Barriers to industrial decarbonisation

1. Executive Summary

Industrial decarbonisation is critical to allowing us to reduce the environmental impact of our economic activity whilst protecting living standards and achieving sustainable economic growth. At a roundtable event in November 2024, IChemE brought together expert stakeholders to discuss this challenge and how to address it.

- There are significant workforce barriers to industrial decarbonization.
- The government should prioritise education and (re)training opportunities for people to enter and progress in chemical and process engineering (and STEM more broadly) to ensure an adequate workforce. As part of this the government should commit to supporting science teachers in schools and adequate research funding.
- There is significant industrial activity (and therefore emissions) outside the main clusters. This has to date been relatively underexposed to policy makers.
- The government should seek to expand its industrial clusters initiatives to other areas of high industrial activity, and further integrate them into its wider plans on industrial decarbonization.
- Strategic and systematic thinking is needed regarding the demands being placed on scarce resources (such as clean energy and feedstocks including biomass), production facilities (eg. the important role that oil refineries currently play in a wide range of activities such as steel recycling), and workforce.
- The Government should make full use of tools such as systems thinking in this area. This will allow the Government to optimise the energy system to deliver the lowest cost/lowest carbon/fastest transition energy system. The Government should continue to work with the Climate Change Committee and Energy Systems Catapult to develop systems thinking approaches to deliver best value for the UK tax payer.
- The UK has seen notable success in this area, for instance in promoting the growth of wind power and the industrial energy transformation fund. These both required long term vision and investment.
- The Government should replicate the success of initiatives such as the promotion of wind power and commit to the stable long-term funding they require.
- Shaping and promoting consumer demand has an important role to play in industrial decarbonization.
- The government should explore producing or supporting a kitemark to help consumers in buying green products.

2. Introduction and background

The UK is committed to transitioning to net zero, and industry contributes about 14% of UK greenhouse gas emissions[i]. Industrial decarbonisation is a critical issue if we want to reduce our use of carbon without curtailing industrial activity or making a significant sacrifice in living standards. A previous government published an industrial decarbonisation strategy in 2021. The current government has signalled the importance of the transition to clean energy by making it a central mission, and highlighting the importance of decarbonisation of industrial energy use in the industrial strategy.

In November 2024, IChemE hosted a roundtable which looked at the challenges and prospects for industrial decarbonisation, bringing together leading figures from industry, academia, think tanks and the third sector. This document summarises main themes from the discussion as well as key conclusions and recommendations.

3. Emerging themes

3.1 The current state of play in industrial decarbonisation

At present, the UK's industrial emissions are concentrated in a relatively small number of large firms, with industrial clusters responsible for over half of the UK's total industrial emissions. However, there is a significant volume of industrial activity beyond these major clusters that is less well researched, less visible to policymakers, and with lower levels of access to infrastructure.

3.2 Future aspirations on carbon and CCUS

It was noted that in the future there will continue to be residual industrial emissions that cannot be prevented and something will have to be done with this carbon. It was suggested that finding a way to use this carbon could be a better route forwards than simply capturing and storing it underground. At the same time, it was also noted that in the UK the volume of $C0_2$ emitted is an order of magnitude larger than the potential demand for products made from carbon

There was a discussion about carbon capture, utilization, and storage (CCUS) technologies that capture CO2 emissions from large sources and either store or reuse them. This discussion looked at the path dependency implications for decarbonisation in the UK. One view was that this technology risks locking the UK in to emitting carbon, preventing a more decisive shift to other technologies. Conversely, it was suggested that CCUS was critical enabling

technology for the future. For instance it has a critical role to play in enabling hydrogen (particularly blue hydrogen in the shorter term), and in underpinning bioenergy with carbon capture and storage.

3.3 The need for systematic and strategic thinking about the demands being placed on scarce resources.

A clear theme in the discussion was the need to think carefully about the demands being placed on scarce resources (such as clean energy and feedstocks such as biomass), production facilities (such as the important role that oil refineries currently play in a wide range of activities including steel recycling), and workforce. Tools such as a carbon use hierarchy were proposed as ways to help address this challenge. It was also noted that at present, government policy on carbon was acting as a blocker by requiring carbon to be buried under the sea instead of being used for other purposes.

3.4 The importance of demand

It was noted that in addition to challenges with producing and supplying industrial products, market demand was a crucial factor. The need to promote robust demand via green public procurement and product standards was highlighted as crucial in helping promote investment, particularly for startups. Similarly, it was noted that market demand presented an additional challenge to making a success of industrial decarbonisation, as decarbonised products must be competitive on quality and price.

The role of demand reduction was also highlighted (for instance for critical materials) as having an important role to play in this area.

Thinking about the incentives for the consumers, attendees discussed whether the government could produce or support a kitemark for genuinely green products so that the public are confident that what they are buying is low carbon, for instance.

3.5 Skills and workforce challenges

A key barrier that came up throughout the discussion was the lack of a sufficiently large and skilled workforce to deliver the transition to a less carbon intensive economy. It was noted that there were simply not enough people with the STEM skills needed, either at present or forecast in the future, to deliver the changes needed. It was therefore seen as crucial to continue to prioritise support for STEM teaching in schools, designate chemical and process engineering along with other STEM disciplines as subjects of national

strategic importance, and make retraining and upskilling as economically and socially attractive as possible for individuals and companies. Recent work by The Industrial Decarbonisation Research and Innovation Centre in this area was noted as providing some helpful insight into the challenges in the decarbonisation supply chain.

Some emerging good practice was noted in developing the workforce on a local level, with a formal cluster organisation seen as providing a helpful focal point for education providers to engage with employers and for industry to express their needs.

There was some discussion of what factors contribute to these workforce challenges. The idea of people being 'poached' from the STEM workforce and going into finance jobs was discussed. The view was expressed that although the economic incentives for working in industry were robust (see, for instance the IChemE salary survey), the wider cultural attitudes around working in these areas (such as "There's no manufacturing industry in the UK" "Oil and gas is a bad sector" and "Chemicals is a dirty word") could be putting people off. It was observed that much of the skills and capital essential to delivering decarbonisation will come from the oil and gas industry, and it was suggested that it is crucial not to unintentionally denigrate those working in these industries. It was also noted that social sciences and the arts had a crucial role to play in communicating more positive messages around the energy transition and decarbonization to the public.

3.6 Cost as a barrier:

The UK's high cost electricity was a recurring theme in discussion, with UK costs being high relative to other countries and high relative to the cost of natural gas – both factors posing significant constraints on decarbonisation. The government's current support for Energy Intensive Industries was felt to be insufficient to narrow the gap with other jurisdictions.

3.7 Barriers around stability, approaches to risk and 'being the first mover'

Attendees noted that investors and businesses seek certainty, predictability and a consistent long-term policy direction when making their decisions, which have not been available in the UK in recent years. ExxonMobil recently pulled out of a $C0_2$ pipeline project, blaming a lack of policy certainty.

It was suggested that the central challenge for decarbonisation of industry is not in creating and deploying new technologies, but rather in rolling out

existing technologies at sufficient scale, and ensuring that the policy and financial incentives are in place that encourage people to take the risks required. It was felt that currently, there were insufficient incentives to encourage firms to be the first movers and invest to deploy technologies that whilst technologically mature were not yet deployed widely on a commercial basis.

If policy can create the confidence that the UK is a good place to invest in these technologies, it was felt to be entirely possible to achieve industrial decarbonisation. Wind power was seen as an example of good practice, where a sustained investment system and architecture produced results in the long term. Relatedly, the industrial energy transformation fund was seen to be impactful but did require sustained investment.

3.8 Regulation

A number of barriers were identified connected to regulation, for instance with CCUS, where industry is keen to deploy the most advanced technologies that exist but the regulator emphasises the need for technology to be mature and well evidenced. It was suggested that in several fields connected to industrial decarbonisation, there might be a need to reconsider the approach to regulation (for instance, as has been frequently suggested in connection to construction).

3.9 Electrification challenges

Several challenges were noted relating to electrification, including limited access to investment, the lack of a clear business model, and the extremely long time taken for grid connections. The example of Germany and their Carbon Contracts for Difference was noted as a positive example, as it allowed for different decarbonisation models to be applied.

4. Conclusions and recommendations

- There are significant workforce barriers to industrial decarbonization.
    - ***The government should prioritise education and (re)training opportunities for people to enter and progress in chemical and process engineering (and STEM more broadly) to ensure an adequate workforce. As part of this the government should commit to supporting science teachers in schools and adequate research funding.***
- There is significant industrial activity (and therefore emissions) outside the main clusters. This has to date been relatively underexposed to policy makers.

    - ***The government should seek to expand its industrial clusters initiatives to other areas of high industrial activity, and further integrate them into its wider plans on industrial decarbonization.***
- Strategic and systematic thinking is needed regarding the demands being placed on scarce resources (such as clean energy and feedstocks including biomass), production facilities (eg. the important role that oil refineries currently play in a wide range of activities such as steel recycling), and workforce.
    - ***The Government should make full use of tools such as systems thinking in this area. This will allow the Government to optimise the energy system to deliver the lowest cost/lowest carbon/fastest transition energy system. The Government should continue to work with the Climate Change Committee and Energy Systems Catapult to develop systems thinking approaches to deliver best value for the UK tax payer.***
- The UK has seen notable success in this area, for instance in promoting the growth of wind power and the industrial energy transformation fund. These both required long term vision and investment.
    - ***The Government should replicate the success of initiatives such as the promotion of wind power and commit to the stable long-term funding they require.***
- Shaping and promoting consumer demand has an important role to play in industrial decarbonization.
    - ***The government should explore producing or supporting a kitemark to help consumers in buying green products.***

IChemE, December 2024.

About IChemE

The Institution of Chemical Engineers (IChemE) is the qualifying body and learned society for chemical, biochemical, and process engineers in the UK and worldwide, with over 31,000 members. Our mission is to champion the input of chemical engineers to create a sustainable future. We support our members in applying their expertise and experience to make an influential contribution to solving major global challenges, and are the only organisation permitted to award Chartered Chemical Engineer status and Professional Process Safety Engineer registration.

Find out more about IChemE and our strategic vision of Engineering a Sustainable World at icheme.org