Decarbonisation strategies in industry

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IDRIC

UKERC
UK Energy Research Centre

UNIVERSITY OF LEEDS

Outline

- Industrial decarbonisation challenge in context
- Cluster theory
- Outline of research
  - Current research on industrial cluster decarbonisation
  - Dispersed site decarbonisation
- Synthesis and preliminary conclusions

Industrial decarbonisation challenge in context

- Industrial activity accounted for 26% of global CO_2 emissions in 2020 (IEA 2021a)
- Energy intensive industry is particularly hard to abate due to its heterogeneity, long investment cycles, trade exposure, and low profit margins
- Technology for industrial emission reduction is relatively immature and will require significant infrastructure investment alongside an abundant supply of low carbon energy
- A suite of technology, efficiency and policy measures will be required, addressing the short, mid and long term

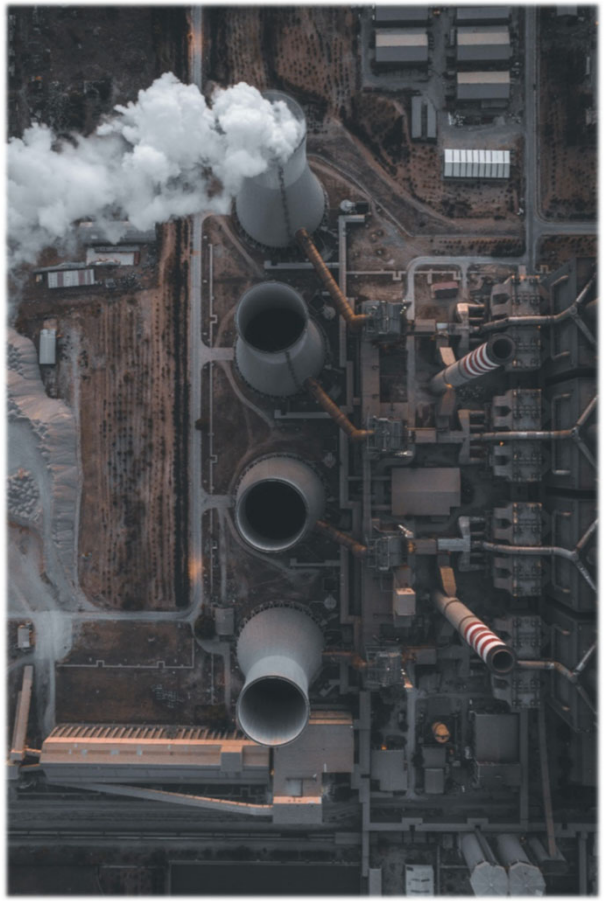
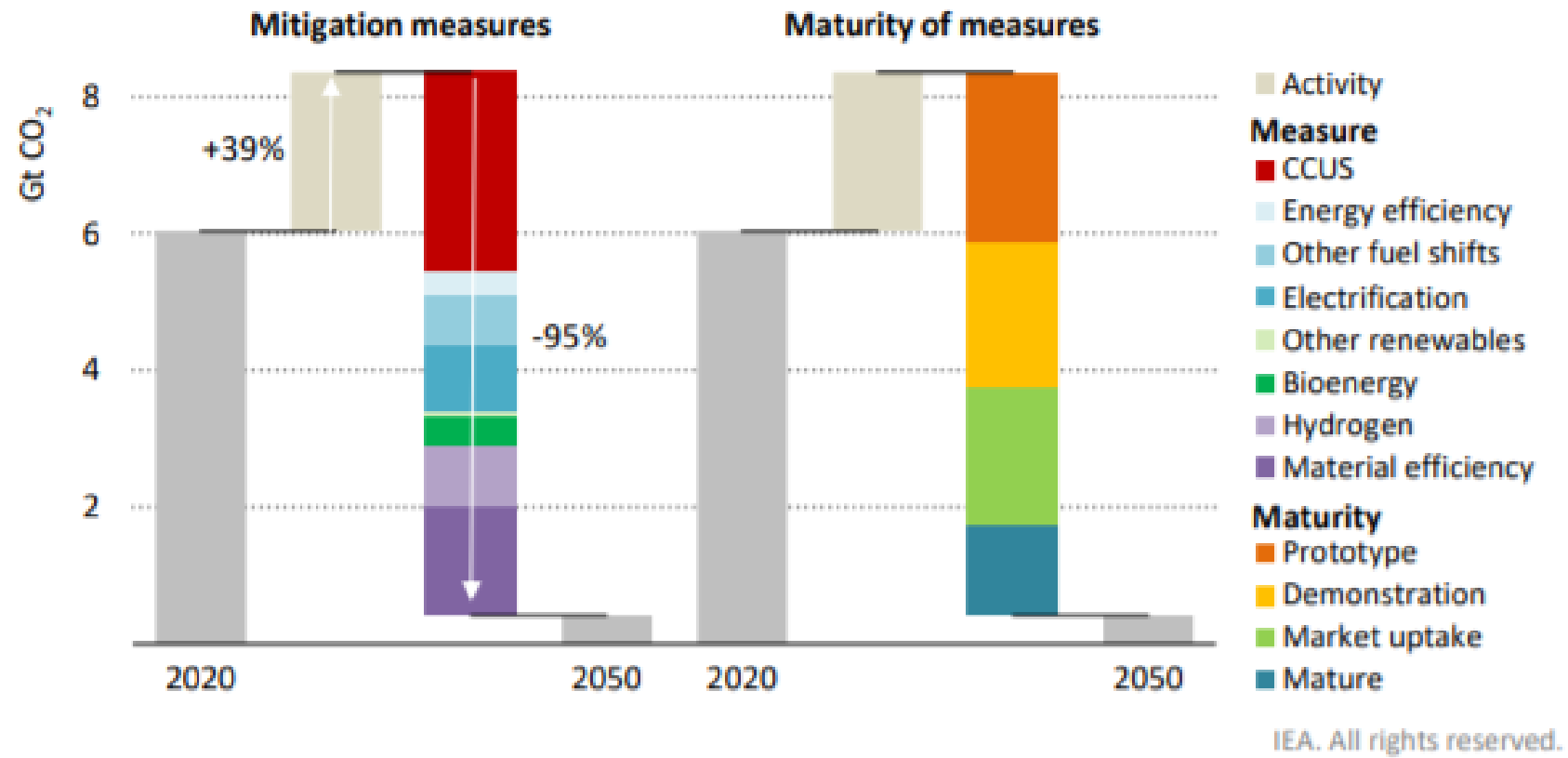


Photo by Fatih Turan from Pexels

Global CO_2 emissions in heavy industry and reductions by mitigation measure and technology maturity category in the NZE



An array of measures reduces emissions in heavy industry, with innovative technologies like CCUS and hydrogen playing a critical role

IEA (2021b, p.123)

Implications

- There is no silver bullet. A array of interconnected measures is required alongside innovation
- Technology options will require the co-location of facilities for CCUS, low carbon hydrogen alongside high voltage electricity transmission
- Industrial decarbonisation strategy will require sequential deployment of infrastructure as technologies reach maturity
- Governments will need to prioritise the areas where they deploy enabling infrastructures – likely high emitting industrial clusters
- Some areas will have access to decarbonisation infrastructures earlier than others and therefore greater opportunities to decarbonise, risking distributive injustices

Evolving ideas of clusters

1. Geographic concentrations of **interconnected** companies, specialised suppliers, service providers, firms in **related industries**, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that **compete** but also **co-operate** (Porter, 1998, p. 197)

- Resources flow towards clusters and away from other places

2. Gateways for scaling up the deployment of clean hydrogen allowing the **co-location of supply and demand** and providing **economies of scale,** creating **hubs of development** to bring down cost and **stimulate innovation** (IEA, 2019)

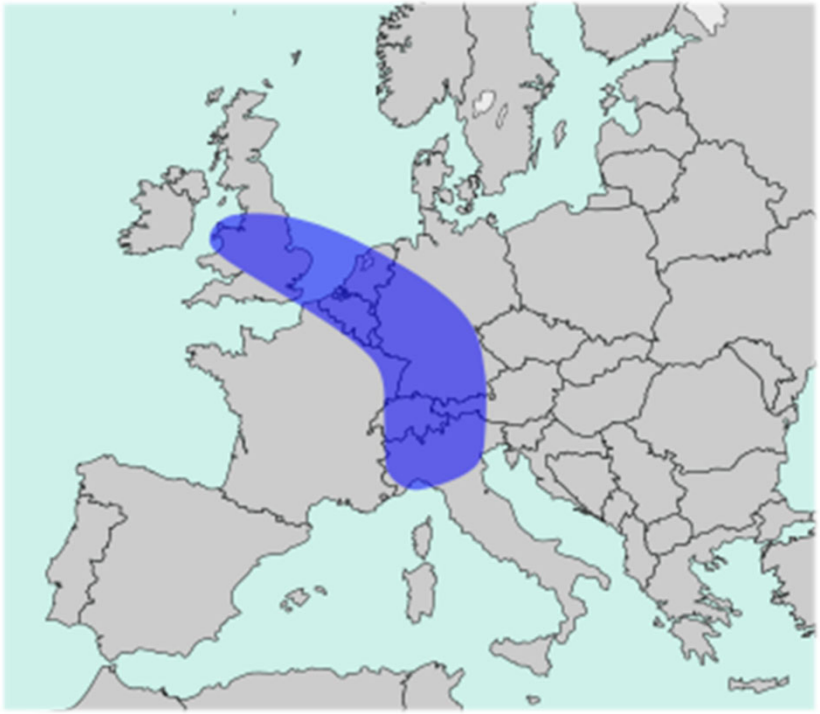
3. Places where **related industries** have **co-located**. Benefits include deploying and utilising **shared decarbonisation infrastructure,** enabling industry to reduce the unit cost for each tonne of carbon abated as well as **opportunities** for resource and energy efficiency and **learning and innovation sharing** (HM Government, 2021, p.119)

Outline of research

	IDRIC	UKERC
Research question	What approaches are being used internationally to drive the development of low carbon industrial clusters?	What role might place based strategy have in supporting industrial decarbonisation for dispersed sites?
Geographical focus	International	England
Conceptual focus	Clusters	Dispersed sites
Data collection	Rapid Evidence Assessment followed by workshops	Expert interviews followed by workshops
Starting date	Oct 2021	Feb 2021

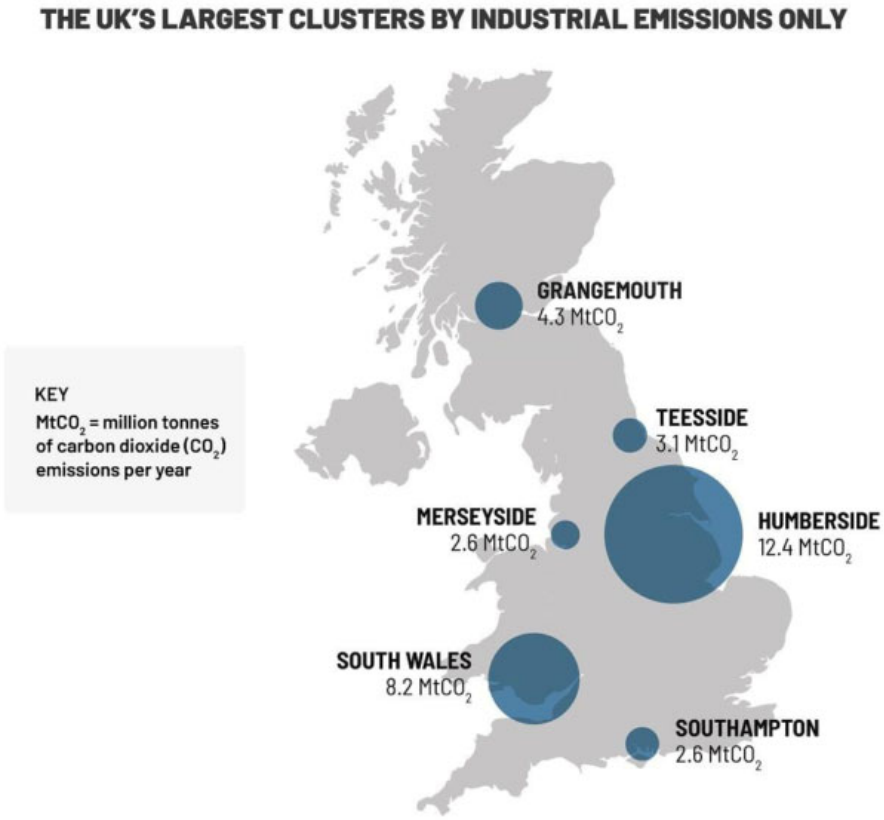
Preliminary findings from REA

- The majority of cluster studies focus upon clusters as drivers of economic growth
- Studies on industrial decarbonisation generally focus either upon particular interventions or highest emitting sectors (steel, cement, chemicals).
- Place-based approaches to decarbonising specific regions or industrial clusters focus on west and central Europe (the blue banana)
- Lack of cross-country comparisons
- Globally, new cluster infrastructure initiatives are being announced weekly



Context of dispersed sites research

- The UK government has prioritised industrial clusters for early deployment of hydrogen and CCUS infrastructure
- Ambition to establish the world's first net zero carbon industrial cluster by 2040, with at least one low-carbon industrial cluster by 2030
- For sites outside clusters (47% of industrial emissions) focus is on energy and material efficiency with eventual electrification



Location and emissions of UK largest industrial clusters HM Government (2021. p.119)

Preliminary findings from dispersed sites

1. The UK Government's stated aim for industry emissions to fall by about two thirds by 2035 and by at least 90% by 2050 compared to 2018 levels has focussed minds
2. The cluster/dispersed sites division risks increasing inequalities between sectors and therefore places
3. Outside of clusters, concerns over competiveness are leading to reluctance to invest
4. A lack of strategy for dispersed sites is a strategy by default

Concerns about inequalities within and between sectors

We do have some grave concerns about the lack of plan for dispersed sites, only 24% of our CO_2 emissions are currently covered by the announced Net Zero Clusters

Glass sector

Paper mills don't employ that many people […] You're not just mid-range in terms of energy consumption you're mid-range in terms of visibility to government

Paper sector

One of our members who is near a hydrogen cluster, has applied to be on the HyNet project, and they were told, "Come back later please, at a later stage." So, they can't take part in some of the development activities that they desperately need.

Ceramics sector

Concerns about electrification

Storm Arwen shows the power grid isn't resilient enough for a changing climate

Fred Pickering and **Dr James Fisher** on how the devastating storm, which has left thousands without power for several days, has exposed Britain's fragile energy infrastructure

'The question is how much of the damage is due to unprecedented neglect as opposed to unprecedented severity of the storm.' Photograph: Danny Lawson/PA

UK's high electricity prices could hamper steel makers' decarbonisation

/ Isla MacFarlane

New homes in England to have electric car chargers by law

By Michael Race
Business reporter, BBC News

22 November | Comments

Climate change

New homes and buildings in England will be required by law to install electric vehicle charging points from next year, the prime minister has announced.

Reluctance to invest

Investment needs to be attracted from the large multinationals and they've got a choice where in the world they spend their money

Cement sector

We cannot fund this ourselves because our competitors do not fund it themselves and therefore if we do, we're just out of business

Steel sector

They don't want to make a mistake, they don't want to invest in something now which becomes the Betamax of tomorrow. And that is a concern, no one quite knows what's the best thing to do, so why not wait?

Trade Union

A strategy by default?

I have started to challenge people a little bit about whether there is an industrial future at all for the Black Country and indeed Birmingham given the government's decarbonisation strategy… this business about, "Well, we'll sort industry out with hydrogen and carbon capture and storage and we'll work down the country."

By the time they get to Birmingham and the Black Country, industry will have had to have left so there won't be anything there to decarbonise.

Have we thought about this, would be my question? I don't think we have.

Representative Black Country Cluster

Synthesis

- Clusters are an evolving concept and not always as self-evident as they might seem. A more reflective approach to how we conceive of clusters would help shape industrial decarbonisation strategy
- Within both UK industrial strategy and academic literature there is a focus on the highest emitting sectors, often steel, chemicals and cement. However, all sectors need to decarbonise and focussing on some may hinder others
- The present focus on the deployment of ‘big ticket’ CCUS and clean hydrogen projects risks eclipsing the importance of actively managing near term strategies for material and energy efficiency and electrification

Preliminary conclusions

- Setting strategies has value but as COP26 made clear, the focus of efforts must now move from designing frameworks to implementing them
- Clusters and dispersed sites are not separate entities but two sides of the same coin, industrial decarbonisation strategies need to manage both aspects
- More research is needed which takes a holistic approach across sectors, places and decarbonisation approaches
- Industrial decarbonisation strategy is in large part a spatial strategy

Acknowledgements

Thank you to my interviewees and advisory group members

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