficiency, transparency, and public confidence that environmental and social considerations have been addressed. Drawing on these insights might help UK clusters—and other large-scale industrial or low-carbon initiatives — reduce or even avoid the pitfalls of ad hoc, project-by-project planning, thereby facilitating the swift, sustainable growth necessary to meet pressing economic and environmental objectives.

6.2.6 Electricity Grid Infrastructure – Proactive Planning to Tackle Delays

Upgrading the electricity grid across the UK and Europe presents significant challenges, some of which parallel the complexities involved in planning and deploying CCUS infrastructure. Large-scale grid projects, such as new high-voltage power lines, often encounter protracted permitting delays and uncertainties – delays of five to ten years are common - due to local opposition, complex environmental assessments, and multi-stage

[73] World Bank, 2008. *Special Economic Zones: Performance, Lessons Learned, and Implications for Zone Development* [online]. Available from: https://documents.worldbank.org/curated/en/343901468330977533/pdf/458690WP0Box331s0april200801PuBlic1.pdf [Accessed 2 April 2025].

[74] Nature Humanities and Social Sciences Communications, 2025. *Can special economic zones create transformative and sustainable development outcomes?* [online]. Available from: https://www.nature.com/articles/s41599-025-04448-0 [Accessed 2 April 2025].

[75] United Nations Economic Commission for Africa (UNECA), 2021. *To be transformative, special economic zones must be mindful of land justice, worker's rights and environmental sustainability* [online]. Available from: https://www.uneca.org/stories/to-be-transformative%2C-special-economic-zones-must-be-mindful-of-land-justice%2C-worker%E2%80%99s [Accessed 2 April 2025].

consultation processes. A pertinent example is the UK's North Sea offshore wind transmission infrastructure, where new power lines have faced substantial setbacks due to multiple rounds of stakeholder engagement and regulatory scrutiny. Recognising these barriers, the UK government and Ofgem introduced fast-track measures to expedite critical network upgrades, including the introduction of the Electricity Transmission Acceleration Plan (2023), which aims to halve the approval times for major projects.

To mitigate unnecessary delays and support the rapid expansion of renewable energy, the UK has undertaken several regulatory and procedural changes. The Energy Act 2023 provides statutory backing to prioritise grid development for achieving net-zero targets. NPSs for energy infrastructure (EN1-5, revised in 2023) have been updated to streamline major project approvals, explicitly recognising the urgent need for new grid infrastructure to support decarbonisation. The UK government has signalled its intent to designate certain grid reinforcements as NSIP, enabling them to benefit from a more predictable DCO process under the Planning Act 2008. The Electricity Networks Commissioner Report (2023) recommends reducing duplicate consultations and introducing a presumption in favour of network development in critical zones. Ofgem's Strategic Investment Framework, introduced in 2022, aims to ensure anticipatory investment in grid expansion, reducing reliance on a reactive approach. Additionally, the Accelerated Strategic Transmission Investment (ASTI) framework provides funding mechanisms to fast-track essential grid upgrades.

Similarly, the EU Renewable Energy Directive (RED III) sets a two-year maximum for permitting major renewable projects and a one-year limit in designated go-to areas. However, in practice, transmission network expansions and renewable generation projects have faced delays of up to nine years. To bridge this gap, several EU countries are implementing targeted solutions. Germany has established one-stop shop authorities for grid permitting under the 2019 Grid Expansion Acceleration Act (NABEG), which simplifies approval processes and reduces administrative hurdles. Additionally, Germany is experimenting with partial undergrounding of high-voltage transmission lines as mandated by the Federal Requirements Plan Act (BBPlG) to mitigate public opposition. France has revised its regulatory framework through the Multiannual Energy Programme (PPE) and the 2023 Acceleration of Renewable Energy Act, which prioritises pre-identified energy corridors for grid and renewable infrastructure, expediting permitting and reducing environmental disruption. The Netherlands has introduced spatial zoning mechanisms under the Offshore Wind Energy Roadmap 2030 and the Dutch Environmental and Planning Act (Omgevingswet), streamlining approval processes for offshore wind connections while maintaining environmental safeguards. Denmark's Energy Infrastructure Planning Act (2022) strengthens anticipatory grid development by mandating early-stage identification of necessary transmission upgrades linked to offshore wind expansions.

The Strategic Spatial Energy Plan (SSEP) is an initiative by the UK's National Energy System Operator (NESO) to develop a comprehensive, long-term strategy for the nation's energy infrastructure. This plan aims to align energy system development with national net-zero goals by identifying the necessary transmission networks and infrastructure to support a sustainable energy future. The SSEP is designed to inform the Centralised Strategic Network Plan (CSNP), which will outline a firm delivery pipeline for transmission network development over a 12-year period, with a broader 25-year outlook. This approach ensures that investments in the energy sector are strategically planned to meet long-term sustainability objectives. Moreover, Regional Energy Strategic Plans (RESPs) are being developed to enhance local energy planning. These plans involve collaboration among local governments, gas and electricity networks, and heat network developers to create tailored roadmaps for regional energy systems, facilitating a coordinated transition to net-zero emissions.

The electricity grid expansion experience offers valuable lessons for CCUS infrastructure planning, particularly in identifying pipeline routes early, securing land-use protections, and ensuring permitting efficiency. Just as energy corridors are mapped in advance, CCUS developers can engage early with local authorities to integrate pipeline routes into regional development plans. Securing routes via Local Plan protections or DCOs can enhance certainty and reduce bottlenecks. Designating CO_2 transport and storage networks as essential national infrastructure, akin to electricity transmission, can help prioritise approvals under relevant planning regimes such as the Planning Act 2008 in the UK and EU-wide NSIP frameworks (such as the Trans-European Networks (TEN) policy, which supports key infrastructure in transport (TEN-T), energy (TEN-E), and telecommunications (CEF Digital), as well as the Connecting Europe Facility (CEF) funding instrument and Projects of Common Interest (PCIs) that receive prioritised treatment). Early and continuous dialogue with communities, coupled with flexible route planning such as landscape screening and undergrounding pipelines in sensitive areas, can address opposition and accelerate approvals. The UK's electricity network experience underscores the importance of mitigation measures in building community trust, supporting long-term project delivery, and ensuring developments are responsive to local needs. Establishing one-stop permitting authorities for CCUS infrastructure, akin to Germany's grid approach, could consolidate approvals and improve

regulatory efficiency. By drawing upon best practices from grid expansion efforts, CCUS planners can navigate regulatory complexities more effectively, minimising delays and ensuring alignment with broader decarbonisation goals.

6.3 KEY TAKEAWAYS

Strategic Spatial Planning (SSP) represents a transformative framework for reconciling economic growth and environmental sustainability within an integrated, place-based approach. Recent case studies—including the EU Hydrogen Valleys, UK's HS2 and Freeports initiatives, and renewable energy frameworks in Germany and Denmark—underscore SSP's capacity to drive systemic change by aligning national policies with local spatial strategies. Effective integration, as exemplified by the EU Net Zero Industry Act's coordination of hydrogen projects, illustrate that when spatial planning is embedded within statutory frameworks and linked to broader policy goals, it can reduce fragmentation, streamline permitting processes, and generate the cross-sector collaboration necessary for sustainable growth.

Streamlining regulatory processes emerges as essential for accelerating infrastructure delivery without sacrificing democratic accountability. Mechanisms such as centralised approvals under the UK's Planning Act and the EU's consolidated permitting under the Net Zero Industry Act balance efficiency with transparency. Nonetheless, maintaining public trust requires continuous stakeholder engagement, highlighting the importance of procedural reforms that retain rigorous democratic oversight.

Anticipatory and proactive infrastructure planning is essential to mitigate long-term risks and reduce future delays. By pre-identifying strategic zones for industrial development, renewable energy, transport corridors, and associated infrastructure needs (water, wastewater, waste) governments can de-risk private investment and avoid costly legal disputes. Examples from Denmark's renewable energy planning and the UK's Electricity Transmission Acceleration Plan demonstrate that anticipatory spatial strategies significantly reduce legal disputes and investment uncertainty, promoting timely infrastructure deployment.

Stakeholder engagement and equity further underpin the legitimacy of SSP. Inclusive processes that incorporate community input, benefit-sharing mechanisms, and equitable compensation frameworks ensure that the diverse impacts of development are managed transparently. Successful practices include benefit-sharing mechanisms seen in Danish cooperative wind energy models, compensation schemes as implemented by HS2, and participatory spatial design processes. Institutionalising these approaches ensures marginalised voices shape and benefit from development, ultimately securing broader societal acceptance and long-term project viability.

The success of large-scale initiatives further relies on strategic investment combined with adaptive governance structures. Blended finance mechanisms, regulatory sandboxes that support innovation, and international knowledge-sharing hubs are instrumental in de-risking early-stage technologies and aligning large-scale infrastructure projects with long-term economic and environmental objectives. Illustrative examples include the EU's IPCEI framework for hydrogen initiatives and the UK's pooled planning mechanism —such as the Nature Restoration Fund and Community Infrastructure Levy—both highlighting the essential role of sustained investment and adaptive institutional frameworks in responding to complex and evolving infrastructure and environmental challenges.

In conclusion, **SSP emerges as a dynamic, iterative governance model essential for achieving sustainable development.** Its strength lies in promoting policy coherence, regulatory efficiency, proactive risk management, inclusive participation, and adaptive governance. Crucially, SSP approaches can be designed to integrate environmental capacity assessments—ensuring that policy decisions account for ecological thresholds and the long-term carrying capacity of natural systems. By adopting SSP methodologies, governments can effectively navigate complex urban, regional, and industrial development challenges, thus fostering resilient, equitable, and future-oriented communities.

7. OPTIONS FOR BETTER PLANNING FOR INDUSTRIAL CLUSTER DECARBONISATION

This section explores potential strategies and practical ways forward for enhancing the planning, permitting, and development processes associated with managing environmental capacity for developing low carbon industrial clusters. Drawing upon identified case studies and existing UK cluster initiatives, including Humber, Teesside, and HyNet, this chapter outlines good practices and identifies strategic opportunities for development of industrial clusters and managing environmental capacity.

7.1 GOOD PRACTICES

Drawing from the case studies and planning documents, several good practices emerge to facilitate planning of low-carbon industrial clusters.

Effective stakeholder and regulatory engagement between project developers and public bodies is crucial for the success of complex infrastructure projects. The following practices illustrate how early and continuous involvement can build trust, reduce uncertainties, and streamline project approvals.

- Where possible, developers should take the initiative of ensuring local communities, councils, and stakeholders (including other hydrogen and CCUS projects in proximity) are engaged from the outset, ensuring that concerns related to environmental capacity, are identified and addressed early.
- Proactive consultations, similar to those undertaken in the Humber pipeline routing process, build trust by bringing potential issues to light and allowing for timely adjustments.
- Maintaining open dialogue throughout the project lifecycle, allowing route modifications and enhanced mitigation measures to be implemented proactively, prevents concerns from escalating into costly delays or legal challenges.
- Hosting regular community forums and extensive route-wide consultations fosters transparency and continuous engagement, complemented by targeted compensation schemes addressing site-specific impacts.
- Early regulatory engagement is achieved by formulating a comprehensive consenting and permitting strategy during the Front-End Engineering Design (FEED) phase, with the goal of coordinating submissions. Information derived from FEED, such as detailed environmental assessments, technical design specifications, risk management strategies, and proposed mitigation measures, informs and streamlines subsequent planning submissions.
- Permitting and planning, including early engagement, should ideally be twin tracked, to enable a comprehensive assessment of proposals coming forward, hence enabling flagging of potential issues at the earliest opportunity.
- Early engagement with bodies such as the Health and Safety Executive on hazardous substances and the EA on permits, might reduce uncertainties by the time planning determinations are made.
- Early pre-application engagement with the EA (for permits) and the planning authority (for planning) supports the development of robust, high-quality applications and reduces the likelihood of delays in each process.
- Proactive resource planning with regulators, as demonstrated in the HyNet project, involves signalling upcoming planning and permit applications to ensure that the planning authorities and agencies are adequately staffed to manage multiple submissions simultaneously.
- While large-scale projects like HS2 demonstrate extensive engagement strategies, the mixed reception within affected local communities highlights the importance of not only comprehensive consultation but also genuinely addressing local concerns and clearly communicating project benefits.

Establishing Strategic Cluster Plans has been helpful for coordinating decarbonisation efforts across the UK's industrial clusters, ensuring that local planning and national strategies align with industry needs to support a coherent and investment-ready low-carbon future.

- All major UK clusters—including the Humber Industrial Cluster, Tees Valley Net Zero, and HyNet—have developed decarbonisation plans that map out pipelines, capture sites, and storage links, with one-off funding provided by UKRI's Industrial Decarbonisation Challenge. This funding was outside of normal planning processes and only available to certain eligible organisations. These plans function as informal spatial strategies that coordinate projects and identify critical infrastructure needs.
- Cluster plans engaged a wide range of stakeholders, including industry leaders, local authorities, research institutions, and policymakers to develop coordinated decarbonisation strategies. For example, the Humber Industrial Cluster Plan involved CATCH (a membership organisation for the energy, process, engineering, and renewables industries in Yorkshire and the Humber), Hull and East Yorkshire Local Enterprise Partnership, and eight industrial partners. Similarly, HyNet North West was led by Progressive Energy (a low-carbon energy project developer) and Cadent Gas Ltd (the UK's largest gas distribution network), working with local enterprise partnerships and regional industries to advance hydrogen and carbon capture infrastructure.
- While the Humber Industrial Cluster Plan explicitly assessed environmental capacity – for instance, by commissioning a detailed water availability study that identified water supply as a key constraint on its decarbonisation projects – other UK cluster plans have yet to incorporate such systematic reviews. Published plans for clusters like Teesside and South Wales tend to focus on decarbonisation initiatives and broadly stated environmental goals, without evaluating local limits for air quality, water resources, or ecosystems. Notably, even within the Humber plan, comprehensive integration of biodiversity and air quality constraints remains underdeveloped, highlighting a gap that persists across most industrial cluster strategies. Thus, while the Humber plan provides an initial approach to account for environmental capacity, most industrial cluster plans continue to overlook these critical aspects.
- The cluster plans have been referenced in planning applications. For example, projects in Teesside and Humber reference their respective cluster plans to clearly demonstrate how individual developments contribute to a wider, coherent strategy, thereby aligning local proposals with regional decarbonisation goals.
    - Where funding permits, these cluster plans should be regularly updated and the remit could be expanded to capture environmental capacity, wider geographic areas, supply chains, and additional industries in the same area. By doing so, these plans can better reflect emerging technologies, policy shifts, and cross-sector or cumulative opportunities and challenges ultimately providing a stronger basis for cumulative environmental assessment and management through more coherent stakeholder planning.

Utilising integrated planning tools—such as SPDs, AAPs and centralised development corporations—creates a robust framework for industrial transformation.

- The South Tees SPD and Development Corporation present a good example of how Planning can enable industrial transformation. With an adopted SPD that outlines clear development principles (for example, STDC6: Energy Innovation), local authorities in Redcar & Cleveland have provided project developers and their investors with certainty regarding acceptable infrastructure development. This model has streamlined planning for essential utilities and transport links through public-private partnerships, and extensive consultation along with a SEA ensured that community and environmental considerations were thoroughly integrated.
- The South Tees Area SPD Strategic Environmental Assessment evaluates environmental capacity factors affecting industrial development across the STDC area. It identifies key constraints including land contamination, flood risks, and ecological sensitivities related to the Teesmouth and Cleveland Coast SPA. The assessment makes specific recommendations to address these constraints, such as requiring development proposals to demonstrate "net environmental gain" where viable, implementing a mitigation hierarchy for biodiversity impacts and applying site-specific flood risk management measures. The SEA also recommends clarifying the requirements for environmental permits,

supporting appropriate remediation to reduce environmental harm, and developing thematic strategies for water management and materials handling. These recommendations recognise the area's environmental limitations while providing a framework to guide industrial regeneration within the site's carrying capacity.

- The STDC, later expanded to become the Teesworks Development Corporation, represents an innovative governance model that centralises planning powers and funding mechanisms. This statutory body has unique planning authority, compulsory purchase powers, and direct access to government funding that enables rapid decision-making and coordinated development across the entire industrial zone.
- Similar Development Corporation models could be explored for other industrial clusters, where coordinated planning across multiple local authorities may accelerate decarbonisation projects.
- SPDs and AAPs are tools for cluster-scale planning. The South Tees Area SPD, for instance, offers detailed guidance on land use zoning, design standards, and environmental expectations within the Teesworks industrial zone, while maintaining the flexibility to seize local opportunities—such as positioning sites for CCUS hubs or hydrogen plants. A similar approach could be adopted in other industrial cluster regions by developing an AAP for areas like South Humber Bank or Port areas, ensuring coordinated spatial planning for carbon capture facilities, pipeline networks, and clean energy projects.
- Successful implementation of these enhanced planning strategies requires robust cooperation across local authority boundaries and alignment with each council's local plan timetable. The value of statutory guidance—such as a cluster AAP— which may demand significant time and resources depends on the strategic importance , and this will also determine the likely funding source and budget available.
    - Embedding decarbonisation cluster plans within the statutory planning framework ensures that local developments and national decarbonisation strategies are aligned. This approach delivers more investment certainty, streamlines infrastructure planning, and facilitates a more coherent and integrated transformation to a low-carbon industrial future.

Planning for phased cluster development with a more structured approach to permits and consent timings and scope might enhance overall cluster programme development efficiency through stakeholder alignment and decision making.

- Avoiding extremes of either approving cluster components individually, or a single, complex consent for entire clusters, cluster project approvals could be better coordinated.
- The UK Government has accepted the principle of phasing cluster growth through its Track and Track Expansion process. To date however, successive Governments have found it difficult to maintain their expected decision timelines for hydrogen and CCUS projects.
- The initial phases are right to continue to focus, as has been the case to date, on securing consents for common infrastructure, such as the trunk pipelines and a manageable number of key anchor projects, which serve as the foundation for future expansion.
- Attention now needs to focus on planning for cluster expansion and applying learnings from first clusters to subsequent clusters. While the focus through 2030 will remain on delivering initial phases, planning for post-2030 expansion will require a more strategic and structured approach that can accommodate the anticipated acceleration in net-zero project deployments.
- This phased approach allows for greater flexibility, mitigating risks associated with long-term infrastructure commitments while ensuring that early successes build momentum for subsequent phases.
- A more structured approach to planning and permitting could enable environmental services industries to strategically prepare for cluster expansion. By establishing clearer timelines and development pathways, these industries can align their own infrastructure investments, including waste management facilities, water treatment systems, remediation capabilities, ecological offsetting solutions, and skills training, with the projected growth of industrial clusters. This coordination ensures

that environmental support infrastructure is ready and online when future net-zero projects are ready to deploy, avoiding bottlenecks that could otherwise delay implementation.

- Once the backbone infrastructure is in development or operational, additional projects would be incorporated, for example as part of the Track Expansion process, through change processes that better manage uncertainties, reduce the risk of duplication and build momentum and responsiveness in a predictable way. This can also help to align decisions related to infrastructure growth onshore and offshore.
- A phased rollout ensures that early projects can deliver tangible results, reinforcing public and investor confidence. By demonstrating viability and environmental compliance early in the process, developers can reduce opposition and secure buy-in from key stakeholders, including local communities, regulatory bodies, and funding institutions.
- Importantly, each phase should also incorporate demand assessments to ensure that the scale of infrastructure development aligns with current and projected market needs.

7.2 POTENTIAL WAYS FORWARD

It is important to ensure that developments within industrial clusters proceed in alignment with environmental limits and national and local objectives and priorities. Some ways to support the delivery of industrial clusters, while mitigating the associated negative environmental impacts are as follows:

Strategic spatial plans could be developed for each cluster. Cluster-wide infrastructure, land use and environmental considerations could be aligned at an earlier stage than at permit decision. This may also support subsequent projects to meet cumulative environmental limits. In some cases, these cluster spatial plans could focus on specific environmental themes, such as BNG, nutrient or pollution impacts within the cluster, thereby supporting wider mitigation measures to create headroom for new developments.

Scenario-based analysis could be employed to account for market uncertainties and evaluate different potential development pathways within the cluster. Climate considerations, Net Zero targets, vulnerability and resilience can be evaluated based on scenarios. This integrated approach would reflect the interconnected nature of environmental systems with other systems.

Cross consideration between cluster-level spatial plans and local and national level policy priorities and planning could occur. The cluster-level spatial plans can therefore consider the objectives of local planning policy. Local planning policy documents, such as Local Plans, Area Actions Plans and SPDs, can also be updated to account for the cluster-level spatial plans, ensuring that priorities align and environmental capacity is considered. This can ensure that local priorities are aligned with the objectives of cluster development, as reflected through the cluster-level spatial plans.

A focus should be made on addressing environmental impacts, including cumulative environmental impacts, within industrial cluster developments. The development of spatial plans for industrial clusters should include the requirement for SEAs of planned developments, including a stronger focus on cumulative environmental impacts. As new projects, such as hydrogen or carbon capture facilities and H_2 or CO_2 pipelines emerge, the cluster level spatial plans and associated SEAs should be subsequently updated to account for these additional projects. Outside of new project developments occurring, the cluster-level assessments should also be routinely reviewed and updated. Such an approach would support project developers in ensuring that sufficient environmental headroom is available for the proposed projects. Hence, the initial projects under development should also be mindful that environmental headroom should be available for new projects to develop.

The cluster-level SEA could be commissioned with responsibility assigned to a lead authority or a collaborative partnership (e.g., constituent Local Planning Authorities operating jointly, or through existing or newly formed joint cluster stakeholder bodies, with input from statutory bodies such as the EA and Natural England, where required). The assessment can operate within existing SEA requirements for relevant plans/programmes affecting the cluster, ensuring compliance with existing statutory processes, while providing enhanced analysis of cumulative environmental capacity. The assessment could aim to establish a robust environmental baseline covering biodiversity, population and human health, water resources and quality, air quality, soil, climatic factors (both mitigation and adaptation), material assets, cultural heritage, landscape, and their interrelationships.

Subsequent project-level EIAs can focus on site-specific issues and compliance with established benchmarks whilst drawing from shared cluster-level data and findings, reducing duplicative effort in baseline collection, strategic analysis and CIA.

Innovations in cluster project and environmental data collection, analysis, sharing and representation may reduce risks of replication of similar work, in additional to potentially enhancing transparency. An environmental baseline for the cluster could be updated periodically to ensure that environmental constraints including cumulative impacts are easier to consider. This can also assist planning bodies to have clearer oversight of how individual proposals incrementally affect the clusters environmental capacity constraints.

Developing and maintaining a registry of designated clusters and related projects could improve transparency and assist local authorities, statutory consultees, and developers. Such a resource may highlight interconnectedness of industrial cluster decarbonisation projects with each other.

Collaboration amongst developers, government agencies and local authorities should occur to improve cluster-level spatial plans, cluster SEAs and associated data collection and tools. This will ensure that cluster plans remain effective and aligned with national, regional and local priorities.

Development Corporations should be considered as a highly effective governance and delivery model for coordinating complex cluster planning and implementation. Building on the example of the South Tees Development Corporation, new Development Corporations could consolidate planning powers, secure dedicated funding streams, and enable accelerated delivery of critical infrastructure such as CCUS networks, hydrogen production hubs, and associated utilities. These statutory bodies can act as central conveners of local authorities, industry, and national bodies, ensuring alignment of priorities and providing a single point of accountability for delivery. Development Corporations could integrate cluster-level spatial plans into their core mandates, ensuring that environmental constraints and cumulative impacts are addressed from the outset. Furthermore, Development Corporations could play a proactive role in managing community engagement embedding public participation into cluster planning and helping to balance economic, environmental, and social objectives.

8. CONCLUSIONS

This study has explored challenges in managing the overall environmental capacity of decarbonisation projects in industrial clusters. The study aims to highlight the opportunities within planning tools that could help inform a more strategic approach to cluster-based planning. This occurred through an evidence review, including Local and National planning documents, in addition to stakeholders interviews. Based on the evidence, the following key findings and potential ways forward were determined.

Major pipelines and power station modifications benefit from national-level oversight, promoting cohesive, strategic decision-making for large-scale projects. Under the NSIP DCO framework, key CO_2 and hydrogen pipelines align with central government priorities, while Section 36 consents bring the Energy Secretary into the process for power-station modifications. This arrangement not only mitigates fragmented approvals but also provides the certainty required for substantial investment in UK decarbonisation efforts.

Local authorities carry pivotal responsibilities for the majority of capture and hydrogen developments, underscoring the importance of local planning capabilities. While top-down coordination exists for major infrastructure, most projects are approved under the Town and Country Planning Act, placing considerable demands on local expertise, consistency in decision-making, and available resources. This scenario can lead to variability in approval timescales, emphasising the need for coherent guidance and ongoing capacity-building to address emergent technologies.

Teesside's integrated approach to hydrogen and CCUS illustrates how proactive collaboration can streamline industrial decarbonisation projects. By explicitly embedding clean technologies into local plans and working closely with combined authorities, Teesside reduces administrative hurdles, consolidates environmental assessments, and fosters an environment more attractive to investors. This level of cooperation not only speeds up approvals but serves as a repeatable blueprint for rolling out similar low-carbon initiatives across the UK's other industrial regions.

By contrast, Humberside and the North West often exhibit more siloed governance, limiting cohesive decision-making and cross-boundary coordination. Dispersed local authorities commonly operate in isolation, with little to no knowledge on whether or not a project is within a cluster. This fragmented approach can intensify land-use conflicts, hamper collaborative mitigation, and impede efficient deployment of new decarbonisation solutions.

'First mover' projects risk exhausting local environmental capacity, passing higher costs and regulatory constraints onto subsequent developments. Sequential approvals allow early entrants to secure finite resources or permissible emissions headroom, thus curbing the flexibility of later applicants. This dynamic discourages wider industrial participation, slows regional progress towards net-zero targets, and creates uncertainty that can deter future investment.

A gap in environmental capacity analysis means critical resources and potential impacts can be overlooked in favour of commercial and technological considerations. While much work has been done on engineering feasibility and business case assessments, including technology, shared infrastructure, carbon savings, economic benefits, and supply chains, local regulators and authorities often lack comprehensive data on issues like water availability, long-term ecological effects, and cumulative emissions. This absence of robust environmental capacity studies undermines strategic planning and can limit the scope for sustainable growth.

Strategic Environmental Assessments at the cluster level offer an effective method for identifying and tackling these collective risks that are not well covered by existing project planning processes before they escalate. By evaluating emissions, water needs, and habitat considerations across multiple concurrent or projected projects, SEAs enable local authorities to refine land-use priorities and implement balanced permitting conditions. Crucially, these assessments must be regularly updated, reflecting ongoing technological progress and evolving policy standards.

Clear integration of hydrogen and CCUS infrastructure in statutory plans and guidance reduces investor ambiguity and helps streamline project reviews. By explicitly acknowledging low-carbon technologies in local plans, supplementary documents, or broader cluster strategies, public bodies can provide more transparent parameters for project sponsors. This alignment strengthens collaboration between developers, regulators, and communities, highlighting the synergy between green industrial growth and wider economic and environmental objectives.

Enhanced governance structures, from formal joint committees to cluster boards, can boost efficiency and reduce duplicative processes across multiple jurisdictions. When local authorities, agencies, and industry coordinate under a shared framework, critical challenges such as pipeline routing and environmental mitigation can be tackled more cohesively. This approach can accelerate timelines, clarify policy interpretation, and bolster the competitive standing of regional decarbonisation initiatives.

Development Corporations and Strategic Authorities can play a crucial role in coordinating the planning and delivery of decarbonisation within industrial clusters. Development Corporations, such as Mayoral Development Corporations, are statutory bodies established to drive regeneration in specific areas, with broad powers over planning, funding, and development control. The South Tees Development Corporation is a strong example of how such entities can centralise decision-making and accelerate the delivery of critical infrastructure.

Similarly, Strategic Authorities, including combined authorities and combined county authorities, consolidate responsibilities across transport, housing, economic development, environment, and public health. By integrating leadership across these areas, they can align industrial decarbonisation with wider regional growth and net zero ambitions.

Together, Development Corporations and Strategic Authorities can provide a robust governance framework to manage the complex demands of decarbonisation. They enable integrated spatial planning, environmental assessment, and infrastructure delivery, while ensuring consistency across local boundaries and giving clear direction to industry and investors.

9. APPENDIX 1: STAKEHOLDER ENGAGEMENT

Stakeholder engagement was critical to understanding current planning practices and exploring potential improvements. An engagement and communications plan were developed to identify risks, guide engagement activities, set their objective, describe the approach, and identify stakeholders.

Stakeholder engagement with a diverse array of stakeholders involves some risks which should be mitigated proactively. Given the varied interests, expectations, and levels of involvement, potential pitfalls can include miscommunication, conflicting priorities, and incomplete representation of key viewpoints. Table 9-1 below examines the key risks associated with stakeholder engagement in the context of strategic spatial planning and industrial cluster development.

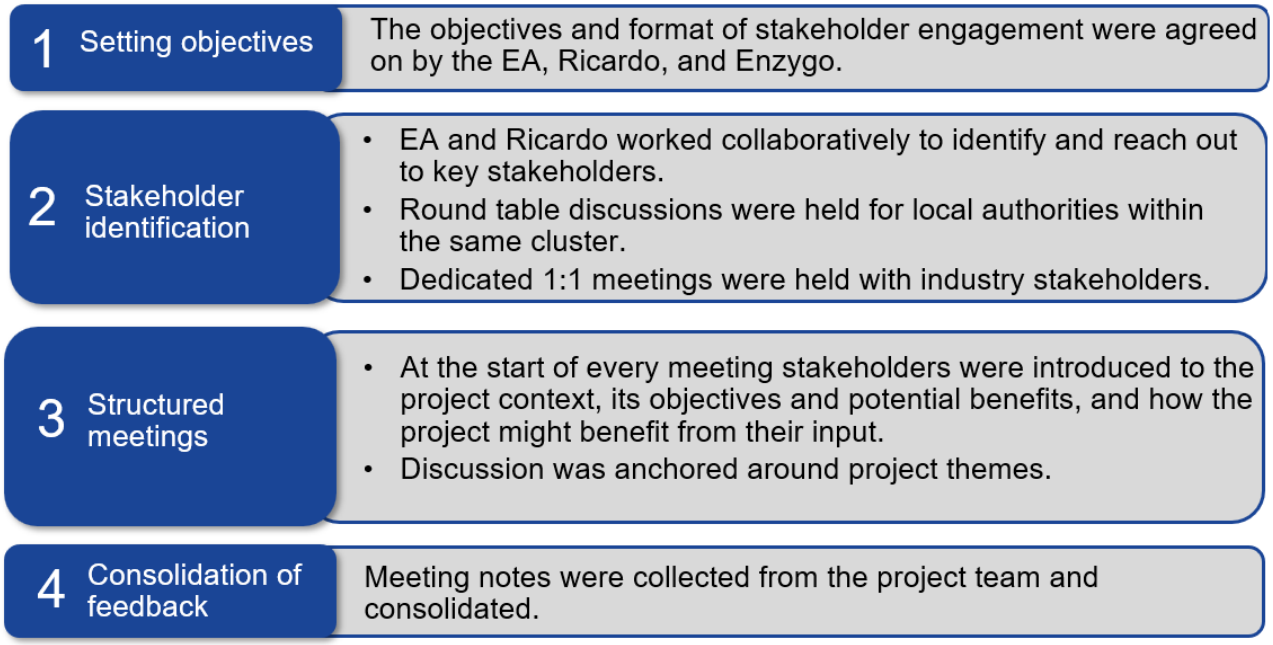
Table 9-1. Risk register for stakeholder engagement

Risk	Mitigation
Duplication of stakeholder engagement from other phases of work by the EA, resulting in engagement fatigue and reduced participation.	Review stakeholder engagement outcomes from previous project phases to inform future conversations and avoid duplication. Prioritize quality over quantity; use shorter sessions.
Sharing of stakeholder details collected previously for alternative projects without adequate permissions for subsequent use.	Review individual cases to assess relevance and compliance with data privacy regulations.
Stakeholders may expect immediate results or guarantees that their input will dictate outcomes, leading to disappointment if unmet.	Set clear expectations upfront (e.g., “Your input may inform recommendations in the report, but final authority rests outside of the EA’s remit”).
Stakeholder engagement can be time-consuming and costly, straining budgets or timelines.	Prioritise high-impact stakeholders and activities; use online meetings; limit participation of team members to a minimal functioning few.
Poor engagement or inadequate responses from stakeholders	Review lessons learnt from previous phases of the project and adapt engagement plan and format to maximise outcomes.
Dependency on key stakeholders leading to biased outcomes.	Engage stakeholders from different industries and geographies to ensure diverse perspectives on planning.
Misunderstanding of stakeholder feedback	Post-meeting reconciliation of notes from the meeting attendees to reaffirm understanding.

9.1 STAKEHOLDER ENGAGEMENT APPROACH

The engagement journey involved activities before, during, and after the meeting, as outlined in Figure 9-1 below.

Figure 9-1. Approach to stakeholder engagement



Step 1. Setting objectives

Multiple stakeholders were involved with different perspectives on planning for low carbon technologies in industrial clusters. The main stakeholder categories and the objective for engaging them outlined below.

Environment Agency

- To ensure that existing knowledge and expertise about current practices are fed into the project.
- To ensure that the recommendations align with work going in different teams across the organisation.
- To ensure that messaging or recommendations are not contradictory with EA or cluster specific narratives.
- To keep internal project teams and stakeholders up to date with progress on the project.

Local Authorities

- To understand the baseline of planning mechanisms for Local Authorities that cover the cluster areas and to be able to escalate any blockers.
- To incorporate any recommendations into the project output.
- To strengthen the relationship with the EA.
- To socialise the project and the messaging with them to get buy in.

Industry and trade bodies

- To understand the planning related constraints that industry have encountered during the planning of their projects that could have been better facilitated strategically.
- To strengthen the relationship with the EA – allowing two-way conversation and facilitate a platform for message sharing after the project.

Government

- Will benefit from an evidence base to understand the baseline and recommendations for mechanisms which may support their investment and development strategies.
- Are leading planning reform which project recommendations can support.
- Can identify duplication and cross over of plans during the project.

Step 2. Stakeholder identification

The aim of this stakeholder identification process is to gain an understanding of current planning practices from several perspectives involved. Although the engagement timeframe was limited, our focus was on stakeholders with direct experience in and active involvement with planning for industrial cluster projects. By engaging a diverse range of stakeholders—including project developers, various planning authorities, and government bodies involved in permitting—the likelihood of overlooking key challenges is reduced, and a broad spectrum of insights are captured. This process is designed to elicit recommendations that reveal both common and conflicting interests among the different parties. Specifically, this approach covers project developers seeking consent for low carbon initiatives. It addresses both those working on individual projects, such as point source capture at a single site, and those involved in developing shared infrastructure, such as CO_2 pipelines. In addition, it includes authorities at different levels and locations, from local to regional, along with government bodies responsible for planning and permitting.

Table 9-2. List of stakeholders

Stakeholder Group	Who
Internal EA Teams	Technical team
Local Authorities (Teesside)	Tees Valley Combined Authority (5 LAs: Darlington, Hartlepool, Middlesbrough, Redcar & Cleveland and Stockton-on-Tees)
Local Authorities (HyNet)	The deployment project is mostly located within the Cheshire West and Chester Local Authority and the LCR Combined Authority
Local Authorities (Humber)	Hull City Council, East Riding of Yorkshire, North East Lincolnshire Council, North Lincolnshire Council
Partners	North Sea Transition Authority
Industry/Trade Bodies	RTPI, IDRIC

Step 3. Structured meetings

Following a review of the engagement methods used in previous phases of the project, questionnaires were steered away from, as they were not an effective means of engagement and failed to draw meaningful responses from stakeholders, instead virtual meetings and round table discussions were held with the identified stakeholders. The project background, objectives, and purpose of the meeting were shared in an email before the meeting, along with a slide containing this information as well as the discussion topics. Online meetings with stakeholders were arranged between February 2025 and March 2025. Meetings lasted 60 to 75 minutes, starting with a quick round of introductions by the attendees, followed by an introduction to the project and its objectives as well as the expectations from the meeting. The discussion was guided by open ended questions to allow stakeholders the liberty to elaborate on their experiences and touch upon tangential topics that may be of interest.

Topics for discussion were tailored depending on the type of stakeholder. However, most meetings were structured around key themes, including but not limited to:

- The extent to which existing practices are strategic in planning for industrial clusters.
- The extent to which cumulative impacts on environmental capacity are considered.
- Coordination between planning bodies at all levels (local, national, and regional) towards planning for industrial clusters.
- Main challenges facing planning and permitting for industrial cluster projects now and in the future
- The extent to which planning bodies have the necessary expertise in low-carbon technologies to process consent for these types of projects efficiently.

These themes were introduced through open-ended questions. The interview questions underwent iterative refinement throughout the study, incorporating insights and feedback gathered during ongoing stakeholder engagements. This adaptive approach ensured the questions remained aligned with emerging themes and stakeholder priorities.

Step 4. Consolidation of feedback

Consolidating the feedback from our stakeholder meetings has provided a glimpse of current planning practices and the challenges faced by the parties involved. Meeting notes were gathered from participants and affiliated to the thematic questions.

10. APPENDIX 2: PLANNING IN ENGLAND AND WALES

10.1 ENGLAND

10.1.1 National Level

Planning and permitting at the National Level is administered through *NSIPs* under the *Planning Act 2008*. This legislation was introduced to streamline a formerly fragmented system, ensuring that large-scale projects—such as significant energy generation, major roads, or substantial water supply facilities—are determined in a more efficient and transparent manner. Under this framework, decision-making is centralised through the Planning Inspectorate (PINS) and the Secretary of State (SoS), reflecting the Government's commitment to expedited delivery of critical national infrastructure.

This regime is therefore designed to facilitate large-scale projects with substantial national impact by providing a streamlined process that includes pre-application consultations, detailed examinations, and a final decision by the Secretary of State via a DCO.

Projects of national significance often require comprehensive EIAs, SEAs, and Habitat Regulations Assessments (HRAs) to ensure that potential environmental impacts are thoroughly evaluated. In addition, for developments that extend offshore—such as wind farms or CCS facilities—marine planning regimes are applied, with marine licences and specific consultations (e.g., through the Marine Management Organisation in England) ensuring compliance with broader maritime objectives.

The Act covers projects deemed 'nationally significant', including:

- Energy: Onshore electricity-generating stations over 50 megawatts electric (MWe), offshore wind, CCS, and hydrogen facilities.
- Transport: Major roads, railways, ports, and airports.
- Water: Large reservoirs and wastewater treatment plants.
- Waste: Hazardous waste infrastructure.

The NSIP process comprises several stages, namely pre-application consultation, submission, acceptance, pre-examination, examination, recommendation and decision, and post-decision.

In recent years, the UK has implemented significant reforms to accelerate approvals for vital infrastructure projects by streamlining planning processes and reducing bureaucratic delays. These changes, guided by updated NPSs and key legislation such as *The Energy Act 2023 and the Levelling-Up and Regeneration Act 2023*, aim to streamline the planning process by reducing examination timescales, minimising legal delays, and simplifying documentation. The revised NPSs reflect shifting priorities, particularly in support of net-zero targets and emerging low-carbon technologies[76], whilst policy updates, including commitments outlined in the British Energy Security Strategy and the Powering Up Britain policy paper, have strengthened the framework for projects such as hydrogen hubs, CCS, and large-scale renewable energy developments, enabling them to progress more efficiently through the NSIP regime[77] [78].

These measures align the NSIP regime with the UK's decarbonisation and 'levelling-up' objectives, expediting critical project delivery while preserving rigorous environmental and community safeguards. In particular, *The Energy Act 2023* streamlines consent for low-carbon initiatives, including hydrogen pipelines and CCS clusters,

[76] **Great Britain. Department for Energy Security and Net Zero**, 2023. *National Policy Statements for Energy Infrastructure* [online]. Available from: https://www.gov.uk/government/collections/national-policy-statements-for-energy-infrastructure [Accessed 6 March 2025].
[77] **Great Britain. Department for Energy Security and Net Zero**, 2023. *Powering Up Britain: Energy Security Plan* [online]. Available from: https://assets.publishing.service.gov.uk/media/642708eafbe620000f17daa2/powering-up-britain-energy-security-plan.pdf [Accessed 6 March 2025].
[78] **Great Britain. Department for Business, Energy & Industrial Strategy**, 2022. *British Energy Security Strategy* [online]. Available from: https://assets.publishing.service.gov.uk/media/626112c0e90e07168e3fdba3/british-energy-security-strategy-web-accessible.pdf [Accessed 6 March 2025].

whereas the Levelling-Up and Regeneration Act 2023 integrates NSIP decisions with local planning and introduces 'environmental outcomes' to replace certain EU-derived habitats assessments.

A notable innovation is the fast-track route to consent, outlined in guidance published in April 2024[79]. This optional process is designed for applicants who can demonstrate that their proposals meet a high 'quality standard'—including evidence of comprehensive pre-application engagement, minimal outstanding disputes, and clarity over principal areas of disagreement. Eligible schemes may benefit from a shorter Examination period (down to four months from the usual six) and accelerated post-Examination stages, potentially reducing the overall determination timeline to as little as 12 months from acceptance to decision.

To qualify for the fast-track route, developers must engage with the enhanced pre-application service offered by the Planning Inspectorate. This ensures that key technical and environmental considerations—such as compliance with SEAs BNG requirements, and local planning policies—are addressed before submission. Where statutory consultees, such as the EA or Natural England, raise concerns, developers have the opportunity to engage and address issues early, thereby minimising issues during the Examination phase.

However, it is argued that while the fast-track process may shorten the formal Examination phase as it can result in increased costs and extended efforts during the pre-application stage. Developers must invest significant time and resources upfront to meet the stringent quality standards - in effect the process might simply reallocate time and costs from the Examination stage to the pre-application phase, raising questions about the overall efficiency and cost-effectiveness of the route.

Additionally, judicial review (JR) procedures are being refined to expedite court proceedings that can otherwise delay NSIPs. Stricter time limits for lodging JRs and raising new claims, coupled with higher standing requirements, are designed to prevent undue hold-ups in implementing nationally significant schemes. Critics caution, however, that any limiting of legal recourse must be balanced against the need for fair and meaningful scrutiny of large-scale developments.

Looking ahead, the Government's National Infrastructure Strategy sets targets to halve overall NSIP approval times by 2025 and commits significant investment (in excess of £160 billion) towards transport and energy infrastructure. Proposals to merge the National Infrastructure Commission with the Infrastructure and Projects Authority—forming the National Infrastructure and Service Transformation Authority (NISTA) in 2025—may support large-scale projects. Potential increases in threshold limits for onshore wind (up to 100MW) and solar farms (up to 150MW) demonstrate one approach to scaling up renewable energy capacity.

Overall, the modernised NSIP framework looks to balance the Government's ambitions for rapid delivery of major infrastructure with the imperative of maintaining robust environmental and public engagement standards. The new fast-track route offers a clear incentive for developers to invest in high-quality applications and stakeholder engagement, while revised legislation and policy statements provide a foundation for tackling both current demands—such as energy security and economic regeneration—and long-term net-zero goals.

10.1.2 Regional Level

Combined Authorities and Metro Mayors

As of May 2024, England had eleven combined authorities, each led by a directly elected Metro Mayor. These mayors, in collaboration with their respective combined authorities, exercise devolved powers as stipulated in their devolution agreements. The UK government's recent white paper, Power and Partnership: Foundations for Growth, (published on 16 December 2024)[80], outlines plans to further extend devolution, with the objective of ensuring that all areas of England can benefit from mayoral governance.

Certain city-regions, such as Greater Manchester and the West Midlands, have established combined authorities led by directly elected mayors. These authorities play a crucial role in developing strategic frameworks that address key policy areas, including housing, transport, and local economic development. By

[79] **GREAT BRITAIN. Ministry of Housing, Communities and Local Government and Department for Levelling Up, Housing and Communities,** 2024. *Guidance on the fast-track process for Nationally Significant Infrastructure Projects* [online]. London: The Stationery Office. Available from: https://www.gov.uk/guidance/planning-act-2008-fast-track-process-for-nationally-significant-infrastructure-projects [Accessed 6 March 2025].

[80] **GREAT BRITAIN. Ministry of Housing, Communities and Local Government,** 2024. *English Devolution White Paper: Power and partnership: Foundations for growth* [online]. London: The Stationery Office. Available from: https://www.gov.uk/government/publications/english-devolution-white-paper-power-and-partnership-foundations-for-growth [Accessed 6 March 2025].

coordinating policies across multiple local authority areas, they facilitate regional growth and infrastructure development.

By February 2025, several new combined authorities had been established, reflecting the government's continued commitment to decentralisation. A notable addition is the Greater Lincolnshire Combined County Authority, which was officially formed on 5 February 2025. The first mayoral election for this authority is scheduled to take place in May 2025.

The formation of additional combined authorities reflects the ongoing transformation of local governance in England, driven by a push for greater efficiency, financial sustainability, and regional autonomy. The Power and Partnership: Foundations for Growth white paper, builds on the legislative framework set out in *the English Devolution Bill (July 2024)* and outlines a comprehensive vision for restructuring local government. One of its key proposals is the transition from two-tier local government systems to unitary authorities for populations of at least 500,000, a move intended to streamline administrative functions, reduce duplication of services, and improve financial resilience in the face of growing fiscal pressures on local councils.

In addition to structural reforms, the white paper reaffirms the government's commitment to expanding devolution across England, aiming to ensure that all areas have access to devolved powers. It sets out proposals for enhancing mayoral governance, making directly elected mayors a core feature of local government, with an expanded remit over transport, housing, economic development, and public services. The paper also underscores the importance of fiscal devolution, advocating for greater financial autonomy for local authorities through increased control over local taxation and investment decisions.

Together, the English Devolution Bill and the white paper represent a concerted effort to reshape England's governance landscape, shifting power away from Westminster and towards regional and local leaders. While the reforms promise greater regional autonomy and administrative efficiency, their success will depend on effective implementation, equitable funding distribution, and long-term political commitment.

Beyond statutory duties, many local authorities form voluntary alliances, jointly produce Local plans. These partnerships help integrate infrastructure provision, minimise duplication, and align shared goals for economic development.

Historically, Regional Spatial Strategies (RSS) provided regional-level planning frameworks for the regions of England outside London, where strategic planning responsibility lies with the Mayor through the London Plan. Introduced in 2004, RSS set out high-level policies for housing, transport, and economic development. Their revocation was announced on 6 July 2010 by the Conservative–Liberal Democrat coalition government, effectively ending the RSS system. However, many of the principles underpinning RSS—such as aligning local plans with broader regional priorities, preserving flexibility for local adaptation, and coordinating policy across multiple authorities—continue to influence current approaches to regional governance and planning.

In place of Regional Spatial Strategies (RSS), certain combined authorities outside London now have the power to produce SDS. Building on the London Plan model, SDS establish region-wide frameworks that address housing delivery, strategic transport corridors, environmental sustainability—including net zero objectives—and the coordinated provision of infrastructure. By aligning local planning under a unified vision, SDS reflect the Government's commitment to devolution and promote a more integrated and strategic approach to policymaking. These frameworks enable combined authorities to coordinate statutory responsibilities, foster cross-boundary collaboration, and engage local communities, thereby supporting sustainable and balanced regional development.

Unlike the statutory London Plan, SDS in other regions are often, but not always, non-statutory. This distinction arises from variations in devolution agreements, legislative powers conferred to combined authorities, and the discretionary nature of local governance structures. Some combined authorities—such as Greater Manchester and Liverpool City Region—have been granted statutory plan-making powers through their devolution deals, allowing them to produce legally binding SDS that directly influence local development policies. In contrast, other areas, including the West Midlands and West Yorkshire, currently operate under non-statutory SDS, which, while influential, do not carry formal legal weight. These non-statutory strategies serve as strategic guidance, promoting policy alignment across local authorities and encouraging consistency with national planning objectives.

In Greater Manchester, the Greater Manchester Spatial Framework was initially conceived as a statutory SDS but evolved into the non-statutory Places for Everyone Plan after Stockport Council withdrew from the agreement. Despite its non-statutory status, the plan continues to shape local development by coordinating

housing allocations, economic growth strategies, and green belt protections across the remaining nine boroughs. Similarly, the West Midlands Combined Authority has developed a non-statutory SDS that guides investment priorities for transport infrastructure, brownfield land regeneration, and employment hubs. While these frameworks do not legally bind local planning authorities, they exert considerable influence on decision-making, fostering regional coherence in spatial development.

Overall, the evolving role of SDS reflects the broader trajectory of England's devolution agenda. By enabling combined authorities to take a strategic approach to planning, SDS reinforce regional autonomy while supporting national priorities such as economic growth, housing supply, and environmental sustainability. Whether statutory or non-statutory, SDS represent a critical mechanism for integrating planning functions at a regional scale, ensuring that development is managed in a coordinated and sustainable manner.

10.1.3 Local level

The local planning system operates primarily under the Town and Country Planning Act 1990. Local Planning Authorities (LPAs) manage this framework, which is further supported by Local Development Plans and, where applicable, Neighbourhood Plans. This approach emphasises community engagement and adherence to locally defined strategic priorities while incorporating robust environmental assessments to address issues such as air quality, water resources, and biodiversity.

Local planning may also involve environmental permitting measures, including EIAs and SEAs, particularly in areas sensitive to developmental impacts. Furthermore, for projects that involve marine components, local authorities coordinate with specialised marine licensing regimes to ensure that such developments align with both local and national environmental policies.

Although planning legislation in England has evolved through multiple amendments, *the TCPA 1990* remains foundational. Its core provisions outline key processes for planning applications, appeals, enforcement, and public consultation. This foundation was further built upon by *The Planning and Compulsory Purchase Act 2004* introduced new plan-making arrangements, emphasising sustainability and the importance of LDFs. More recently, the *Levelling-up and Regeneration Act 2023* has sought to address perceived inefficiencies in the planning system. Among its innovations is the proposed replacement of the Community Infrastructure Levy (CIL) and traditional Section 106 obligations with a single Infrastructure Levy. This shift aims to improve transparency, capture increases in land value more effectively, and deliver infrastructure aligned with local needs.

In tandem with these primary statutes, other legislation significantly influences planning outcomes. *The Environment Act 2021* mandates a minimum 10% BNG for most new developments, thereby integrating ecological enhancement into development proposals.

Local Planning Authorities (LPAs)

LPAs, typically district, borough, or unitary councils, play a central role in shaping local development by creating, updating, and enforcing planning frameworks. These authorities are responsible for a suite of statutory and SPDs that collectively guide sustainable and strategically aligned development within their jurisdictions.

Key responsibilities of LPAs include:

- **Preparation of Core Planning Documents:** Developing statutory Local Plans (also known as Development Plan Documents) which set out the overarching spatial vision, strategic priorities, and policy framework for an area.
- **Supplementary Planning Documents:** Preparing SPDs to provide detailed guidance on specific topics such as design standards, housing density, sustainable energy use, or heritage conservation.
- **Climate and Net-Zero Strategies:** Increasingly integrating climate action plans and net-zero objectives into planning frameworks to address sustainability and decarbonisation targets.

The preparation of these documents involves extensive public consultation, collaboration with statutory consultees, and iterative drafting to ensure alignment with national policies and local community priorities.

In addition to policy formulation, LPAs manage most planning applications excluding NSIPs. Despite their central role, many LPAs are constrained by limited resources, leading to backlogs and protracted decision-making processes.

Compliance monitoring is another core responsibility, with LPAs empowered through enforcement procedures, issuing enforcement notices when unauthorised developments are identified. In recent years, higher financial penalties have been introduced for persistent breaches, reflecting the government's intention to uphold planning regulations more rigorously. Councillors, who often serve on planning committees, play a critical part in determining applications, balancing professional planning officers' recommendations with community interests and political considerations.

An overview of the types and functions of planning documents prepared by LPAs is provided in the table below.

Table 10-1. Summary of key local planning authorities planning documents and their functions

Document	Description
Local Plans and Development Plan Documents including Area Action Plans	Local Plans guide the location, nature, and scale of development within each LPA's jurisdiction. They establish strategic priorities such as housing targets, employment allocations, transport corridors, and environmental safeguards. Their preparation typically involves extensive public consultation, engagement with statutory consultees (for instance, the Environment Agency and highways authorities), and iterative drafts to refine policy proposals. Once the plan is examined by an independent inspector and deemed "sound," it is formally adopted. Under national planning policy, LPAs in England are also obliged to demonstrate a rolling five-year supply of deliverable housing land. Failure to do so triggers the "tilted balance," whereby development proposals may be granted permission if the benefits are judged to outweigh any adverse impacts. This requirement underscores the central government's emphasis on boosting housing delivery to meet national targets. Local Plans are ordinarily reviewed every five years to ensure they remain up to date; however, legal disputes over topics such as green belt boundaries or housing numbers can introduce significant delays and create uncertainty in local decision-making. An example of a Development Plan Document is AAPs, which are a DPD providing a detailed planning framework for areas expected to undergo substantial change or regeneration. This can include enterprise zones, key industrial estates, or large ports with potential for low-carbon industrial growth. With many councils declaring a climate emergency or adopting net zero targets, Local plans increasingly include specific climate policies. These can mandate sustainable design, low-carbon infrastructure, and decarbonisation strategies. However, the extent of detail on emerging technologies varies significantly between authorities.
Supplementary Planning Documents (SPDs)	SPDs offer more detailed guidance on particular topics, policies or locations, supplementing the core policies of the Local Plan. Typical examples include design codes, renewable energy guidance, or climate change adaptation strategies. SPDs can be used to outline best practice for industrial developments, specify sustainability standards for large-scale energy projects, or identify opportunities for shared infrastructure such as district heating networks. Local authorities may also use other forms of non-statutory guidance, such as planning guidance notes or policy guidance documents, to assist with the interpretation and implementation of statutory policies. However, the specific type of guidance used varies between authorities, with some favouring design guides, masterplans, or other advisory frameworks to support planning decisions.
Climate Actions Plans and Climate Emergency Declarations	A growing number of local authorities have declared a climate emergency and/or established area-wide net zero targets, often with target dates such as 2030 or 2040. These declarations typically trigger the creation of Climate Action Plans or Net Zero Strategies, which can outline policy measures, investment priorities, and partnership opportunities to reduce emissions across sectors. Although these plans are not statutory development plan documents, they can be important material considerations in the

Document	Description
	planning process. Planners and decision-makers may reference them when assessing applications, especially where proposed developments have significant carbon implications. Typical impacts on planning policies include: • **Site Allocations:** Identification of suitable sites for low-carbon industry or renewable energy in line with climate goals. • **Design Standards:** Encouragement (or requirement) of higher energy efficiency, low carbon heating, and use of advanced technologies (e.g. hydrogen, CCUS) in new developments. • **Monitoring and Report:** Outline mechanisms to track progress towards emission targets, potentially triggering policy updates or supplementary guidance as needed

The Local Planning Application Process

Prospective applicants often engage in pre-application discussions with LPAs, seeking guidance on potential issues such as heritage impacts, transport constraints, or design requirements. While some LPAs offer this service free of charge, others levy fees that vary by project scale.

Planning applications themselves can be submitted in several forms. An outline application establishes the principle of development, with details (known as “reserved matters”) determined at a later stage. A full planning application provides comprehensive information, including layout, appearance, and landscaping. In instances where development has commenced or been completed without permission, a retrospective application is required.

Public consultation is integral to the planning process: LPAs typically publicise proposals online and through site notices, affording residents and stakeholders a minimum of 21 days to respond. The LPA collates representations and material considerations—encompassing design quality, traffic impact, and heritage significance—into an officer report. For major or sensitive schemes, decisions are taken by an elected planning committee.

Unsuccessful applicants, or those disputing conditions imposed by the LPA, may appeal to the Planning Inspectorate. Appeals usually proceed via written representations, but more complex cases may necessitate a hearing or public inquiry. Timescales vary, with many decisions reached within several months, although high-profile appeals can extend beyond a year.

10.1.4 Planning

Permitted Development Rights (PDRs)

Permitted Development Rights allow specific types of development to proceed without the need for a standard planning application, subject to conditions and prior approval requirements. In recent years, these rights have expanded, particularly to facilitate the conversion of offices to residential units and, more recently, the extension of existing buildings. Proponents argue that PDRs expedite much-needed housing delivery and revitalise underused commercial properties. Critics, however, note that such developments can circumvent obligations to provide affordable housing and can result in suboptimal design or living conditions. These concerns have prompted reviews and, in some instances, tighter oversight of certain PDR categories.

Community Infrastructure Levy (CIL) and Section 106 Obligations

Infrastructure funding mechanisms have been integral to ensuring that new developments contribute to the broader public good. Under the existing system, the Community Infrastructure Levy (CIL) is charged per square metre of qualifying development and allocated to infrastructure projects such as transport improvements, schools, and open spaces. In parallel, Section 106 agreements are site-specific legal obligations requiring developers to provide affordable housing or other community benefits.

Under the Levelling-up and Regeneration Act 2023, a new Infrastructure Levy is proposed to replace both CIL and the majority of Section 106 obligations. This consolidated levy aims to be more flexible and transparent, enabling LPAs to channel funds more effectively into priority infrastructure projects.

Duty to Cooperate

The Duty to Cooperate is a statutory obligation requiring neighbouring local authorities and public bodies to work collaboratively in addressing strategic planning issues that cross administrative boundaries. This duty, established under the Localism Act 2011, is particularly relevant to matters such as transport infrastructure, housing provision, economic development, environmental sustainability, and flood risk management. By fostering inter-authority cooperation, it aims to ensure that local development strategies are coordinated, effective, and aligned with broader regional and national priorities.

While the duty encourages partnership and shared decision-making, its effectiveness has been inconsistent due to variations in local priorities, political differences, and resource disparities between authorities. In some cases, cooperation has led to successful regional strategies, such as the coordination of transport corridors, large-scale housing developments, and environmental protections. For example, in Teesside, collaboration between local authorities and private sector partners has supported large-scale clean energy projects, such as Net Zero Teesside, a CCS initiative aimed at decarbonising regional industry. Similarly, the Greater Manchester Spatial Framework showcased effective cross-boundary cooperation by aligning housing and infrastructure planning across ten boroughs, ensuring a coordinated approach to growth.

However, in other instances, conflicting local agendas, lack of enforcement mechanisms, and political resistance have resulted in delays, fragmented decision-making, and suboptimal policy outcomes. For instance, the St Albans Local Plan was halted in 2020 due to inadequate collaboration with neighbouring authorities, particularly concerning housing needs and strategic land use planning. Likewise, Sevenoaks District Council's Local Plan was rejected in 2019 for failing to demonstrate meaningful engagement with adjacent authorities regarding unmet housing demand. These cases highlight the challenge of relying on a duty that lacks enforcement mechanisms, often turning what should be a collaborative process into a bureaucratic hurdle that undermines effective planning and regional development.

One of the key criticisms of the Duty to Cooperate is that it lacks a formal enforcement mechanism, meaning that while authorities are legally required to engage in discussions, there is no obligation to reach an agreement. This has led to legal challenges and complications in the local plan-making process, with some councils struggling to meet housing targets or infrastructure commitments due to a lack of consensus with neighbouring areas.

In light of these challenges, recent policy discussions—including those outlined in the Power and Partnership: Foundations for Growth white paper—have suggested that the duty may need to be replaced or reformed. Proposals include stronger statutory mechanisms for cross-boundary planning, increased support for regional partnerships, and clearer accountability structures to ensure that strategic cooperation translates into tangible outcomes.

Ultimately, while the Duty to Cooperate remains a key pillar of local governance, its impact varies significantly depending on political will, regional priorities, and resource availability. Moving forward, further reforms may be necessary to ensure that collaborative planning efforts result in consistent, equitable, and effective development strategies across England.

Government Reporting on Local Planning

The UK Government regularly reviews and reports on local planning performance to identify areas for improvement and ensure alignment with overarching policy objectives. These reviews often emphasise the challenges faced by under-resourced LPAs, highlighting the need for additional funding and technical support to manage planning backlogs.

Government reports also address infrastructure delivery, examining how well planning approvals correspond with the timely provision of roads, schools, and health facilities. Since meeting housing targets is a priority, local authorities are monitored for their progress in maintaining an adequate pipeline of residential development. Underperforming LPAs can be placed in “special measures,” allowing the Secretary of State to intervene in decisions.

Enhancing transparency and trust in the planning system remains a core concern in these reports. The government has called for more comprehensive consultation procedures, clearer explanations of how decisions are reached, and an increased use of digital platforms to widen public participation. Coupled with legislative changes, these measures reflect a commitment to continual refinement of the planning system in England and Wales.

10.2 WALES

10.2.1 National Level

The Planning (Wales) Act 2015 and the Developments of National Significance (Wales) Regulations 2016 introduced a streamlined consent regime for large-scale projects in Wales, such as energy developments exceeding 10 megawatts of electrical output. Under this framework, developers submit their applications directly to Welsh Ministers via Planning and Environment Decisions Wales (PEDW). By centralising these submissions, the Welsh Government aims to simplify the decision-making process, reduce administrative delays, and ensure that projects of national or regional importance undergo thorough but efficient scrutiny.

In terms of alignment with national policy, any proposal must satisfy the strategic objectives set out in Future Wales – The National Plan 2040 and conform with the principles and guidance of Planning Policy Wales (PPW). These policy instruments emphasise sustainable development, placing social, economic, and environmental objectives at the forefront of planning decisions. As part of ensuring consistency, proposals should also demonstrate how they meet broader national priorities.

This regime in Wales runs in parallel to the NSIPs process that applies in England (and, in certain cases, across the UK). While the Welsh DNS framework has distinct procedural elements tailored to devolved Welsh planning powers, both regimes share a common goal: to streamline the authorisation of major infrastructure schemes and ensure that nationally significant developments are delivered in a timely and responsible manner. By offering clarity on roles and responsibilities, the processes help investors, local communities, and stakeholders understand how key decisions are made and how important infrastructure projects can progress consistently and sustainably across Wales.

10.3 ENVIRONMENTAL LEGISLATION

Environmental permitting regimes are essential tools for regulating industrial activity in the UK. They ensure that proposed developments and industrial clusters minimise their impact on air, water, biodiversity, and other natural resources. By setting clear legal requirements, these processes help local authorities and regulatory agencies maintain sustainable development, promote resource efficiency, and protect ecosystems for future generations.

A strong legislative foundation underpins environmental permitting across the UK, with a selection of key Acts summarised in the table below.

Table 10-2. Environmental Legislation

Act	Description
Environment Act 2001	Introduced legally binding targets for air quality, water resources, and biodiversity, and established the Office for Environmental Protection (OEP) to oversee compliance. It also mandates Local Nature Recovery Strategies (LNRS), reinforcing the principle that ecological considerations should be central to land-use planning.
Environmental Protection Act 1990	Provides essential controls over waste management and pollution, including Integrated Pollution Control (IPC) and Local Air Quality Management (LAQM) frameworks
Environment Act 1995	Created the Environment Agency and the Scottish Environment Protection Agency (SEPA), which remain key regulators for industrial emissions and pollution prevention efforts
Water Framework Directive (WFD)	Requires that all water bodies achieve and maintain good ecological and chemical status. Guides water management planning and

Act	Description
(Directive 2000/60/EC), transposed in England & Wales via the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017	permitting decisions, ensuring that industrial and infrastructural developments do not compromise water quality or deplete resources beyond sustainable limits.
Habitats Regulations (e.g., the Conservation of Habitats and Species Regulations 2017 for England & Wales	Transpose the EU Habitats and Birds Directives into domestic law. Provide legal protections for designated sites (e.g., Special Areas of Conservation and SPAs) and species. Any development likely to have a significant effect on these sites requires an Appropriate Assessment to ensure no adverse impact on their integrity.

Environmental permitting in the UK is administered by different regulatory bodies depending on the jurisdiction. In England, the EA handles permit applications, while in Scotland, Wales, and Northern Ireland, SEPA, Natural Resources Wales (NRW), and the Northern Ireland EA (NIEA) respectively take on this role. Some permitting is also handled by Local Authorities. Permits serve multiple objectives: they evaluate the potential environmental impact of a proposed activity; establish conditions to mitigate harm; and promote long-term sustainability by requiring operators to monitor emissions, manage waste responsibly, and conserve resources. Operators typically must submit technical studies—covering emission controls, monitoring proposals, and mitigation strategies—as part of their permit applications.

Capacity studies play a complementary role to permitting by examining whether local environments can accommodate additional industrial or infrastructural developments without exceeding ecological limits. These studies help planners and regulators understand the cumulative effects of multiple projects, ensuring that new proposals do not collectively push air quality or water resource usage beyond acceptable thresholds.

Environmental Impact Assessment

The EIA process, governed in large part by the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, remains central to evaluating individual projects. Typically involving screening, scoping, and the submission of an Environmental Statement (ES), EIAs require developers to identify, measure, and propose mitigation for any significant adverse impacts. This process engages statutory consultees, local communities, and experts, ultimately informing planning authorities' decisions.

Marine Planning and Offshore Developments

Marine plans guide the sustainable use of marine areas, ensuring that offshore development is balanced with environmental protection and community interests. In cases where onshore projects extend offshore—such as wind farms or CCS facilities—both land-based planning permissions and marine licences are required. The Marine Management Organisation is responsible for regulating these licences in English waters, while Marine Scotland, Natural Resources Wales, and the Marine and Fisheries Division of the Department of Agriculture, Environment and Rural Affairs (DAERA) undertake similar roles in Scotland, Wales, and Northern Ireland respectively.

These marine regulatory frameworks run alongside the existing planning system, which typically governs onshore developments. As outlined previously, in England large-scale energy projects or other major infrastructure schemes are often classed as NSIPs. This designation can bring offshore works under a single DCO, simplifying the overall application process. However, obtaining a marine licence may still be necessary where certain offshore activities lie outside the scope of the DCO or require additional scrutiny. By integrating these processes, regulators and developers can ensure that offshore aspects of projects align with overarching maritime objectives and that the potential impacts on marine ecosystems and coastal communities are properly managed within the wider planning and permitting framework.

11. APPENDIX 3: UK STRATEGIC ENVIRONMENTAL ASSESSMENTS: SCOPE AND COMPONENTS

A SEA is applied to plans and programs in the UK to ensure environmental considerations are integrated at a higher policy or spatial level (in line with the Environmental Assessment of Plans and Programmes Regulations 2004, UK Statutory Instrument 2004 No. 1633).

Unlike project EIAs, SEAs evaluate broad plans (e.g. local development plans, regional strategies, sector policies) and therefore emphasise cumulative and synergistic effects of multiple actions. SEA examines how a whole suite of future projects or policies might collectively impact the environment. In fact, Schedule 2 of these Regulations explicitly requires assessment of "secondary, cumulative, and synergistic" effects of the plan's implementation. This means SEAs look beyond individual site impacts to consider wider trends – for example, a new spatial plan might propose many housing sites whose combined effect on regional traffic, air quality, or biodiversity corridors must be assessed. The geographic scope of an SEA can be large (entire boroughs, counties or even nationwide), and the temporal scope long-term, so baseline studies in SEAs consider the present state of the environment and its likely evolution without the plan. SEAs also must account for other plans and reasonably foreseeable projects to gauge in-combination impacts. For instance, a county-level minerals plan SEA could evaluate whether multiple quarry expansions together create significant dust or landscape impacts even if each project alone is minor. In summary, a CIA is a cornerstone of SEA – interactions among proposals, and interactions with other plans, are carefully evaluated to avoid unintended environmental degradation at the strategic level.

The output of an SEA is typically an Environmental Report prepared in accordance with Regulation 12 of the Environmental Assessment of Plans and Programmes Regulations 2004[81]. While commonly integrated with a Sustainability Appraisal in UK planning practice, this integration is not a statutory requirement. The Environmental Report systematically documents the likely effects of the plan and how they were considered. Key components included in SEAs are included in Table 11-1. Overall, these components ensure that an SEA provides a comprehensive environmental appraisal of strategic decisions before they are finalised.

A SEA is a high-level document which does not normally go into such detail as the EIA for a specific development.

Table 11-1. Strategic Environmental Assessment components.

Component	Description
Plan Outline & Objectives	A description of the plan or program's content and main objectives, and its relationship with other relevant plans. The context is set so readers understand what strategic actions are being assessed (e.g. a Local Plan setting housing and employment land allocations up to 2040, or an energy strategy promoting renewables, hydrogen and CCUS).
Baseline Environment & Trends	A compilation of current environmental conditions in the plan area, covering topics listed in the SEA Regulations – typically biodiversity (flora, fauna), population and human health, soil, water, air quality, climatic factors, material assets, cultural heritage, landscape, etc. For each topic, the Environmental Report describes the existing baseline and how it might evolve under a "do nothing" scenario. Any existing environmental problems or sensitivities (e.g. areas of poor air quality, flood-prone zones, endangered species habitats) are highlighted, since the plan should respond to these issues.
SEA Objectives & Assessment Framework	Many SEAs establish a set of environmental protection objectives or sustainability objectives against which the plan is assessed. These often derive from legislation or policy goals (for example, "protect and enhance biodiversity" or "reduce carbon emissions"). An assessment matrix or framework is used to evaluate whether each

[81] **GREAT BRITAIN. Department for Environment, Food & Rural Affairs, 2018.** *Strategic Environmental Assessment Regulations: Requirements Checklist.* London: The Stationery Office. Available from: https://assets.publishing.service.gov.uk/media/5a81605740f0b62302696f94/Strategic_Environmental_Assessment_Regulations_requirements_checklist.pdf [Accessed 14 March 2025].

Component	Description
	element of the plan contributes to or conflicts with these objectives. This provides a structured, transparent way to identify significant effects. Indicators and targets may be defined for each SEA objective to help quantify impacts.
Consideration of Alternatives	A crucial part of SEA is examining reasonable alternatives to the proposed plan. The Environmental Report will outline different scenarios or strategies that were considered (for example, alternative spatial strategies for growth, or alternative policies). It evaluates the environmental effects of these alternatives in comparison to the preferred plan. This could include, say, different technology balances for delivering low carbon industrial clusters. The SEA must document the reasons for selecting the preferred alternative and rejecting others, considering their environmental implications. Exploring alternatives at this high level helps ensure the final plan is the most sustainable option.
Evaluation of Likely Effects	For each relevant aspect of the plan, the SEA assesses its likely significant effects on the environment. This typically involves an expert appraisal (often qualitative, sometimes semi-quantitative scores) of how the plan's policies or land allocations will affect each environmental topic. Both positive and negative effects are recorded. Importantly, effects are characterised by magnitude, duration (short, long-term), frequency, and whether they are permanent or reversible. The SEA addresses not only direct impacts, but also indirect, secondary effects (e.g. the indirect effect of investing in low carbon technologies on facilitating wider development and employment), as well as cumulative effects when combined with other proposals. For example, an SEA of a strategic spatial plan might note that one industrial cluster in isolation has limited impact, but the cumulative effect of multiple clusters could significantly increase impacts such as road traffic noise/emissions or biodiversity impacts. By evaluating these potential interactions, SEAs provide a holistic view of potential environmental changes resulting from implementing the plan.
Mitigation Measures	Like an EIA, SEA proposes measures to prevent, reduce or offset significant adverse effects of the plan. However, mitigation in SEA often takes the form of recommendations to modify plan policies. For instance, if an SEA finds a proposed industrial area could harm a nearby nature reserve, it might recommend adding a buffer zone policy or enhanced requirements for green infrastructure in that area. These mitigation recommendations are usually integrated into the final adopted plan or associated implementation measures. The SEA might also flag if certain issues need to be addressed at project EIA stage (tiering of mitigation).
Monitoring Plan	The SEA Environmental Report includes measures envisaged for monitoring the significant effects of plan implementation. This is to track whether the plan causes the predicted impacts (for example, monitoring biodiversity in new development areas or traffic growth on key corridors) and to allow for remedial action if unexpected adverse effects arise. Monitoring focuses on the significant effects and the performance of mitigation measures. The SEA sets out indicators and responsibilities for this monitoring, which will be undertaken during the plan's lifespan.
Non-Technical Summary (NTS)	A concise, plain-language summary of all the above information is provided so that the public and decision-makers can easily understand the SEA findings without wading through technical detail. The NTS covers the plan, likely effects, mitigation, alternatives considered, and a summary of conclusions in a reader-friendly format.
Consultation and Iteration	Although not a section per se, it's worth noting SEAs involve consultation with environmental authorities and the public at scoping and draft stages. The SEA process is iterative – feedback often leads to refinements in both the plan and the Environmental Report. The final Environmental Report also documents how consultees' opinions were considered.

An example of SEA in practice is the Greater Manchester "Places for Everyone" Plan (a joint strategic spatial plan for nine boroughs, 2021–2037). This plan, which allocates housing, employment land, and infrastructure

across a city-region, was subject to an SEA as part of its Sustainability Appraisal[82]. The SEA examined cumulative impacts of all proposed development on issues like regional air quality, flood risk, green belt loss, and carbon emissions. It considered alternatives (different spatial distributions of development), assessed each policy and site allocation against sustainability objectives, and recommended mitigation (such as enhancing public transport to mitigate traffic from new developments). By doing so, it influenced the plan to include stronger climate and environmental protections.

Another notable example is the London Plan 2021, which underwent an Integrated Impact Assessment that included an SEA. The London Plan's IIA/SEA evaluated the city-wide environmental effects of planning policies on transport, housing density, green space, etc. – ensuring, for instance, that cumulative increases in housing were matched with policies to avoid deteriorating air quality or loss of biodiversity. The assessment framework tested the London Plan proposals against objectives for sustainable development, and the process integrated considerations of equality and health alongside environmental factors. These cases illustrate how SEAs in the UK can address broad, cumulative impacts. Rather than looking at single projects in isolation, they look at the combined effect of many actions enabled by a plan, and they embed mitigation measures at a policy level (e.g. requirements for sustainable drainage or net gain in biodiversity in all developments). Such strategic assessments are now standard for local and regional plans – from county mineral plans to city transport strategies – under the UK's SEA Regulations. They ensure plans are not considered in isolation, but with full awareness of environmental constraints and opportunities.

[82] **GREATER MANCHESTER COMBINED AUTHORITY, 2021.** *Places for Everyone 2021: Strategic Environmental Assessment* [online]. Available from: https://www.greatermanchester-ca.gov.uk/what-we-do/planning-and-housing/strategic-planning/places-for-everyone/pfe-previous-stages/places-for-everyone-2021-regulation-19/supporting-documents-2021/?folder=02%20Strategic%20Environmental%20Assessment#fList [Accessed 12 March 2025].

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