

HICP Delivery Team

Humber Industrial Cluster Plan

Cluster-level Impact Assessment

Reference:

Revision B | 28 March 2023



© Photo courtesy of Centrica Storage

Job number 285567

Ove Arup & Partners Limited
Admiral House Rose Wharf
78 East Street
Leeds
LS9 8EE
United Kingdom
arup.com

Contents

1.	Introduction	1
1.1	Background to the impact assessment	1
1.2	Developing the Humber Industrial Cluster Plan	1
1.3	The Humber Industrial Cluster Plan key messages	1
1.4	Impact assessment purpose	2
2.	Impact assessment	3
2.1	Assessment framework	3
2.2	Alignment of the SDGs and the HICP Mandates for action	3
2.3	Assessment approach	4
2.4	Impact assessment table	6
3.	Impact assessment via statutory processes	11
4.	Conclusion	12
5.	References	13

Figures

Figure 1.	The 17 UN Sustainable Development Goals.	3
Figure 2.	Matrix demonstrating the alignment of the HICP Mandates for action and the SDGs.	4

Appendices

Appendix A	A-14
Full text of HICP Mandates for action	A-14

1. Introduction

1.1 Background to the impact assessment

This impact assessment is one of a group of reports which underpin the Humber Industrial Cluster Plan (HICP) launched in March 2023. The HICP delivery team comprised Hull and East Yorkshire Local Enterprise Partnership (HEY LEP) and CATCH UK. Arup worked with the HICP delivery team to compile and distil the outputs, insights and deliverables from all the contributors to the Plan, leading to the production of the Plan itself.

This impact assessment was undertaken when the Plan's content and key messages were defined.

1.2 Developing the Humber Industrial Cluster Plan

The HICP sets out how the Humber Industrial Cluster can achieve deep decarbonisation by 2030 and net-zero by 2040 for Scope 1 (direct) emissions. The HICP draws on independent research and analysis undertaken by Element Energy, ERM and KPMG. The work done and outputs produced from each of these companies is summarised below. This impact assessment also draws on this extensive body of information, which should be referred to for more detail on the impacts and mitigations identified.

Element Energy:

- Developed and applied an Industrial Decarbonisation Systems Model to analyse a range of industrial decarbonisation technology options and timescales for adoption.
- Undertook an extensive Markets, Policy, and Regulatory study, providing detailed insight into the risks and barriers around industrial decarbonisation, and recommendations to mitigate them. This study explored fuel switching technologies; carbon capture use and storage; greenhouse gas removal technologies; the prospects for exporting national and international emissions offsets; and the commercial viability of national and international CO₂ import.
- Conducted an Industrial Decarbonisation Water Demand Study to determine potential constraints arising from projected changes in industrial water demand, and its consequences for decarbonisation plans.

ERM:

- Conducted a Societal and Cultural Challenges and Social Innovation Study, which considered the social and cultural strategies needed to support transformational shifts in the cluster, characterised the enabling environment, and quantified the social value and benefits of decarbonisation technologies.

KPMG:

- Prepared an Inward Investment Study which assessed the impact of decarbonisation measures and net-zero status on inward investment.
- Conducted a Supply Chain Study which mapped the existing capabilities, capacities, gaps and pressure points of the engineering supply chain and contracting services sector to support decarbonisation efforts over the next 20-years.
- Delivered a Skills Study into the region's ability to meet key skills requirements needed to support the transition to net-zero, highlighting both strengths and needs.

1.3 The Humber Industrial Cluster Plan key messages

The HICP coalesced around seven 'Mandates for action', summarised as:

1. To implement carbon capture and storage and greenhouse gas removal technologies at pace and scale.
2. To implement low-carbon hydrogen at scale.
3. To adopt all optimal electrification measures.

4. To prioritise efficiency and circular economy measures.
5. To generate social value through the industrial transition.
6. To further develop Humber skills and supply chains.
7. To drive investment and collaboration to deliver the net-zero Humber of Tomorrow.

The full text of the mandates is provided in Appendix A for reference.

Mandates 1 to 4 focus on **what** needs to happen to achieve rapid and deep industrial decarbonisation.

Mandates 5 to 7 focus on **how** this needs to be implemented within the Humber region.

1.4 Impact assessment purpose

Decarbonising the Humber Industrial Cluster provides a once in a generation opportunity to transition the region's valuable industry to net-zero, with wide-spread beneficial effects across the region. But it will be complex.

Decarbonising the Humber Industrial Cluster will involve projects on existing industrial sites and on new sites. Enabling infrastructure and pipelines are required across the region, near to communities and areas of high environmental value. This industrial transition will create jobs and provide opportunity for skills development. There will be significant investment in the region, and this will attract new businesses and enterprises to the area. Successful decarbonisation of the cluster will be achieved through the contributions of hundreds of stakeholders. But the Plan is not being delivered as one project. Responsibility for implementing it is split across businesses, supply chains, national and local government, and many others. Throughout the implementation to 2040 the decisions and actions of each stakeholder will impact directly and indirectly on others, possibly disproportionately.

Given this complexity and the inevitability of there being impacts, this cluster-level impact assessment has been developed. Its purpose is to:

1. **Provide a strategic level assessment framework** to allow potential impacts to be identified early in the implementation stage of the Plan and effectively mitigated.
2. **Present and stimulate consideration of the diverse breadth of potential impacts**, and so provide a starting point for more detailed review and management in the future, in an integrated and balanced manner.
3. **Highlight the aggregated impact of the multiple individual projects** across the region. The impact of each project in isolation may be minor, but when combined could become more significant.

Many of the impacts arising from individual projects will be managed through the statutory planning processes applied to these. Some of the projects will be 'Nationally Significant Infrastructure Projects', due to their size. The specific planning guidance which will apply to these is discussed in Section 3. However, assessing and managing impacts will also need to be carried at a higher level than this. Maintaining this region-wide, strategic awareness and assessment of the impacts of the aggregated programme of decarbonisation related projects will likely be the responsibility of the leadership body responsible for overseeing the Plan's implementation.

2. Impact assessment

2.1 Assessment framework

We have carefully considered the framework against which the impacts of the Plan’s implementation could be assessed. Often a project’s impacts are assessed against specific environmental or other planning criteria. However, given the geographic extent of the Humber region, the diversity of ways in which impacts could occur, and the vision for the Humber to be a global leader and catalyst for change, a holistic, strategic level framework was required. The United Nations Sustainable Development Goals (SDGs) are a call to action to protect the planet and ensure that all people enjoy health, justice, equality, and prosperity. We have used the SDGs as the framework to assess the impacts of the HICP as they are an established, comprehensive, internationally agreed, rigorous method of considering all aspects of sustainability.

The 17 SDGs are shown summarised graphically in Figure 1.



Figure 1. The 17 UN Sustainable Development Goals.

Each SDG has multiple detailed sub-goals, targets, and progress indicators. This impact assessment has been undertaken at the level of each overarching goal, rather than break them down into finer detail. This is as the purpose of this assessment at this stage of the Plan is to map out the full breadth of potential impacts.

We have used the SDG framework to answer two questions:

1. Which of SDGs will be progressed because of the HICP being implemented? *Results detailed in Section 2.2.*
2. What will be the impact of implementing the HICP on each of the areas of sustainable development encapsulated in the SDGs? *Results detailed in Section 2.3 and 2.4.*

2.2 Alignment of the SDGs and the HICP Mandates for action

We assessed the applicability of each of the 17 SDGs to the implementation of the Plan from 2023 to 2040. This identified the SDGs where there will be demonstrable progress made towards their objectives by the Humber Industrial Cluster being decarbonised through the Plan’s implementation. In order of their number, these are:

- Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

- Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all.
- Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
- Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- Goal 10: Reduce inequality within and among countries.
- Goal 12: Ensure sustainable consumption and production patterns.
- Goal 13: Take urgent action to combat climate change and its impacts.

The alignment between these seven goals and the seven Mandates for action in the HICP is illustrated in Figure 2, where the filled green ticks represent areas where there is strong alignment. For example, Mandate 1, *to implement carbon capture and storage and greenhouse gas removal technologies at pace and scale*, will enable clean energy provision (Goal 7), it will support existing industry and allow new low-carbon industry to develop (Goal 9), and it will allow significant reductions of industrial greenhouse gas emissions thus combating climate change (Goal 13). We have also identified some areas where implementing the HICP will support the SDGs, but in a more indirect manner, and this is shown by the white ticks.

This assessment demonstrates the widespread positive impact towards sustainable development that decarbonising the Humber Industrial Cluster can have. It should also be noted that although this positive impact is initially manifest across the Humber it also extends further. The lessons learnt, the technology developed, and the skills and supply chains grown in the Humber will aid the decarbonisation of other industrial clusters nationally and internationally.

	1. Carbon capture and storage	2. Low-carbon hydrogen	3. Electrification	4. Resource and energy efficiency	5. Social value	6. Skills and supply chains	7. Investment and collaboration
4. Quality Education						✓	✓
7. Affordable and Clean Energy	✓	✓	✓				✓
8. Decent Work and Economic Growth					✓	✓	✓
9. Industry, Innovation and Infrastructure	✓	✓	✓	✓		✓	✓
10. Reduced Inequalities					✓	✓	✓
12. Responsible Consumption and Production				✓			✓
13. Climate Action	✓	✓	✓	✓	✓		✓

Figure 2. Matrix demonstrating the alignment of the HICP Mandates for action and the SDGs.

2.3 Assessment approach

In the main part of this report, we assess the impact of implementing the HICP on each of the areas of sustainable development encapsulated in the SDGs. This has been done for each of the SDGs, although implementing the HICP will have a significant, direct, and positive impact on the Goals identified in Section 2.2.





Successful implementation of the Plan, minimising detrimental effects, and maximising opportunity and synergies depends on each of the potential direct and indirect impacts being considered and managed. Our




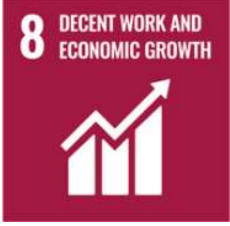
strategic, cluster-level, assessment of these is detailed in Section 2.4, where the impacts are qualitatively presented for each SDG. Four aspects are considered and detailed.





1. **The ‘do nothing’ scenario** – a description of potential impacts in relation to each SDG if the HICP is not actioned and as a result industry ultimately stagnates or declines.
2. **Situation if the HICP is implemented effectively** – a description of the impacts arising if the HICP, and current industry decarbonisation plans are implemented effectively, resulting in rapid and deep decarbonisation.
3. **Potential wider detrimental impacts** – a description of the potential key wider detrimental impacts identified as arising from the implementation of the HICP. Although this focusses on the detrimental / negative impacts, there are also some areas where positive impacts will occur.
4. **Mitigations for a Sustainable Humber** – a description of what potential mitigations could be adopted to ensure a sustainable and equitable future in the Humber region across the full breadth of the impacts considered using the SDG framework.





We have not attributed specific ‘owners’ for each potential mitigation at this stage. Mitigation owners will include individual industries, local and national government, education providers, academia, and non-governmental organisations. Specific owners for each mitigation will need to be identified in the future stages of planning and implementation.


2.4 Impact assessment table

Applicable SDG	The 'do nothing' scenario	Situation if HICP implemented effectively	Potential wider detrimental impacts	Mitigations for a Sustainable Humber
 <p>1 NO POVERTY</p>	Lack of investment in industrial transition leads to business closure, economic stagnation and growing unemployment, contributing to social deprivation.	A rejuvenated net-zero focused industrial transition drives inward investment and boosts employment (direct and indirect).	<p>Inward investment into the Humber does not trickle-down to the poorest.</p> <p>While decarbonisation efforts will create many jobs, those without STEM skills will not be able to access the better paid emerging opportunities. Imported skilled labour may displace local prospects from job opportunities.</p> <p>Communities without advocates could be adversely affected by construction works.</p>	<p>Acceleration of the industrial drive to net-zero considers poverty in the Humber, seeking synergies with community uplift, skills creation, and local benefit.</p> <p>Integrated and collaborative development planning focuses on skills development at all levels and is informed by effective local stakeholder engagement.</p> <p>Specific mitigations are put in place for construction projects with a focus on implications for poorer parts of society.</p>
 <p>2 ZERO HUNGER</p>	The combination of industrial stagnation coinciding with a rising cost of living contributes to poverty and poor diets. Food banks are necessary as the poorest struggle to get by.	Inward investment drives employment and economic development, while growing tax revenues enable significant public sector responses to address poverty and hunger.	<p>The benefit of investment is not equally distributed and does not trickle-down or is intermittent.</p> <p>Changing population profiles leads to need for adaptation in services including food supply which local supply chains must adapt to.</p>	<p>In addition to the above measures on addressing poverty, industrial CSR programs include interventions to address short-term food shortages or food price rises. For example, this could include support of local foodbanks through building long-term relationships and signposting their availability to all employees; providing information on food support available via company Employee Assistance Programmes; facilitating bulk food buying schemes.</p> <p>Social policy and investment encourage local food production, possibly supported by industry sponsored community schemes.</p> <p>Specific mitigations are put in place so that construction of net-zero projects minimises disruption to local agricultural land.</p>
 <p>3 GOOD HEALTH AND WELL-BEING</p>	Industrial emissions risk adversely affecting air quality and contribute to negative health outcomes. Falling economic activity fuels socio-economic decline, reducing access to healthy lifestyle opportunities.	<p>Industrial emissions of greenhouse gasses are reduced to net-zero by 2040.</p> <p>Investment in industry leads to an increased focus on asset health and hence personal safety and well-being.</p>	<p>A focus on CO₂ reduction leads to other pollutants (e.g., NO_x and particulate matter) being given less priority.</p> <p>Construction of new facilities and pipelines across the Humber lead to noise, disruption, or new safety challenges as CCUS and hydrogen are deployed at scale.</p> <p>Workforce capacity shortfalls may result in skilled employees having to work harder or longer to maintain the programmed pace of industrialisation. Health and safety risks are compromised.</p>	<p>Air quality monitoring and improvements efforts are continued and accelerated alongside carbon reduction.</p> <p>New health and safety challenges that may be introduced by the pace and scale of industrial transition, are mitigated on a project-by-project basis in construction and operation.</p> <p>The drive to net-zero is in tandem with a drive to a holistic health safety and well-being improvement in the Humber.</p>
 <p>4 QUALITY EDUCATION</p>	Humber's educational standards improve but continue to lag behind the national average, with students and workers looking to outside the Humber for the best education and employment opportunities.	Increased focus and increasing regional prosperity bring stronger improvements in education and training across the age ranges. Industrial decarbonization creates substantial, sustained demand for skilled workers in existing and emergent sectors, with a focus on science, engineering, modelling, logistics and project management.	<p>Skills development is poorly aligned with industrial demand (both in terms of skills type and the timing of supply).</p> <p>Priorities for tertiary education and vocational training are likely to be dominated by Science Technology Engineering and Mathematics (STEM), with potentially negative outcomes for those seeking to follow alternate paths.</p>	<p>Private and public sector collaboration to ensure education and training in the Humber at all levels is well aligned with anticipated demand.</p> <p>National curricula are designed to ensure a rounded education despite the local need for an increased STEM focus.</p>

Applicable SDG	The 'do nothing' scenario	Situation if HICP implemented effectively	Potential wider detrimental impacts	Mitigations for a Sustainable Humber
	<p>Without significant intervention, current initiatives to address gender imbalance will only go so far (only 16.5% of engineers in the UK are female).</p>	<p>Significant growth in industry-focused education and apprenticeship creates more opportunities for all those entering industry from all genders and backgrounds based on merit providing a multitude of choice for all.</p>	<p>Despite declining barriers to entry in industrial roles, there are continued barriers to progression in terms of pay and prospects.</p> <p>Significant growth in employment opportunities will draw more women into industry. Families are increasing put under pressure if work arrangements do not become more flexible.</p> <p>An overfocus on gender issues means positive action turns to positive discrimination leading to parts of the workforce being frustrated or alienated.</p>	<p>Actual or perceived barriers to both entry and progression are removed from industrial workplaces. Any issues of discrimination that arise are addressed.</p> <p>Society benefits as provision is made to ensure industrial workplaces cater equally for all and consider flexible arrangements for workers with families or caring responsibilities.</p> <p>Workplace measures are put in place to ensure a holistic focus on equality diversity and inclusion which leads to a better outcome for all workers of all backgrounds in the Humber.</p>
	<p>Continued industrial water demand (particularly for cooling) maintains pressure on existing water resources, with additional water resources needed for expanded urban development or agricultural production.</p> <p>Ongoing climate change reduces water availability.</p>	<p>Reduced demand for cooling water as waste heat is usefully repurposed. Efficiency measures also reduce water consumption.</p>	<p>Growth in CCS and low carbon hydrogen both increase water demand, potentially contributing to water stress on the Humber's south Bank in particular.</p> <p>An increase in the population in the Humber will likewise increase demand on existing water and sanitation services.</p> <p>If existing water supplies are insufficient, desalination may be required in the region leading to further clean energy demands and increasing pressure on the electricity grid. Desalination would also require management of the brine discharges.</p>	<p>Industrial planning is done in the context of the regional water resource strategy, including opportunities to align industrial planning for the Humber's south bank with bulk water transfer plans.</p> <p>Forecasting and demand management for water and sanitation takes in account a predicted rise in workers and their families in the Humber.</p> <p>The embodied carbon of the potential water sources is accounted for with desalination used only as a last resort.</p>
	<p>Energy prices continue to be tied to fossil fuel prices, and subject to fluctuation beyond UK influence, leaving access to energy unaffordable for some. Air pollution become an issue in some areas.</p>	<p>Clean energy leads to a fall in carbon and other emissions, net-zero before 2040 is achieved, and negative emissions are generated.</p> <p>A breadth of low carbon interventions including the world's largest offshore wind developments (Hornsea, Dogger Bank) cuts emissions, reduces price fluctuations and increases energy security. Expansion of large-scale hydrogen storage at the Rough and Aldborough caters for intermittency of renewables and facilitates their expansion.</p> <p>The role of the Humber in decarbonising the wider UK is understood and celebrated.</p>	<p>Only carbon dioxide is addressed, and other pollutants are given less attention.</p> <p>Energy prices remain high and have adverse negative impact on those with low incomes.</p> <p>Cheaper electricity prices reduce the incentive to be energy efficient.</p> <p>Large scale deployment of renewable energy leads to loss of visual amenity. Agricultural land is lost to solar PV projects or to unsustainable biomass production.</p>	<p>Energy companies and government collaborate to addresses tackle all pollutants and fuel poverty, ensuring the needs of the most vulnerable are met.</p> <p>Energy price reduction goes hand in hand with efficiency measures and measures to reduce the embodied carbon of energy.</p> <p>Land around the Humber is carefully managed for increased renewable energy generation, food production, nature and carbon sequestration.</p>
	<p>Without investment and development in the Humber Industrial Cluster, employment opportunities and economic growth will be markedly lower.</p>	<p>Inward investment of over £15bn drives growth, creating tens of thousands of direct jobs and boosting local product and service supply chains. It establishes the Humber as a leading region for decarbonisation technology, creating export opportunities, international knowledge sharing, and is a catalyst for change globally.</p>	<p>The surge in required skills for the industrial transition will face capacity and capability challenges especially in the 2025-2030 period, which put the Humber off trajectory.</p> <p>Short-term workforce planning means skilled workers retire before there is time to pass on knowledge and/or train replacements.</p> <p>Where employment opportunities created cannot be served by the local workforce, workers brought in from outside the region or outside the UK could result in social impacts.</p>	<p>An accelerated collaborative focus from the whole industrial community on sustainable growth and inward investment results in clear benefits for the whole of the UK from decarbonising the Humber cluster.</p> <p>The twin imperatives of matching the skills shortage to ensure net-zero trajectory is on track (especially in the 2025-2030 period) and the imperative of prioritising local skills and local people, are addressed via a collaborative planning between industry, local and central government.</p>

Applicable SDG	The 'do nothing' scenario	Situation if HICP implemented effectively	Potential wider detrimental impacts	Mitigations for a Sustainable Humber
				At an early stage, a prerequisite for workers brought in from other regions, or from abroad, is that they are incentivised to build local capacity and capability with a targeted focus across generations, genders, skills levels and minority groups.
	Without innovation and industrial transition, the cluster will gradually be outcompeted by other emerging clusters (UK and abroad). A failure to develop low carbon manufacturing leaves the Humber importing low carbon energy and products, missing a large opportunity.	Innovation drives the industrial transition, diversifying it away from high emissions across all sectors, adding to resilience, adding substantially to strategic infrastructure assets for the UK and reviving the region's industrial pride.	<p>The focus of innovation is distracted by other demands or becomes siloed focusing solely on one of the key industrial interventions (CCUS or hydrogen or electrification or efficiency measures, etc.) which impacts progress of the other interventions and the overall trajectory of the Humber.</p> <p>The relative attractiveness of the Humber region may divert investment from other innovation efforts in other parts of the UK leading to negative feedback and intermittent funding.</p>	<p>Academia, the private sector and government collaborate to incubate industrial innovation addressing a range of policy, people and product measures to accelerate momentum.</p> <p>The Humber works with other clusters and with other regions to ensure benefits from funding of innovation are widespread throughout the UK.</p>
	Without significant investment, efforts to reduce inequality in the Humber cannot accelerate.	Strong growth in inward investment and employment boosts economic growth and public sector revenues.	<p>Investment does not trickle-down into the general population, deepening socio-economic differences.</p> <p>A shortage of skilled labour may drive up wages, increasing the wage differential.</p> <p>More affluent areas with access to better education capture a disproportionate number of available opportunities, increasing social division along economic lines.</p>	<p>Industry, local and national government prioritise local skills and local supply chains to ensure the benefit of the industrial transition reaches all.</p> <p>Education and training initiatives are targeted at specific skills shortages.</p> <p>Effective community engagement highlights where impacts could worsen inequality, enabling early mitigations to be incorporated into the planning cycle.</p>
	Declining prospects for industry undermine inward investment, with a corresponding downturn in investment in the communities across the Humber region.	Decarbonisation of the Humber Cluster catalyses growth and innovation in cities and communities across the region. The region is seen as energetic and successful, attracting investment and talent that supports diversity and fuels a can-do attitude which boosts community resilience and optimism.	<p>Benefit of decarbonisation are short lived or delayed causing complacency and community resistance, further slowing delivery progress. Rapid industrial development may be resented if there is not a corresponding improvement to public space and public assets.</p> <p>Accommodation and services for construction workers are only needed during the height of the transition before workers move on.</p>	<p>The benefits of industrial decarbonisation are captured and clearly communicated to the region and momentum is accelerated. Early community engagement not only mitigates impacts but highlights specific opportunities for improvements in the built and social environment. Hull, Immingham, Grimsby, Scunthorpe, Goole and surrounding towns and villages are increasingly vibrant communities for both for locals and those who have moved to the area for the energy transition.</p> <p>Legacy planning from the provision of accommodation and services for the construction period ensures lasting benefit to the region.</p>
	Minimal further savings in efficiency while Scope 1 emissions remain high. Goods produced and consumed in the Humber carry a significant carbon footprint.	Energy efficiency initiatives reduce energy consumption, while hydrogen generation displaces fossil fuel alternatives. Large scale decarbonisation means production is now cleaner and the goods produced have lower Scope 1 emissions.	<p>Upstream energy production emissions and downstream product transport emissions and impacts are increased because of the transition.</p> <p>The ready availability of affordable energy reduces the incentive for energy and water conservation, increasing demand.</p>	<p>Knowledge and data sharing between industries leads to circular economy practices leading to efficiencies and a reduction in consumption.</p> <p>Central government ensures energy pricing goes hand in hand with efficiency measures and low carbon standards.</p>

Applicable SDG	The 'do nothing' scenario	Situation if HICP implemented effectively	Potential wider detrimental impacts	Mitigations for a Sustainable Humber
 <p>13 CLIMATE ACTION</p>	The Humber continues to be the largest emitting cluster in the UK emitting around 20 MtCO _{2e} / year, with the only substantial decarbonisation arising from industrial downsizing. UK struggles to meet its net-zero target.	<p>The region's decarbonisation efforts reduce emissions from 20 MtCO_{2e} / year industrial emissions to net-zero with CCUS infrastructure facilitating negative emissions of up to 8-16 MtCO_{2e} / year.</p> <p>Industry becomes a catalyst for decarbonisation in other sectors and globally significant exemplar for integrated industrial decarbonisation.</p>	<p>A narrow focus on Scope 1 (site based) emissions leads to scope 2 (indirect) and scope 3 (value chain) emissions being given lower priority. Confusion around negative emissions results in opposition.</p> <p>A focus on industrial decarbonisation leads to attention being diverted from climate change adaptation efforts (e.g., flood risk along the Humber bank to existing or new industrial assets).</p>	<p>Strategic planning by industry and local government ensures life cycle carbon emissions (scope 1,2 and 3) are highlighted and addressed with clear communication and governance plans in place.</p> <p>Industrial infrastructure development is in line with appropriately resourced flood prevention recommendations and measures.</p>
 <p>14 LIFE BELOW WATER</p>	The Humber Estuary receives industrial effluent discharges (in compliance with all current permits) that add trace levels of pollutants and elevate estuary temperatures with potential consequences for estuarine fauna and flora.	<p>Offshore wind farm development improves understanding of coastal ecosystems and may create opportunities for habitat protection, restoration, and biodiversity net-gain.</p> <p>Modifications to processes on sites to abate carbon emissions may also allow associated upgrades to the latest Best Available Technologies, with even lower emission levels.</p>	<p>During construction of new pipelines within the estuary or offshore, marine habitats become degraded.</p> <p>Large scale maritime importation of ammonia (for hydrogen production) increases localised habitat risk from marine spills.</p> <p>Marine habitats near offshore installations remain exposed to accidental releases from offshore fossil fuel extraction operations.</p>	<p>Further assessment of potential impacts on marine water quality and ecosystems become integral to every stage of decarbonisation planning and delivery.</p> <p>The specific marine issues of spills from green ammonia shipping at scale are mitigated by developers during design, construction, and operation.</p> <p>Life below water in the Humber Estuary, surrounding rivers and offshore is improved through a continual upwards drive in standards.</p>
 <p>15 LIFE ON LAND</p>	<p>Declining industry leaves an increasing legacy of brownfield sites with low biodiversity value.</p> <p>Economic decline reduces funding available for ecosystem restoration and enhancement.</p>	<p>Industrial decarbonisation leads to inward investment as new business opportunities are created.</p> <p>All new developments comply with latest government policy, including biodiversity net gain, leading to widespread, localised improvements to habitats across the region.</p>	<p>Increasing demands for biomass for construction, fuels, energy, chemical production and other uses brings increasing pressure on sustainable land allocation and use within the UK and internationally.</p> <p>New industrial development displaces fauna and flora, particular during construction as linear infrastructure may disrupt animal transit routes.</p>	<p>All uses of biomass, including Bioenergy with Carbon Capture and Storage (BECCS) demonstrate sustainable biomass governance, building public support for this critical resource use. Where appropriate, forested areas are increased providing new resources, plus wider benefits to nature, natural flood management, land restoration, etc. in a systematic manner.</p> <p>Comprehensive terrestrial ecosystem mitigation measures are put in place during construction. Opportunities are investigated for how historically degraded sites can be restored to boost regional biodiversity and habitat continuity.</p>
 <p>16 PEACE, JUSTICE AND STRONG INSTITUTIONS</p>	Industrial stagnation and economic decline contribute to social decline. Social support agencies are stretched, and communities are less resilient.	<p>Ambitious decarbonisation achieves net-zero targets, enhances energy security, and boosts economic development, raises wages for those closely involved in it.</p> <p>Communities are empowered through being involved in local decision-making processes. Effective communication around all projects provides increased transparency.</p>	<p>Public institutions struggle to keep pace with the operational, economic, social and environmental changes associated with large scale industrial decarbonisation. These lag in developing the organisation capabilities to respond to and support the industrial decarbonisation happening at pace in the region.</p> <p>Growing wage differences and access to opportunities leads to increased social division.</p>	<p>Public institutions are supported, strengthened and reformed to accelerate a sustainable future in the Humber.</p> <p>Industry and public authorities maintain close collaboration in their strategic and operational planning, to deploy appropriate solutions for emerging challenges.</p> <p>Opportunities for training, development, and jobs are carefully planned to provide equitable access across all communities in the Humber. Improved economic conditions across the region mobilises more support for social and environmental action in the voluntary sector, resulting in improved overall social cohesion.</p>

Applicable SDG	The ‘do nothing’ scenario	Situation if HICP implemented effectively	Potential wider detrimental impacts	Mitigations for a Sustainable Humber
 <p>17 PARTNERSHIPS FOR THE GOALS</p>	<p>Declining focus on partnerships within the region and with other industrial clusters begin to emerge, resulting in less engagement, collaboration and synergies. This reduces the support for necessary pan-industry networks, such as hydrogen pipelines and CCUS infrastructure. Private sector interests shift to individual project focus rather than regional collaboration.</p>	<p>The Humber Industrial Cluster becomes an exemplar of integrated industrial development and public-private partnership. The technology, skills and supply chain capability developed in the region are used to accelerate industrial decarbonisation in other industrial clusters in the UK and internationally. It also enables wider decarbonisation, such as through the generation of hydrogen for non-industrial uses.</p>	<p>Individual industries may want to decarbonise more quickly than is possible with a broader collaboration, potentially resulting in key industries operating independently. Competing interests may also emerge as industries develop better estimates of the costs and benefits of their engagement.</p> <p>Decarbonisation achievements in the Humber region outstrip other clusters, with consequences for the Humber’s funding and support.</p>	<p>Effective information sharing, shared risk-taking and broad-based collaboration become the bedrock to develop new and sustain existing partnerships needed to achieve the region’s long-term decarbonisation goals.</p> <p>The Humber becomes a beacon for industrial decarbonisation and attracts both inward investment and inspires industrial decarbonisation projects around the world.</p>

3. Impact assessment via statutory processes

The HICP is a strategic level decarbonisation Plan, which sets out how industry across the region can optimally decarbonise. It demonstrates that the current projects being developed in the region, including the Deployment Projects, are aligned with what needs to happen to achieve efficient, deep and rapid industrial decarbonisation. The Plan itself is not seeking approval of, statutory consent for, or funding for any particular project. But individual projects highlighted within the HICP are currently being progressed and have either already obtained planning consent through the necessary statutory processes or will be seeking this soon.

As outlined in Section 1.4, this cluster-level impact assessment provides a framework to identify the broad range of potential impacts which will need to be managed through the design, delivery and operation of each individual project, and across the aggregated programme of activities. It does not supersede any aspect of the statutory planning process but is intended to be of use to both the developers of specific projects, and organisations such as the Local Authorities and government departments who will maintain wider oversight of the impacts of industrial decarbonisation.

As each project is taken forward it will require detailed assessment of the potential impacts arising using tools such as Sustainability Appraisals, Strategic Impact Assessments, Environmental Impact Assessments, and Habitat Regulation Assessments. Construction stage and operational environmental management plans will be required, and these will form a mechanism by which the identified impacts are managed.

The Humber Estuary is the UK's second-largest coastal plain estuary, covering 370 km². Its extensive wetlands and coastal habitats are designated as a Special Area of Conservation, Special Protection Area, and a Ramsar Site. It contains many Sites of Special Scientific Interest. This means that obtaining consents for marine works offshore and near shore will require special attention by project developers. Failure to consider this sufficiently early in the permitting process would result in risks to programme. The analysis in the HICP demonstrated the critical impact on the rate of industrial decarbonisation if the necessary carbon dioxide and hydrogen projects were delayed from their current indicative programmes.

Some of the larger projects in and offshore from the Humber will qualify as Nationally Significant Infrastructure Projects. Development Consent Orders (DCOs) are the means of obtaining consent for Nationally Significant Infrastructure Projects. The Planning Act 2008 introduced the DCO system in response to the challenges that were being faced in consenting major infrastructure projects within a reasonable timeframe. DCOs also offer a 'streamlined' approach by allowing for multiple different consent types to be included within a single Statutory Instrument as a 'one stop shop'. DCOs offer a degree of flexibility for the development within a defined set of parameters, and the ability exists for an Order to be amended (albeit this has time implications, as Non-Material Amendments can still take up to 16 months to process to ensure that all due processes are followed in their assessment).

All relevant aspects of the impact assessment detailed in Section 2.4 will be incorporated in the project-specific assessments undertaken as part of the statutory processes. However, it is still important for a body to maintain a strategic, cluster-level awareness of the aggregated impact of all the decarbonisation activities across the region. The outputs from each project-specific assessment will feed into this. Awareness and visibility of the region-wide impacts will allow these to be managed, and the opportunities for the Humber Region through the industrial transformation maximised. Within the region the Humber Energy Board has been appointed to provide this function.

4. Conclusion

The HICP shows how deep decarbonisation by 2030 and net-zero for Scope 1 industrial emissions by 2040 is possible and necessary. The positive impacts of decarbonising the Humber industries are evident. The optimal way to achieve this is now known and defined in the Plan. The priority areas of focus are defined in the Mandates for action, summarised in Section 1.3 and listed in full in Appendix A.

It is imperative that in achieving industrial decarbonisation, all consequential direct and indirect impacts are managed, and all associated opportunities to benefit the wider region, are maximised. This impact assessment has used the UN SDG framework to identify what some of these impacts could be at the cluster-level. We have demonstrated how the Mandates for action, and the fundamental purpose of the Plan to decarbonising industry, will enable continued sustainable development across the Humber. The overall impact of the Plan will be positive – resulting in climate change mitigation, increased resilience, and growth leading to widespread opportunities and increasing equality. As the wide range of projects that contribute to industrial decarbonisation are implemented there will be further wide-ranging positive impacts, as identified in this impact assessment.

This impact assessment has presented the diverse breadth of potential impacts at a very high summary level, and so provides a starting point for more detailed review and management in the future, in an integrated and balanced manner. Where there are potential negative or detrimental impacts these can, and will need to be, managed through appropriate mitigation measures. Again, some of what these may comprise are detailed in this assessment. By considering the range of impacts at a cluster-level, this assessment provides a framework to help ensure potential impacts are considered early, and opportunities for equitable and enabling growth are optimised.

5. References

Humber Industrial Cluster Plan: HICP Delivery Team and Arup. (2023) *Humber Industrial Cluster Plan. Together it is possible.*

The following studies were commissioned by the HICP team while developing the Cluster Plan. All are available at <https://www.humberindustrialclusterplan.org/output-reports.html> .

Systems Model report: Element Energy and Cambridge Econometrics. (2023) *Humber Industrial Cluster Plan - Net-Zero Emissions Pathways in the Humber.*

Market, Policy, and Regulatory Study: Element Energy. (2022a) *Market, Policy, and Regulatory Studies for the Humber Industrial Decarbonisation Plan.*

Societal Study: ERM. (2022) *Humber Industrial Cluster Plan - Societal and Cultural Challenges and Social Innovation Study: Final Report.*

Inward Investment Study: KPMG. (2023a) *Humber Industrial Cluster Plan: Inward Investment.*

Supply Chain Study: KPMG. (2023b) *Humber Industrial Cluster: Supply Chain.*

Skills Study: KPMG. (2023c) *Humber Industrial Cluster Plan: Skills Provisioning & Addressing Market Failures.*

Water Resource Study: Element Energy. (2022b) *HICP Water Study.*

Other sources:

The United Nations Sustainable Development Goals - <https://sdgs.un.org/goals>

Appendix A

Full text of HICP Mandates for action

The full text of the HICP Mandates for action is given below.

1. To implement carbon capture and storage and greenhouse gas removal technologies at pace and scale across the Humber.
 - a. To capture carbon from each industrial process where this is the optimal decarbonisation option.
 - b. To implement the necessary region-wide and offshore infrastructure to convey all captured CO₂ to permanent subsea storage.
 - c. To develop and optimise the offshore storage reservoirs to ensure the necessary short-term injection rates can be achieved, and the long-term capacities maximised.
 - d. To facilitate engineered greenhouse gas removal projects through connections to the region's carbon capture and storage infrastructure.

2. To implement low-carbon hydrogen at scale across the Humber.
 - a. To use hydrogen for each industrial process where this is the optimal decarbonisation option.
 - b. To produce low carbon hydrogen, supported by renewable energy generation, at scale.
 - c. To implement the necessary region-wide infrastructure to distribute hydrogen.
 - d. To store hydrogen at scale for operational resilience, seasonal needs, and to optimise energy use in generating hydrogen.
 - e. To explore opportunities for the Humber hydrogen network to enable decarbonisation in other sectors of the economy, where appropriate.

3. To electrify industrial processes at each site where this is determined to be the optimal decarbonisation technology.

4. To prioritise Resource Efficiency and Energy Efficiency measures in individual businesses and across industrial sectors to reduce baseline emissions to the maximum extent viable, adopting circular economy principles, prior to the adoption of other abatement technologies.

5. To plan, implement, and manage the integrated programme of decarbonisation activities in this Plan to generate social value and bring benefit to all through place making.
 - a. To meaningfully engage with communities throughout each project to mitigate negative consequences and maximise local benefit.
 - b. To deliver each project in a way which enhances the environment across the region.

6. To plan, implement, and manage the integrated programme of decarbonisation activities in this Plan to maximise local impact and benefit, and support a Just Transition.
 - a. To ensure local skills growth matches demand at all levels whilst supporting new skills being brought in where necessary.

- b. To ensure local supply chain growth of materials, components and services matches demand and is optimised to drive local benefit.
7. To drive investment and collaboration to deliver the net-zero Humber of tomorrow.
- a. To recognise the existing ambition, strong alignment with the Plan's proven pathways to net-zero, progress, and momentum of the Humber Industrial Cluster towards deep decarbonisation.
 - b. To unlock the market, policy, regulation and technical barriers to further implementation of this Plan and allow acceleration of the Humber Cluster's decarbonisation.
 - c. To share the lessons and skills developed through decarbonising the Humber Cluster, to then accelerate the decarbonisation of the UK's other industrial clusters in an efficient and planned approach.
 - d. To seize the unique opportunity the Humber Cluster offers to drive inward investment to provide wider regional, national, and international benefit.
 - e. To regularly monitor this Plan's progress through the leadership delivery structure implemented, adapting to change as necessary, to ensure an effective delivery of net-zero before 2040.