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Industrial CCS & CCU View from the UK

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Outline

- Industrial CCS vs Power CCS
- Power CCS in the UK
- ICCS Techno-Economic Study Results
- Tees Valley ICCS
- Next Steps

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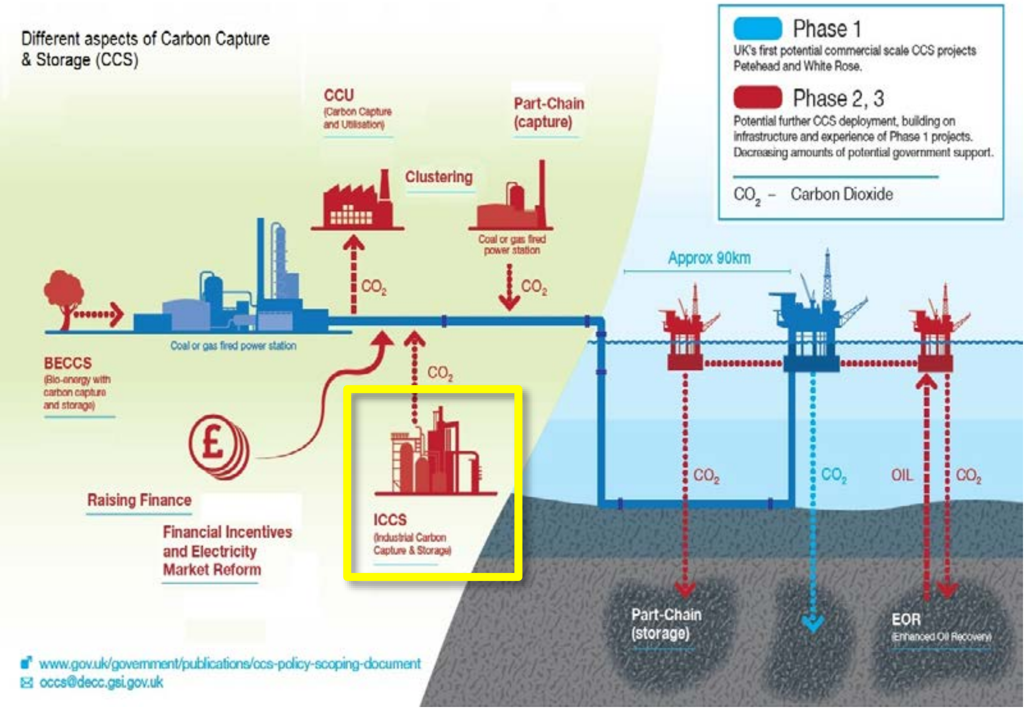
Industrial CCS vs Power CCS

- Process emissions
- Industry produces globally traded products
- Risk of direct carbon leakage
- UK power market is captive (mostly)
- CfD method of funding operation may not work for most UK ICCS applications



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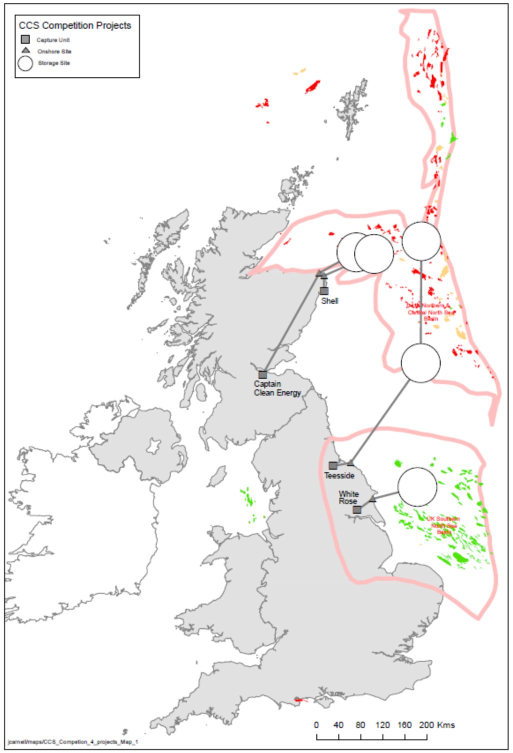
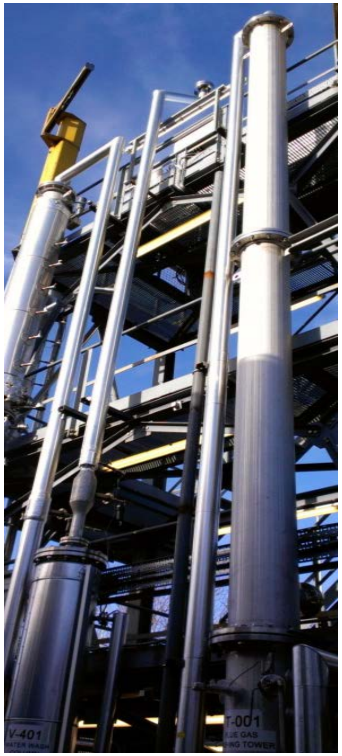
Power CCS Commercialisation Programme

- £1bn / $1.7bn capital funding
- Operational support through CfDs





April 2012	Winter 2012	March 2013	Turn of 2013/4	Q1 2016	2016 - 2020
Launch	BIP	Preferred Bids	FEED Contract Signature	FID	First Operation

Construction and commissioning

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White Rose

Drax

ALSTOM

BOC
A Member of The Linde Group

nationalgrid

- An oxyfuel capture project at a proposed new 448MW supercritical coal-fired power station on the Drax site in North Yorkshire, England
- Capturing around 90% of all carbon dioxide emissions, ~ 2 million tonnes of CO2 per year
- Stored in natural porous rock formations under the North Sea

Peterhead

- A 340MW post-combustion capture retrofitted to part of an existing CCGT at Peterhead, Scotland
- Capturing around 85% of the carbon dioxide emissions, ~ 1 million tonnes of CO_2 per year
- Stored in a depleted gas field under the North Sea

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Techno-Economic Study - Key Questions

1. What are the **most relevant technologies for industrial CCS** in the UK chemical, iron and steel, refining and cement sectors, which can be implemented by ca. 2025? What do they **cost**? What **technology development**, especially piloting, is required to deliver these?

2. **How could CO_2 utilisation be employed** to facilitate capture from industry, for example by making capture possible for sites e.g. where conventional ICCS is not feasible (difficult to access storage), or by improving the economics of capture?

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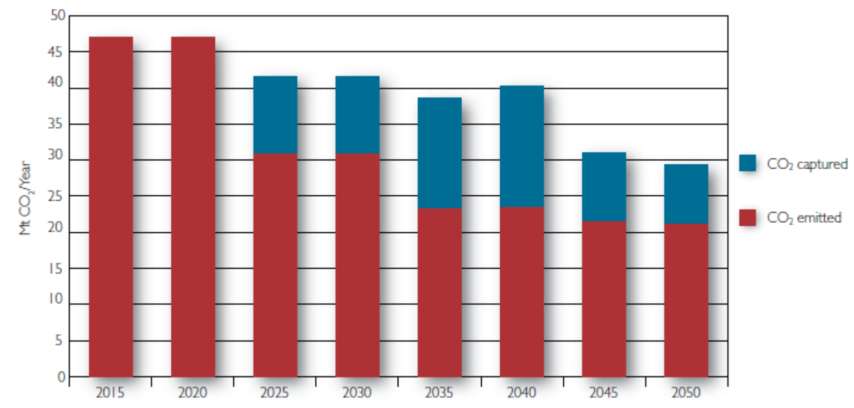
ICCS Analysis Background

- Technologies that can be retrofitted as "bolt on" solutions by ca. 2025 to existing UK cement, chemicals, oil refining, iron and steel plants.
- Larger industrial CO2 sources, on an "80/20" basis.
- Emissions from "process" CO2 (rather than industrial CO2 sources providing heat or power).

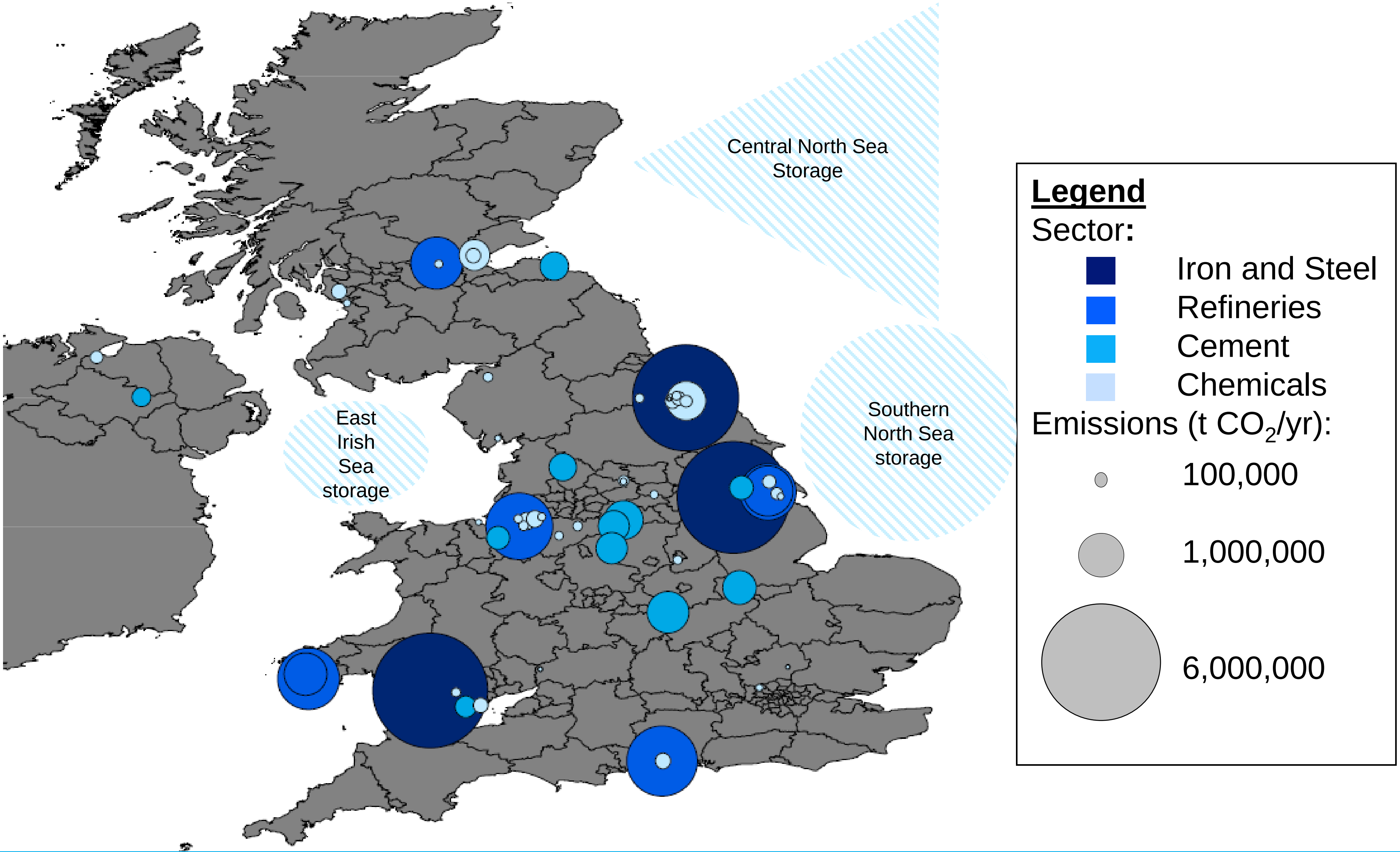
Chart 10: Projection of industry decarbonisation including contribution of industrial CCS



Source: DECC modelling – ESME core run[20]

- CO2 transport, storage, enhanced hydrocarbon recovery, or financing of industrial capture were out of scope.

52 Industrial CO_2 sources



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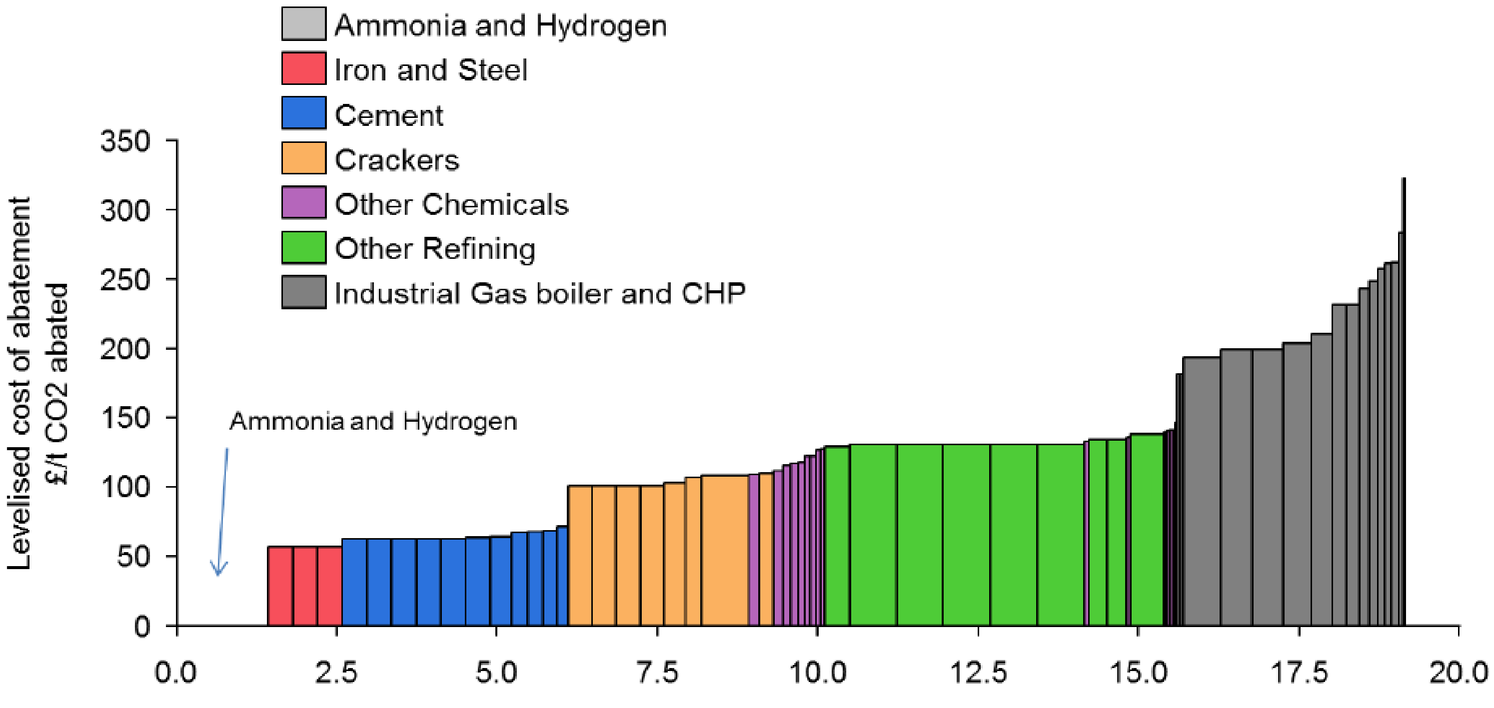
MACC curve of capture technologies



Pragmatic technology deployment scenario

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Barriers to deployment

Commercial requirements

Knowledge gaps

Site integration

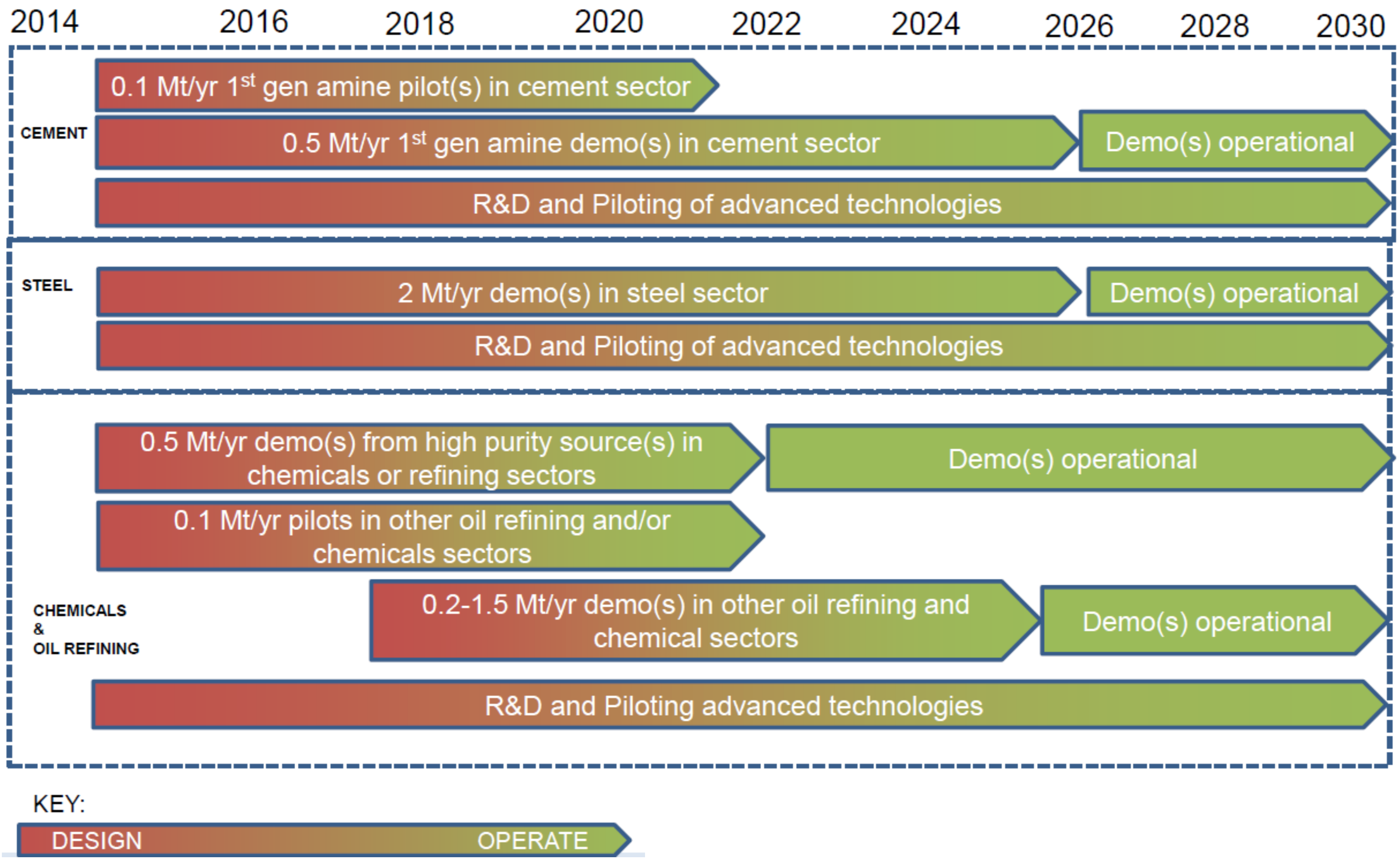
Operational risks

Policy, regulatory and long term investment certainty

Infrastructure availability (transport and storage)

Energy costs

Routes to capture technology deployment



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CCU - Results

Only EOR thought to be commercial by 2025 apart from very limited circumstances where CO_2 already used, such as in use of CO_2 in existing chemicals applications.

Remaining technologies at low TRL, high energy cost, or limited market size.

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TES Conclusions

Only 1st generation amines likely at scale by 2025 and only if pilots very quickly;

2nd generation bolt-on technologies could be ready at scale by 2030s;

Piloting/demonstration needed by 2020s in all cases;

CCU very unlikely to be commercial by mid 2020s;

Hurdles not just technology and cost;

Costs are comparable to power CCS (except high purity sources).

Tees Valley Integrated Complex

TeesValleyUnlimited

Next Steps

- TVU will publish pre-FEED, investment mechanism and business case work
- Welcome EC's proposal for industrial low carbon innovation within NER400 – DECC is talking to stakeholders
- TES and TVU industry collaboration was highly valuable, we will continue to work with industry as next steps are developed
- Questions
  - How much will FEED studies cost?
  - What 2nd generation technology innovation projects may come forward?
  - Who are the key UK players for partnering in innovation and 1st of a kind projects?

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Questions?

https://www.gov.uk/government/publications/co2-capture-in-the-uk-cement-chemicals-iron-steel-and-oil-refining-sectors