

Approaches to industrial cluster decarbonisation

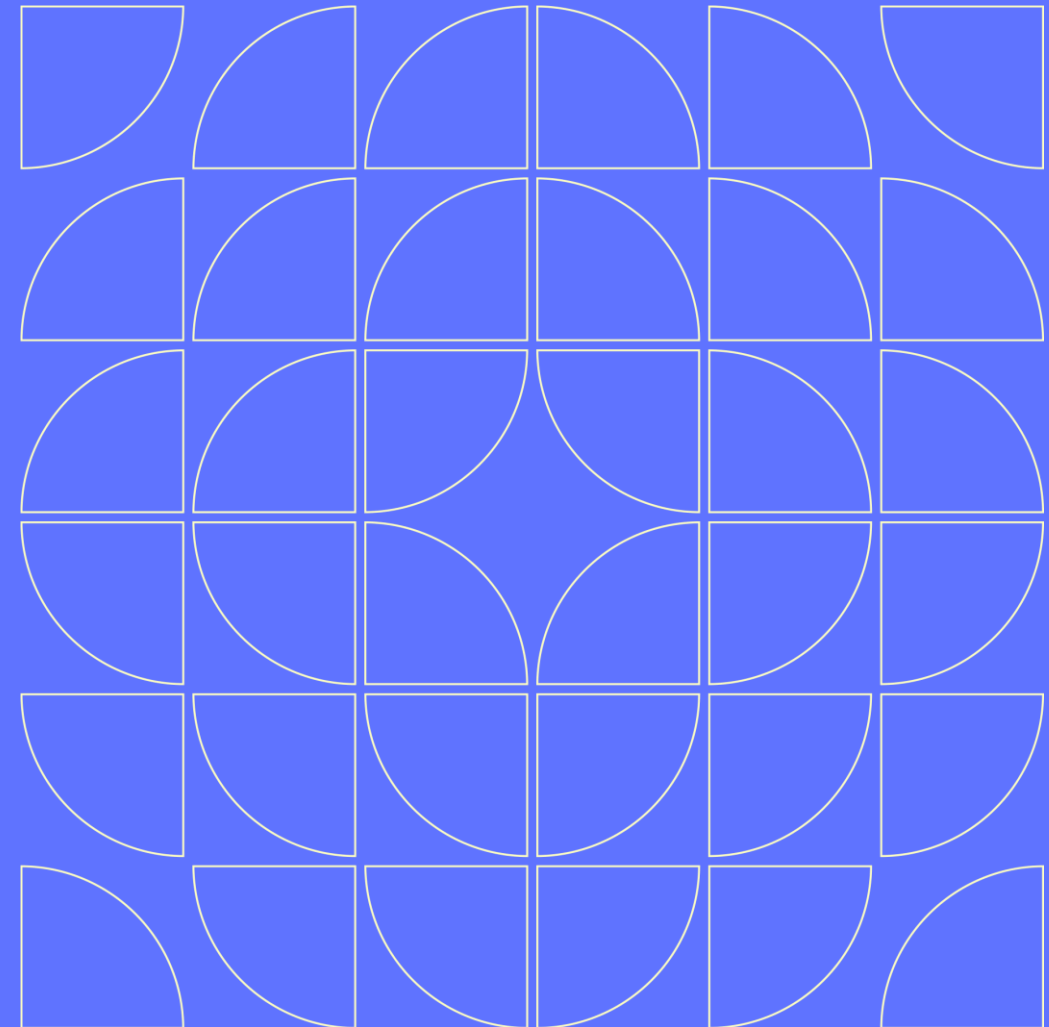
Lessons from international experience

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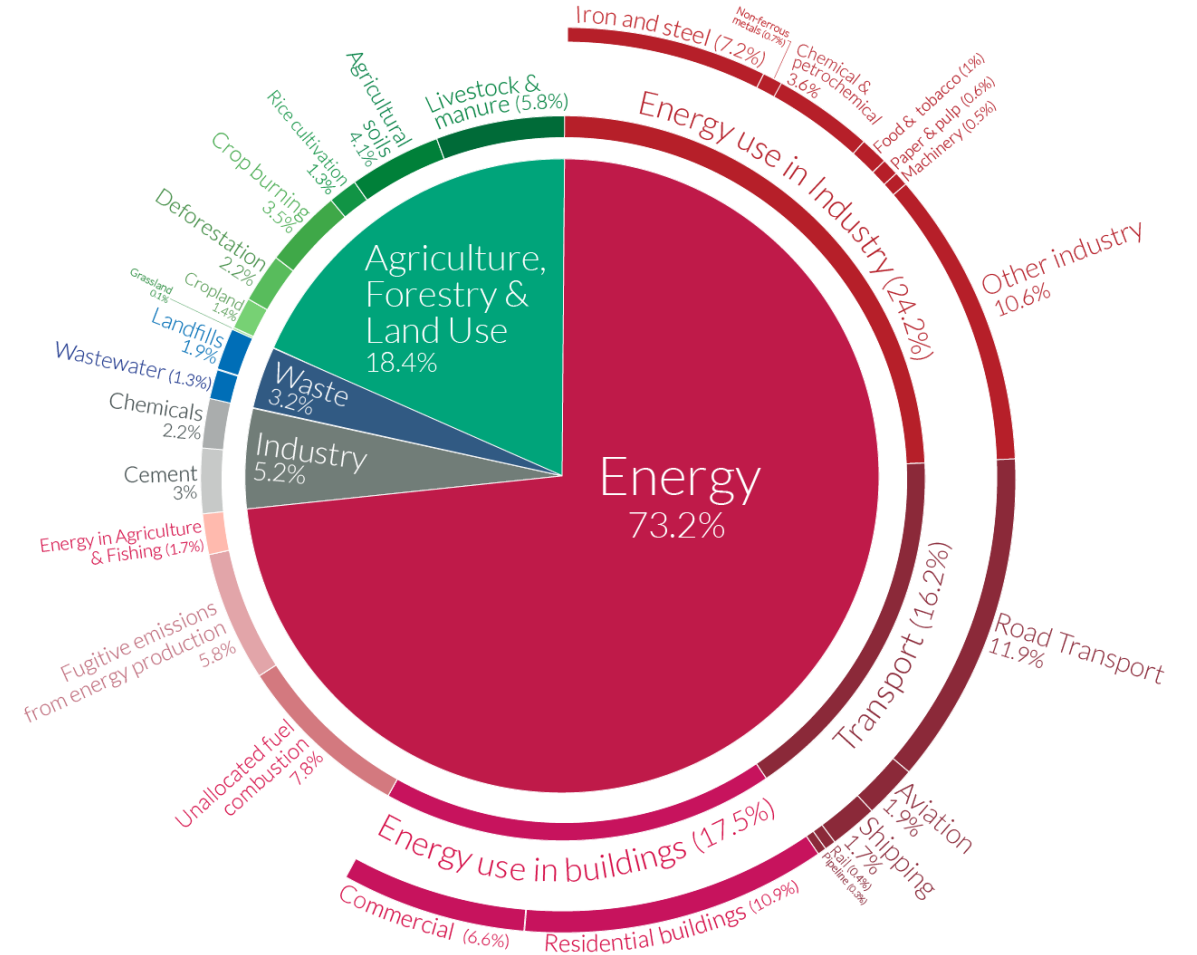
Outline

- Low carbon industrial clusters
- Findings from REA and workshop
- Outstanding questions
- Synthesis

Why is industry significant for decarbonisation?

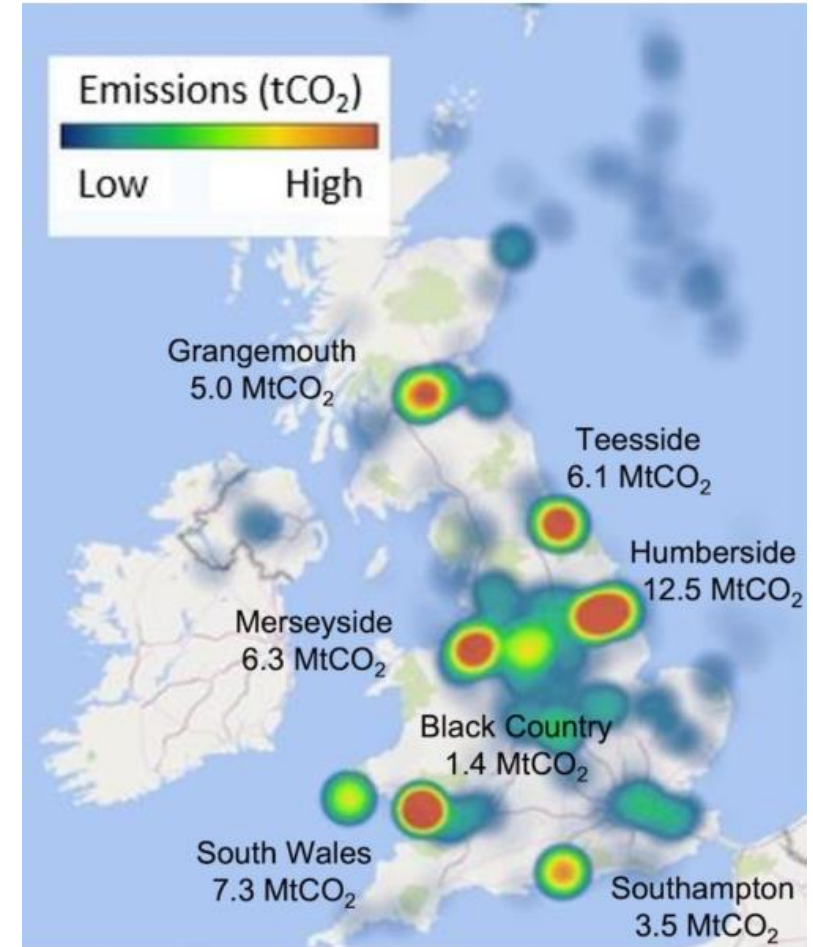
- Industrial energy consumption is still dominated by fossil fuels
- Emits over a quarter of global GHG emissions
- Energy use
- Process emissions
- Provides a quarter of global employment
- Industrial materials are the building blocks of society
- As the global economy and population grow, so will demand for materials

Global greenhouse gas emissions by sector
 This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.



What is a low carbon industrial cluster?

- In a growing number of developed economies, industrial decarbonisation policy is focusing on how to reduce emissions from large industrial clusters of energy intensive industries
- These industrial clusters provide co-location of supply and demand for a range of decarbonisation interventions
- Proximity has the potential to reduce upfront investment in supporting infrastructure and de-risk development by providing a guaranteed customer base.
- In addition, the concentration of skilled personnel provides opportunities for learning and innovation sharing.



UK industrial clusters by emissions intensity
(Element Energy, 2020, p.i)

Why are clusters significant for decarbonisation?

Country	Contribution to global CO ₂ emissions 2017	Percentage of national emissions from industry	Number of large industrial clusters	Key industrial decarbonisation legislation
Netherlands	0.5%	>25%	5	National Climate Agreement 2019 <ul style="list-style-type: none"> • Carbon tax • SDEE++ scheme (CfD) • Porthos recognised by EU as a Project of Common Interest
UK	1%	~16%	6	The Industrial Decarbonisation Strategy 2021 sets an ambition for emissions to reduce by at least two-thirds by 2035 and by at least 90% by 2050 <ul style="list-style-type: none"> • £1bn Carbon Capture and Storage Infrastructure Fund • £240m Net Zero hydrogen funding • £100m Energy Innovation Programme
USA	14%	<25%	~32	Infrastructure Investment and Jobs Act 2021 <ul style="list-style-type: none"> • \$8bn for Hydrogen Hubs Inflation Reduction Act 2022 <ul style="list-style-type: none"> • Enhanced 45Q tax credit for geological storage of CO₂ • 45V hydrogen production tax credit of up to \$3 per kg of hydrogen for the first 10 years of operation up to 2032
China	~30%	~31%	~2,300	The 14th Five-Year Plan and 2035 Strategic Vision Goals (2021) outline objectives for industrial parks across China. Parks to be assigned to one of five target cluster types: <ul style="list-style-type: none"> • Circularity transformation pilot clusters • Eco-industrial clusters – green equipment manufacturing • Low-carbon industrial clusters – reducing CO₂ emissions • Green clusters – energy saving • Near-zero carbon emission pilot zones – digital intelligence

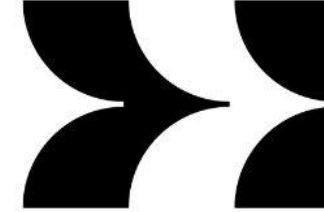
Clusters as the crucible of the industrial transition?

- What approaches are being used internationally to drive the development of low carbon industrial clusters?
 - Studies on industrial decarbonisation clusters generally focus upon techno-economic assessments of the feasibility of CCUS and hydrogen
 - From the historical literature it is clear that non-technical factors such as leadership, vision and strong networks and linkages are key elements of cluster success
 - At present, cluster decarbonisation studies focus on flagship projects in coastal clusters in North-West Europe, North America and Australia
 - The potential for clusters to act as pathfinders for broader industrial decarbonisation initiatives is presently underexplored

Rattle, I. and Taylor, P.G. 2023. Factors driving the decarbonisation of industrial clusters: A rapid evidence assessment of international experience. *Energy Research & Social Science*. **105**, p103265.



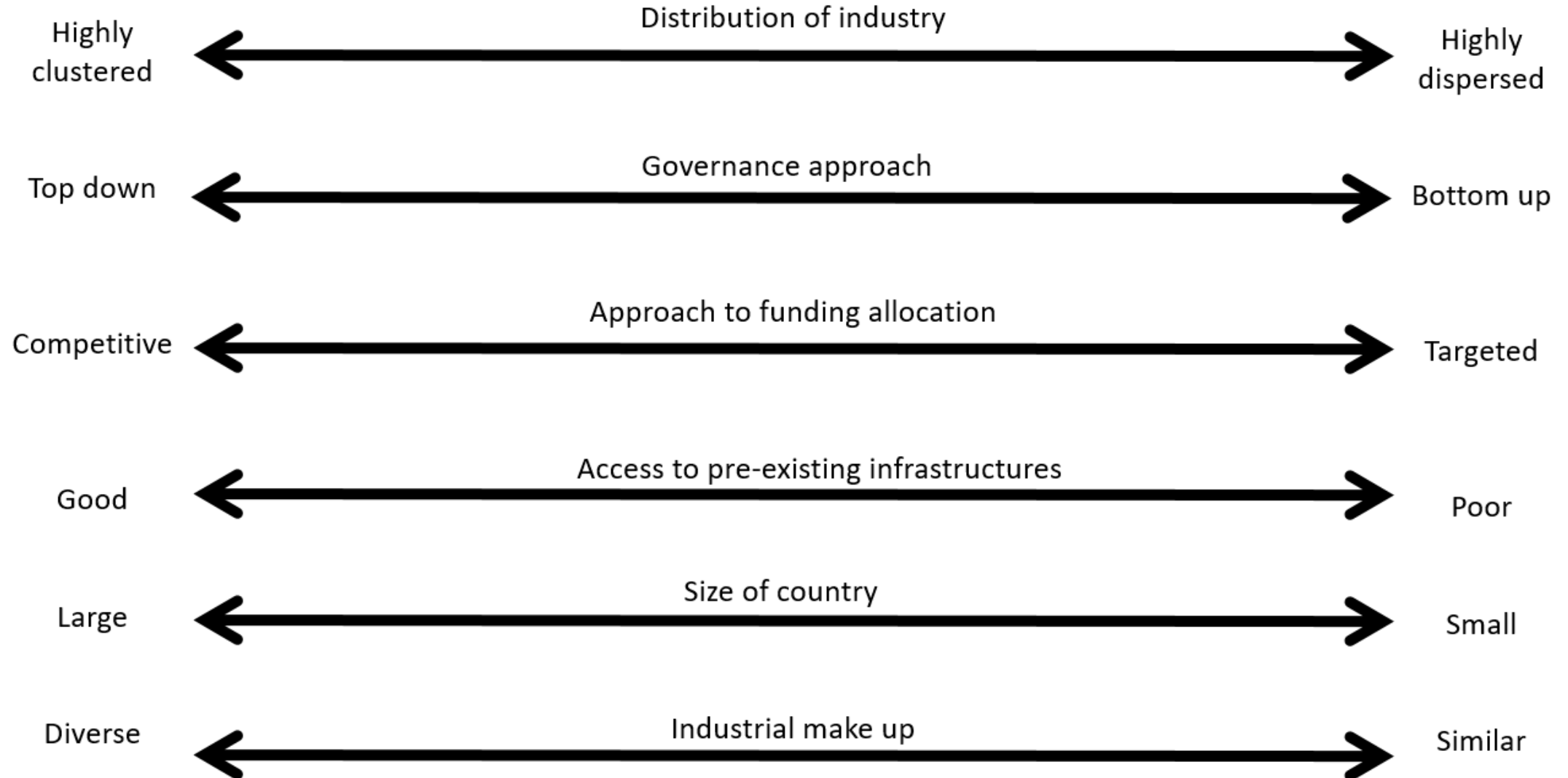
Workshop on Industrial Cluster Decarbonisation: Sharing International Experience – June 23



Note of key findings



Factors shaping approaches to cluster decarbonisation



What about everywhere else?

Emerging sectoral inequalities

Only 24% of our CO2 emissions are currently covered by the announced Net Zero Clusters

Glass sector representative

Investment delay

*One of the biggest barriers to investment in certain kinds of infrastructure and technology and equipment has been this **uncertainty around the pathway that the government's going to take***

NGO representative

An uneven transition

*You have some local authorities who just by their nature are interlinked with their industry, because it's such an important part of the local economy [...] whereas there are other areas who although they have industry, it's not really part of their list of priorities if you like. **So, it just varies***

Energy systems catapult

Synthesis

- Industrial decarbonisation policy internationally is increasingly focusing on how to reduce emissions from large industrial clusters of energy intensive industries
- Different clusters have different capacity to engage with the issue and mechanisms for knowledge exchange and learning from the initial clusters' experiences are lacking
- There remains a need to widen the conversation to include countries, actors and configurations of industrial activity that do not fit within these parameters
- We will need to expand our approaches to industrial cluster decarbonisation to deliver a whole-sector transition

Questions?

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References

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➤ Rattle, I. and Taylor, P.G. 2023. Factors driving the decarbonisation of industrial clusters: A rapid evidence assessment of international experience. *Energy Research & Social Science*. **105**, p103265. <https://doi.org/10.1016/j.erss.2023.103265>