Business Models for CCUS Session

SPE London: Net Zero Programme
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About the CCSA

- The Carbon Capture and Storage Association, is the trade association promoting the commercial deployment of Carbon Capture, Utilisation and Storage.
- Our focus is on:
  - Advocating for policy developments in UK, EU and internationally towards a long-term regulatory and incentive framework for CCS
  - Raising awareness of CCS as a vital tool in fighting climate change and delivering sustainable long-term clean growth
  - Driving progress on commercial-scale projects
  - A technology neutral approach (geological storage and utilisation, capture from industry, power, hydrogen, bioenergy, direct air capture and different capture technologies)
- Find out more at www.ccsassociation.org

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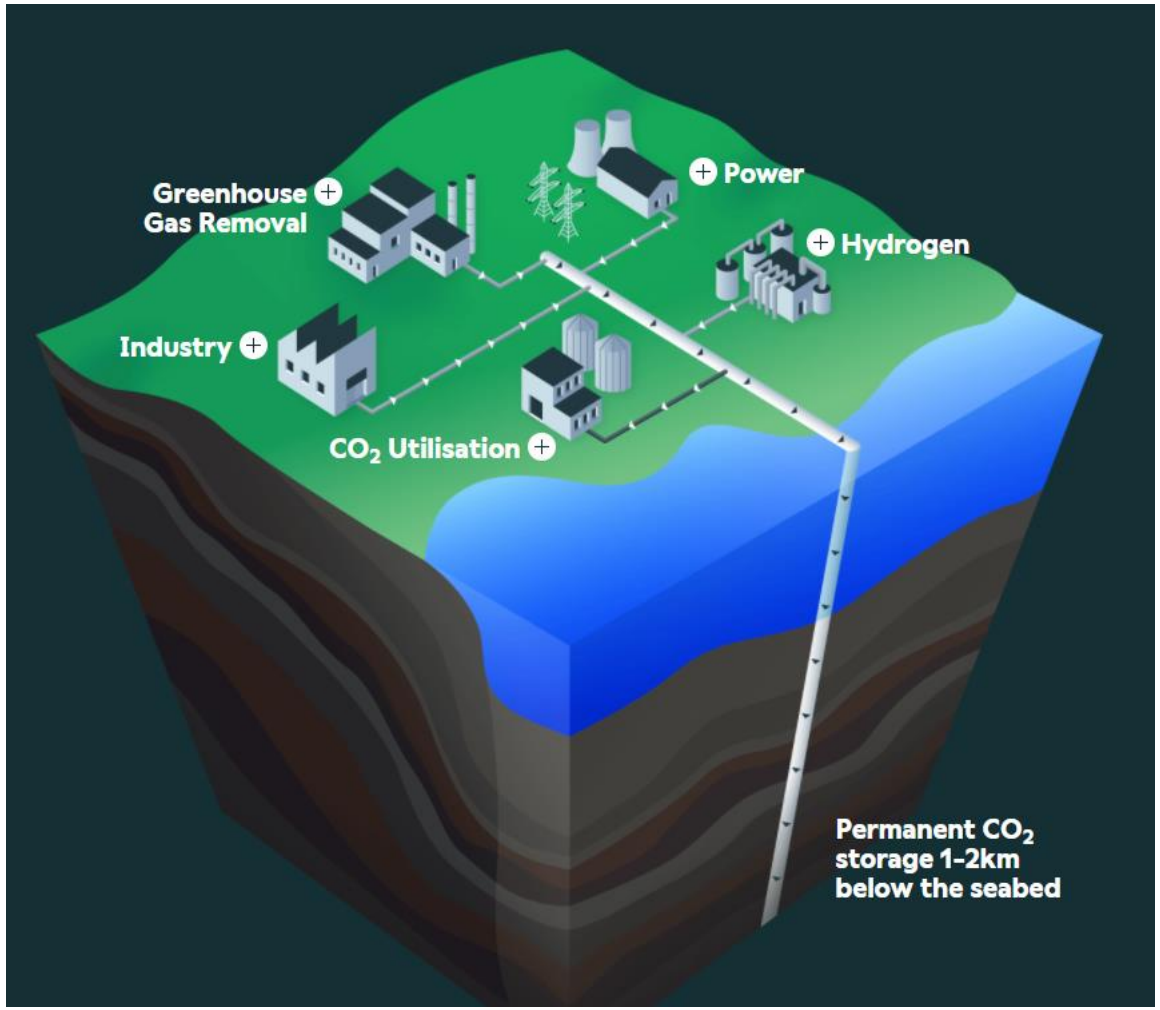
CCUS technologies

- **Capture CO_2:** using capture solvents to capture CO2 from:
  - Power generation
  - Industrial activity (cement, refinery, steel etc)
  - Hydrogen production
  - Bioenergy sources (BECCS) and the air (DACCS)
- **Transport CO_2** via pipeline or ship
- **Store CO_2** in deep geological formations, e.g. depleted oil & gas fields or deep saline formations.
- **Use CO_2** in products, albeit for more limited climate benefit.



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CCUS: Across sectors and regions

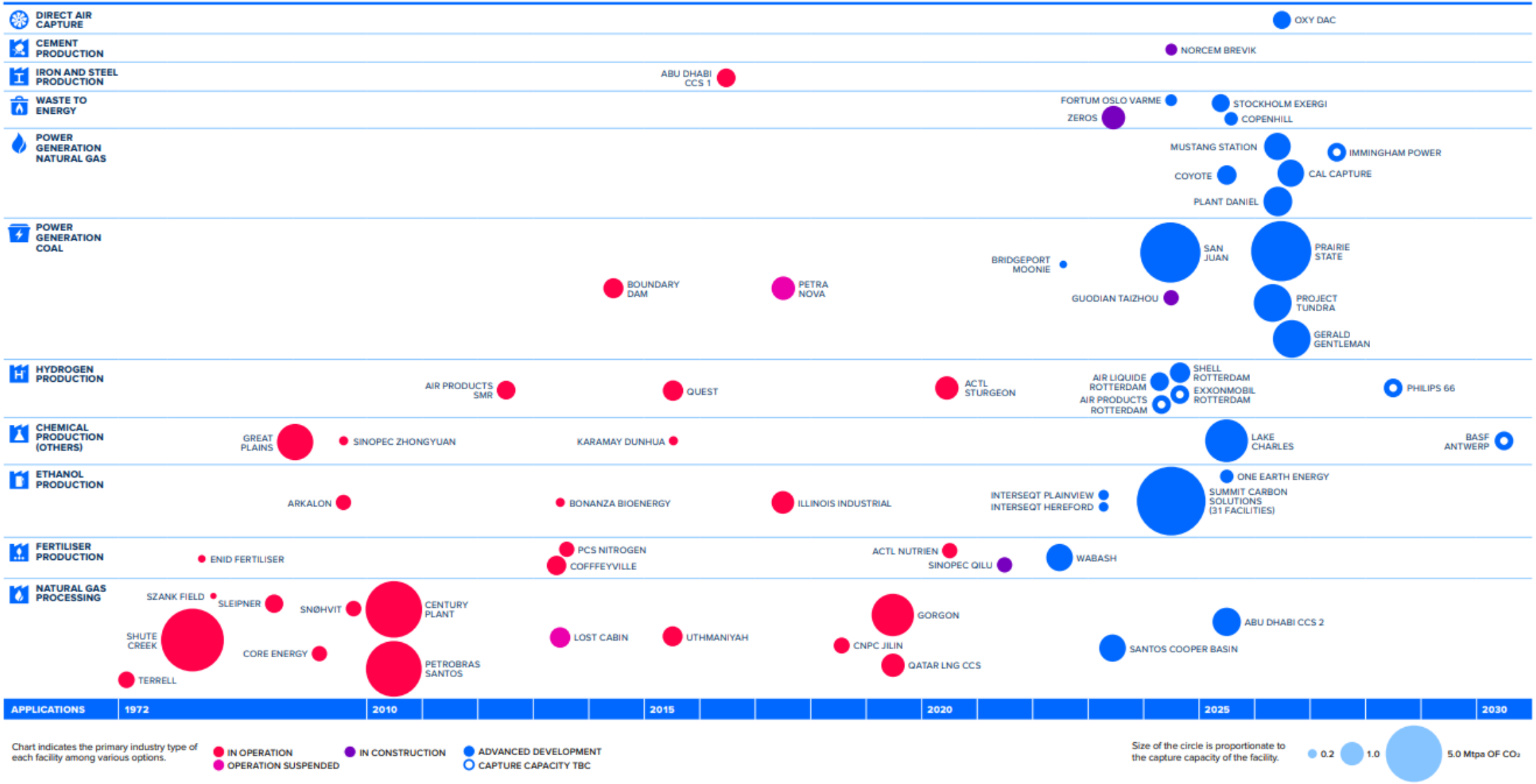

FIGURE 9 CCS PROJECTS BY SECTOR AND SCALE (BY CO_2 CAPTURE CAPACITY) OVER TIME

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Source:
GCCSI Global Status of CCUS 2021

CCUS: The role of CCUS in achieving global net zero ambitions

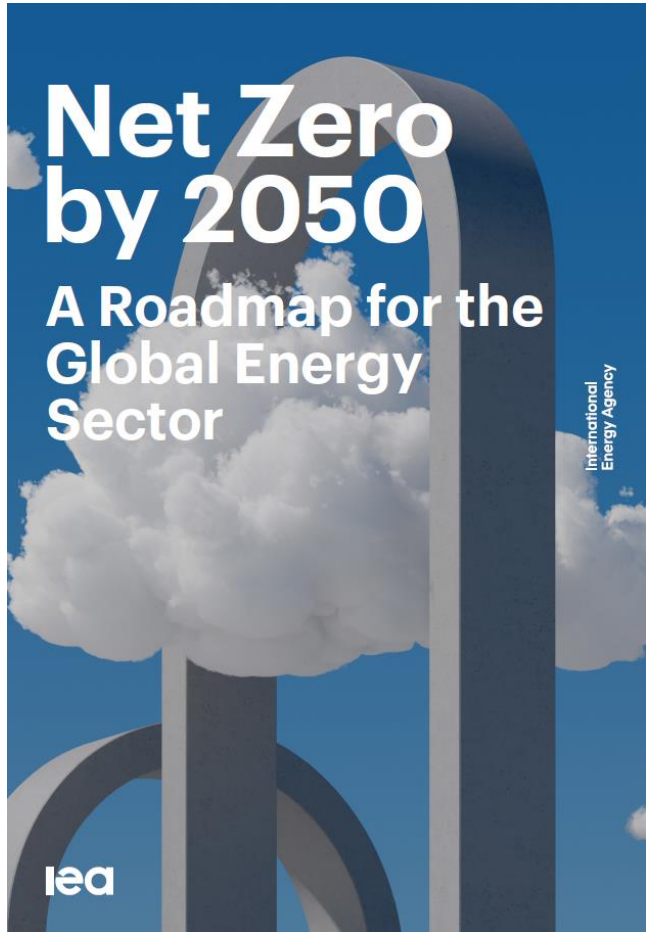
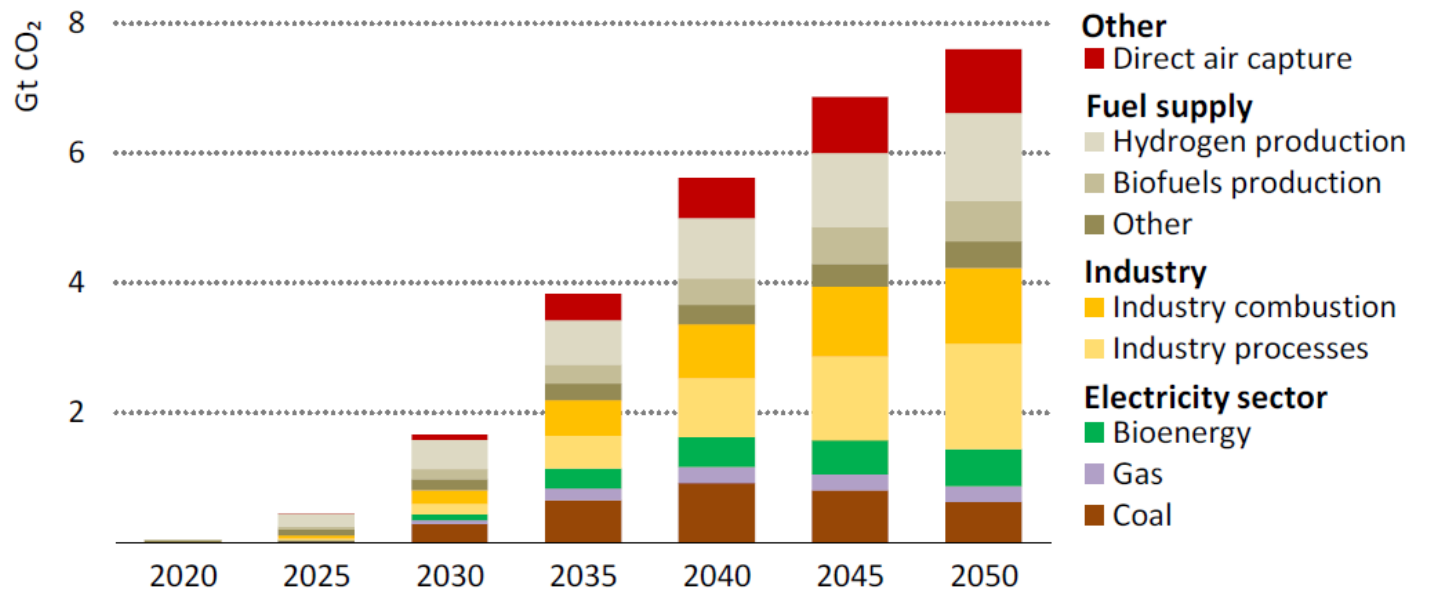


Figure 2.21 ▷ Global CO_2 capture by source in the NZE



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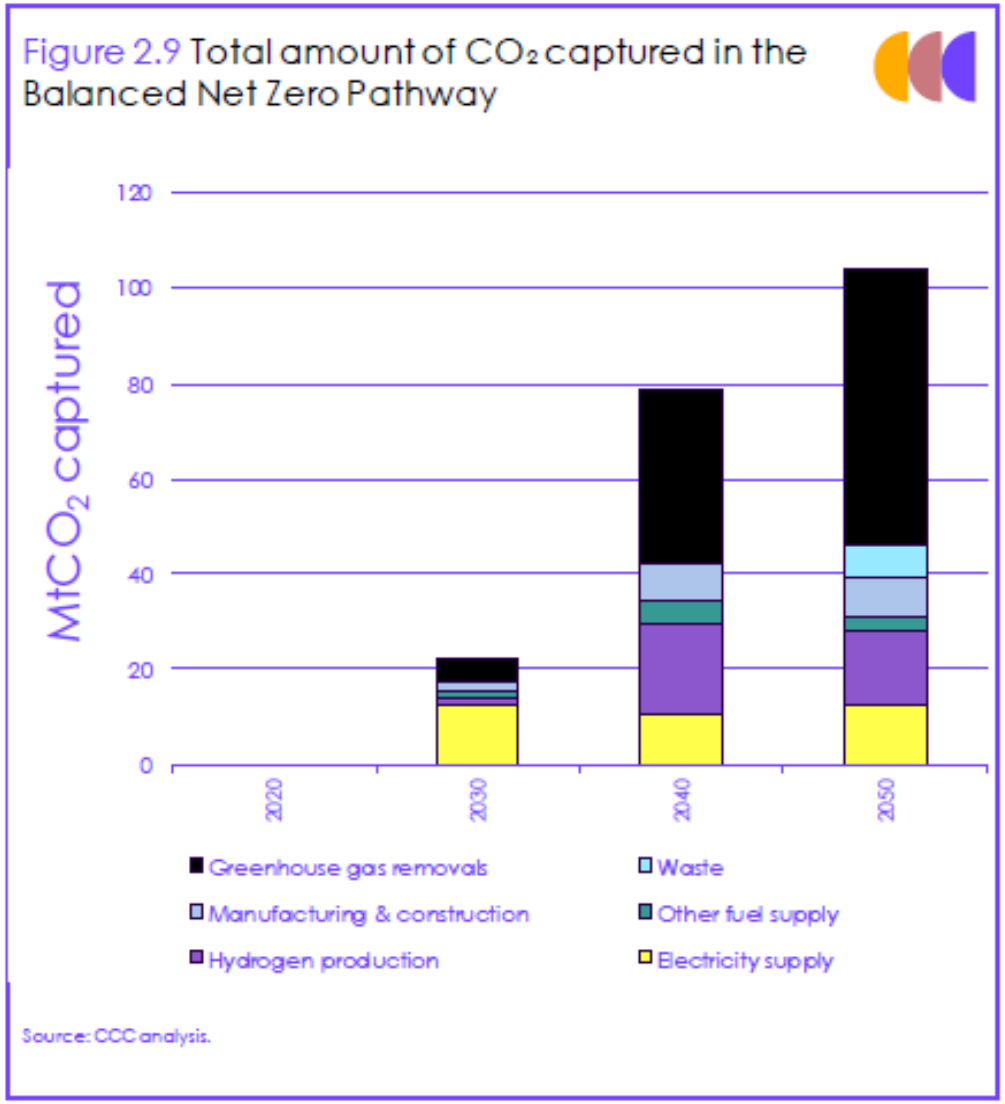
By 2050, 7.6 Gt of CO_2 is captured per year from a diverse range of sources. A total of 2.4 Gt CO_2 is captured from bioenergy use and DAC, of which 1.9 Gt CO_2 is permanently stored.

“CCS is a necessity, not an option”
UK Climate Change Committee, 6th Carbon Budget Advice

- CCC advised that the UK needs to establish;
  - At least two CCS clusters in the mid-2020s, at least four by the late 2020s, and further clusters around 2030.
  - Commercial scale hydrogen and ammonia production, and GHG removal plants all required.
- In the Balanced Net Zero Pathway, the UK requires **104Mt of CO2 storage pa by 2050**.
- UK Government adopted 6th Carbon Budget advice into law (including a 78% GHG reduction target by 2035) in June 2021.



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What Does a Good Business Model Look Like?

Certainty on returns over project lifetimes

Compatible with wider industrial and carbon policies

Long-term & can attract private finance

A framework which can evolve towards the NOAK projects

Protection from cross-chain risks and liabilities

Clear transfer of ownership and liabilities of CO2

Protection from carbon leakage

Is replicable, simple and competitive

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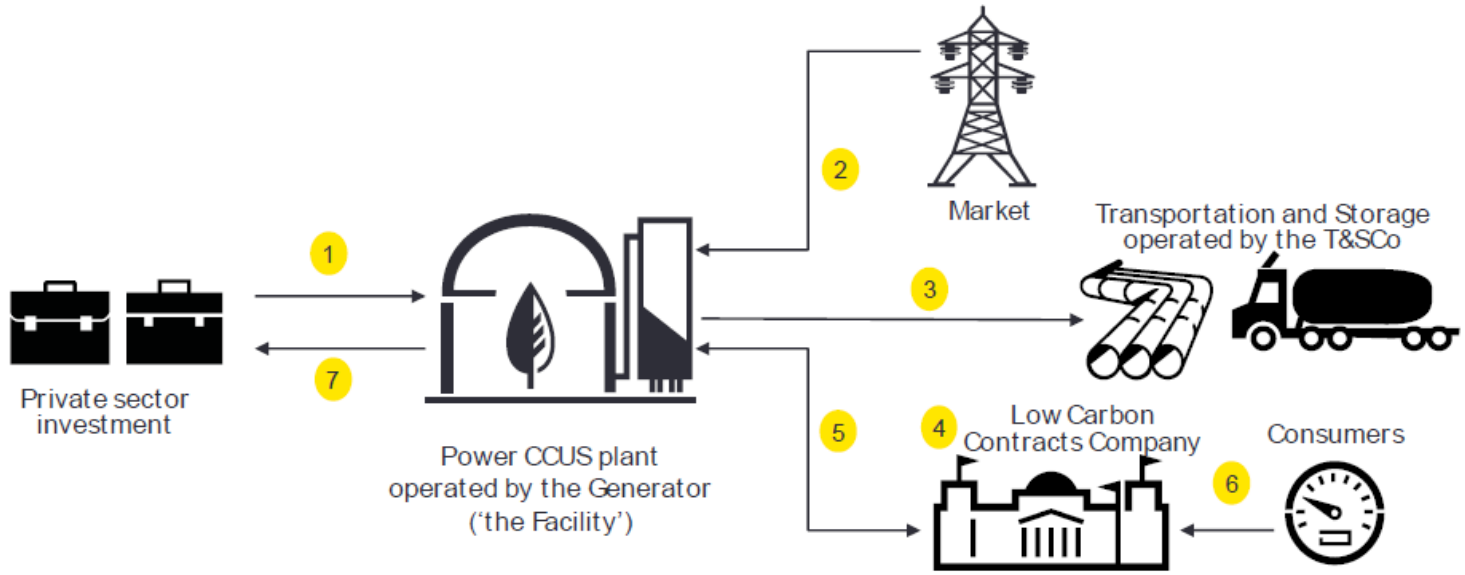
Dispatchable Power Agreement (DPA) for power CCUS

1. Private sector investment and construction of facility with carbon capture technology
2. The Power CCUS Plant provides dispatchable, low carbon power at the market price in the wholesale and balancing markets and provides ancillary services to the Electricity System Operator
3. The Generator pays T&SCo T&S fees for captured carbon
4. LCCC acts as counterparty to the DPA
5. DPA provides the Generator with payments comprising of an availability and variable payment
6. Consumer subsidy funds availability and variable payment
7. Return on investment back to private sector



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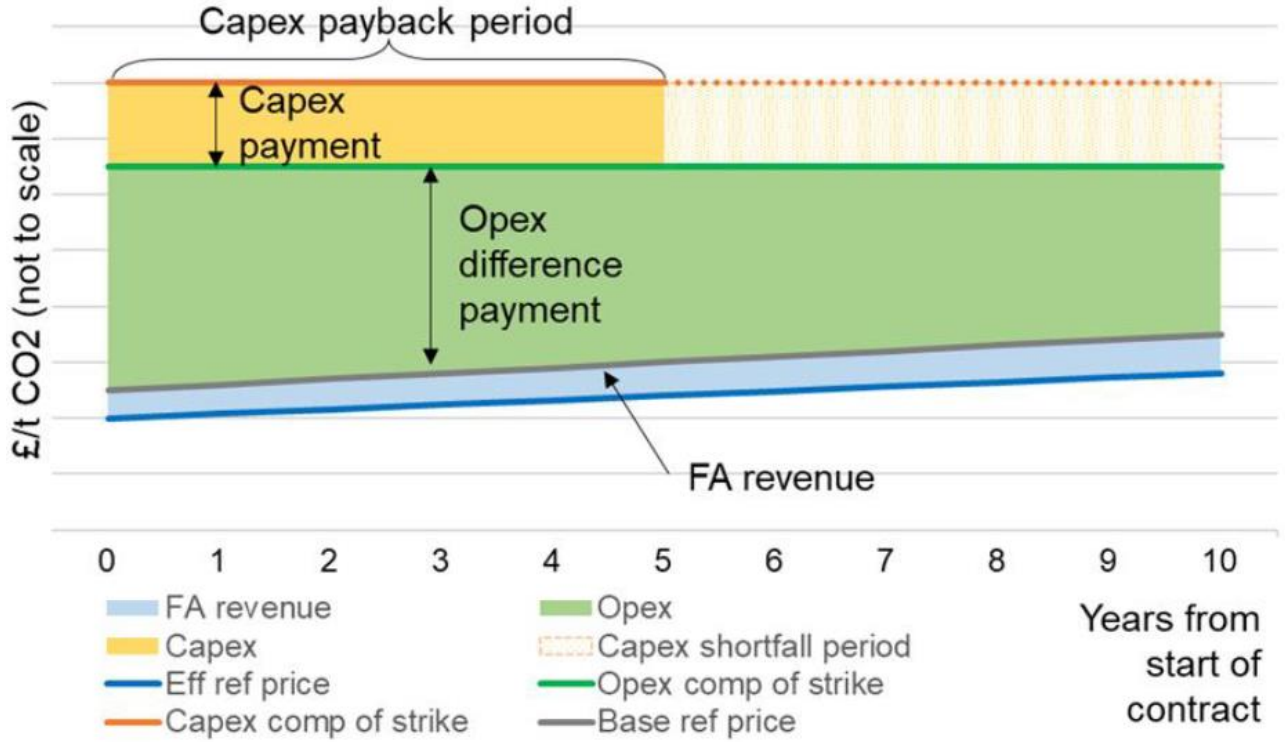
Industrial Carbon Capture (ICC) contract

- ICC contract – overall duration of 15 years possibly profiled (10 + 5 yrs)
- Negotiated bi-laterally for initial projects
- Govt. capital co-funding available for the initial projects
- Subsidy reduces as carbon prices rise and low-carbon product markets emerge
- Reference price set at a fixed trajectory, based on an assumed increase in CO2 price.
- Energy-from-Waste assessing an adapted ICC model which works for the sector



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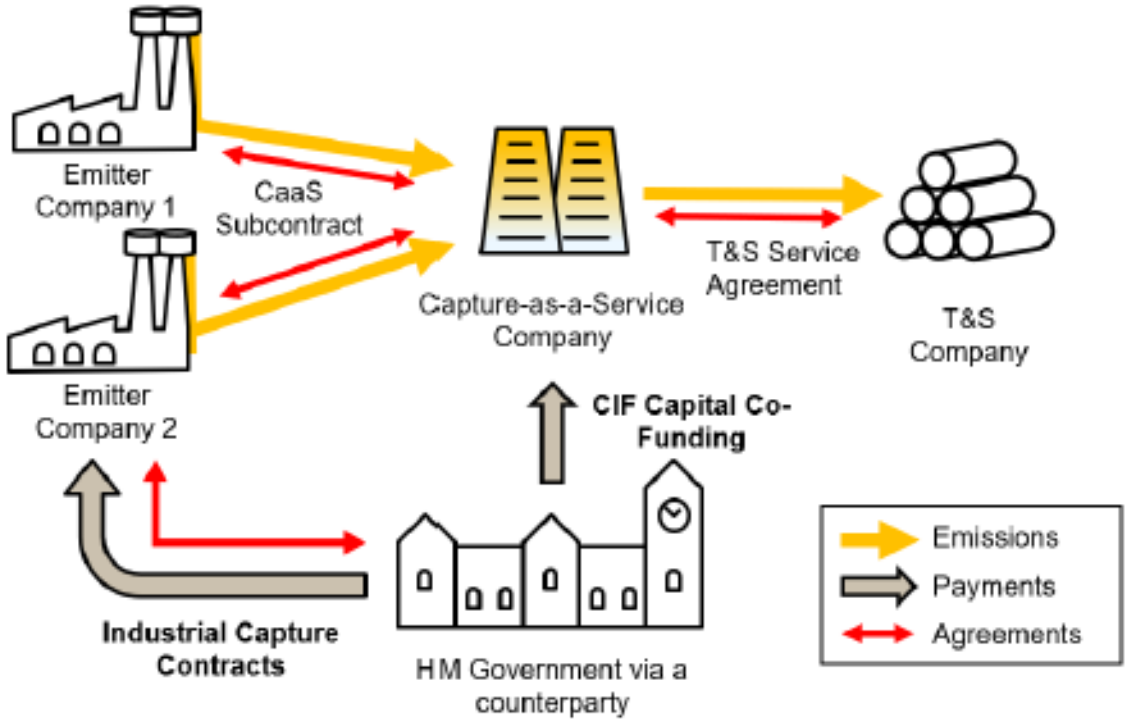
Carbon Capture as a Service (CaaS)

- Categorised under the Industrial Carbon Capture Business Model
- Allows a single capture company to provide a capture service ahead of interaction with the Transport and Storage operators
- An attractive proposition for medium/smaller emitters who may not have the expertise or funding to deploy carbon capture independently
- Development of Non-Pipeline Transport of CO2 a key enabler of the deployment of CaaS across the UK at coastal and dispersed CO2 sources.



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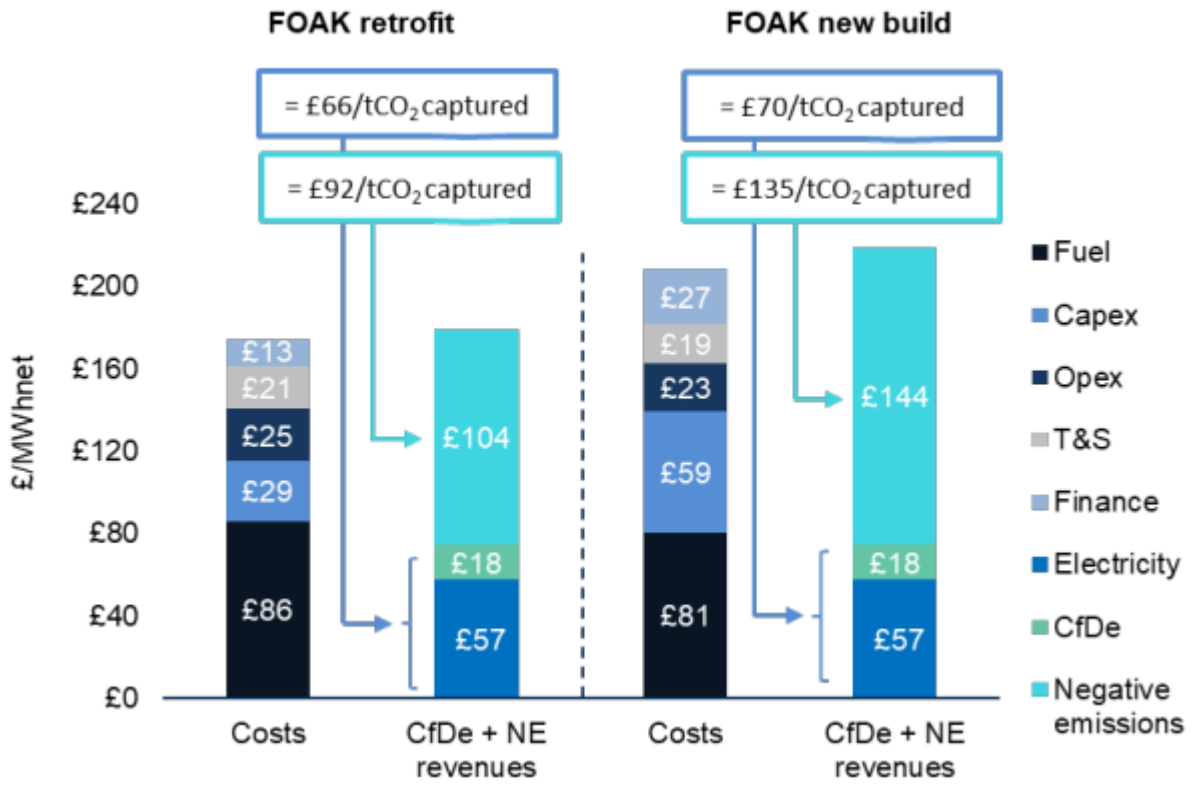
Greenhouse Gas Removals (GGRs) – BECCS and DACCS

- BEIS envisage early market exploration to be done by power BECCS projects (such as biomass fired power stations)
- CCSA envisage a negative emissions payment mechanisms enabling early projects, which over time will move to a Carbon CfD
- Uncertainty on negative emissions in the UK ETS scheme

Electricity CfD with negative emissions revenues



From Element Energy & VividEconomics 2021 report for BEIS on Investable commercial frameworks for Power BECCS

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Questions?

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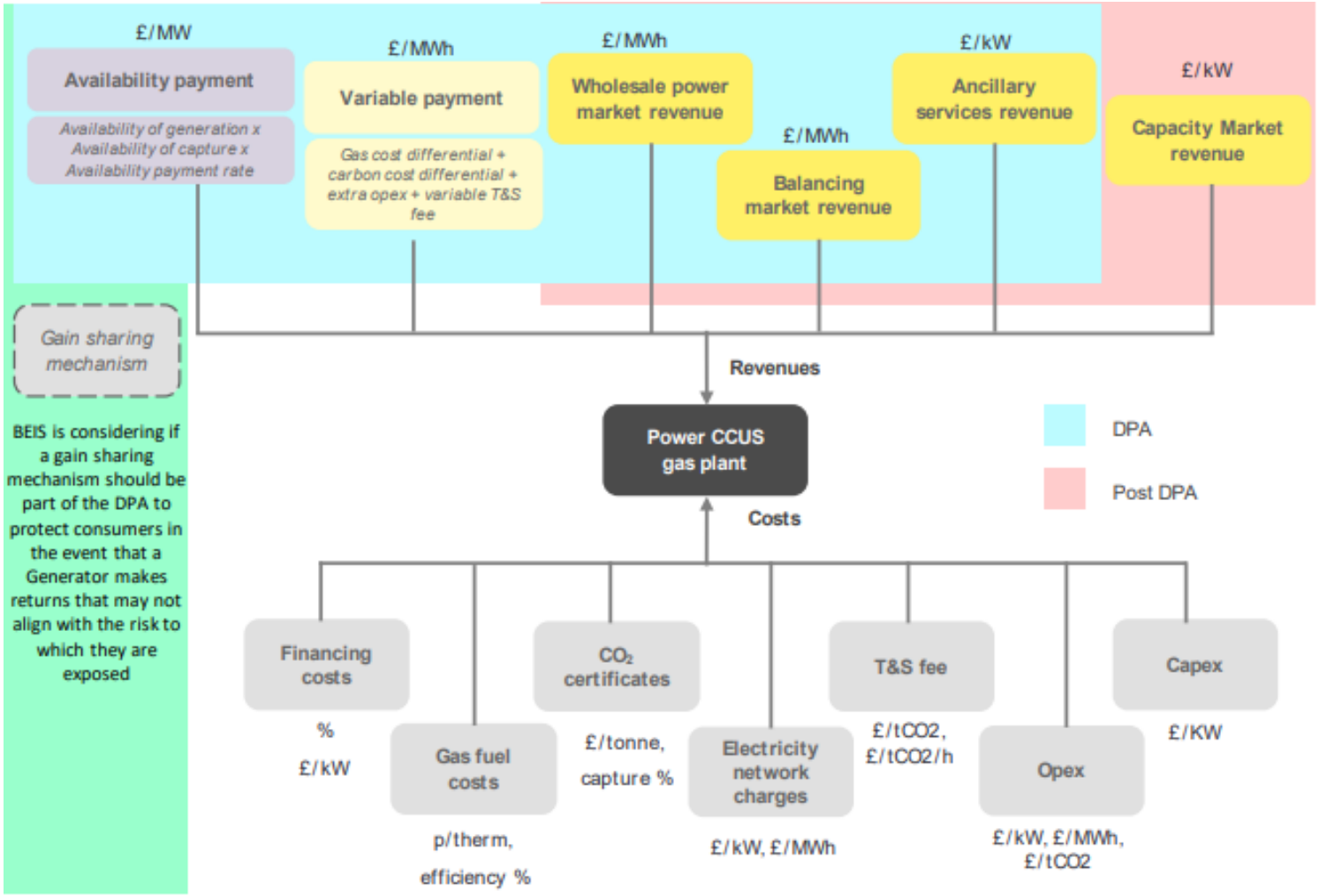
Dispatchable Power Agreement (DPA) for power CCUS



From BEIS Business Model Update 2020

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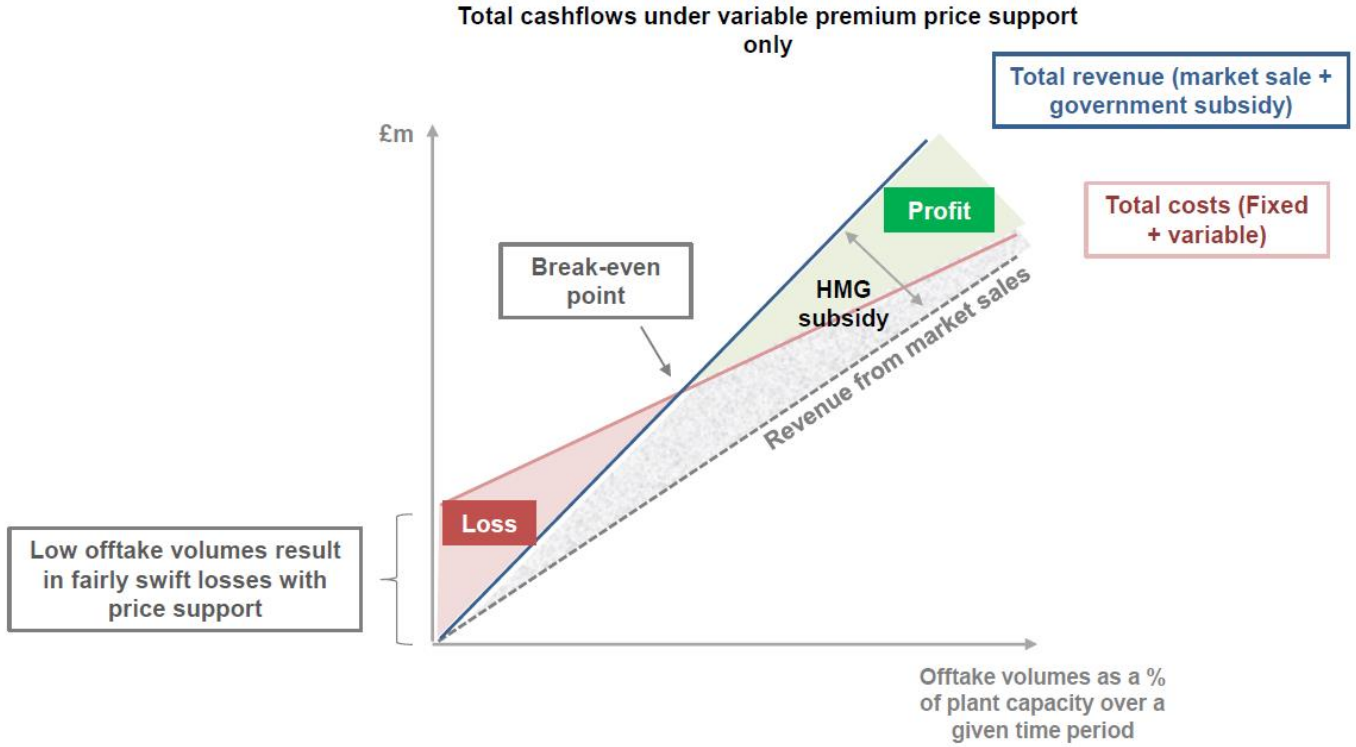
Hydrogen Production CfD

- Production method agnostic (Green and Blue)
- Reference price is the natural gas price
- BEIS considering how to introduce an achieved sales price incentive
- Volume risk is still being considered by BEIS. How do you design a mechanism to cover the issue of early network over production?
- BEIS are proposing a volume risk 'sliding scale', which may not suit the characteristics of CCUS enabled hydrogen production well.
- Finalisation of hydrogen business models in 2022



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Cluster sequencing

Prime Minister's 10 Point Plan commitment – *"at least two clusters operational by mid-2020s and two by 2030"*

- **Track-1:** Bring forward at least two clusters operational by the mid-2020s
  - Phase-1: Provisionally sequence clusters onto Track 1 (announced November 2021)
  - Phase-2: Determine which carbon capture projects within clusters will proceed into negotiations (shortlist to be announced May 2022)

- **Track-2:** Two additional clusters that expected to be operational by 2030
  - Potential selection process **not yet defined**
  - Future phases of access to Track-1 **not yet defined**

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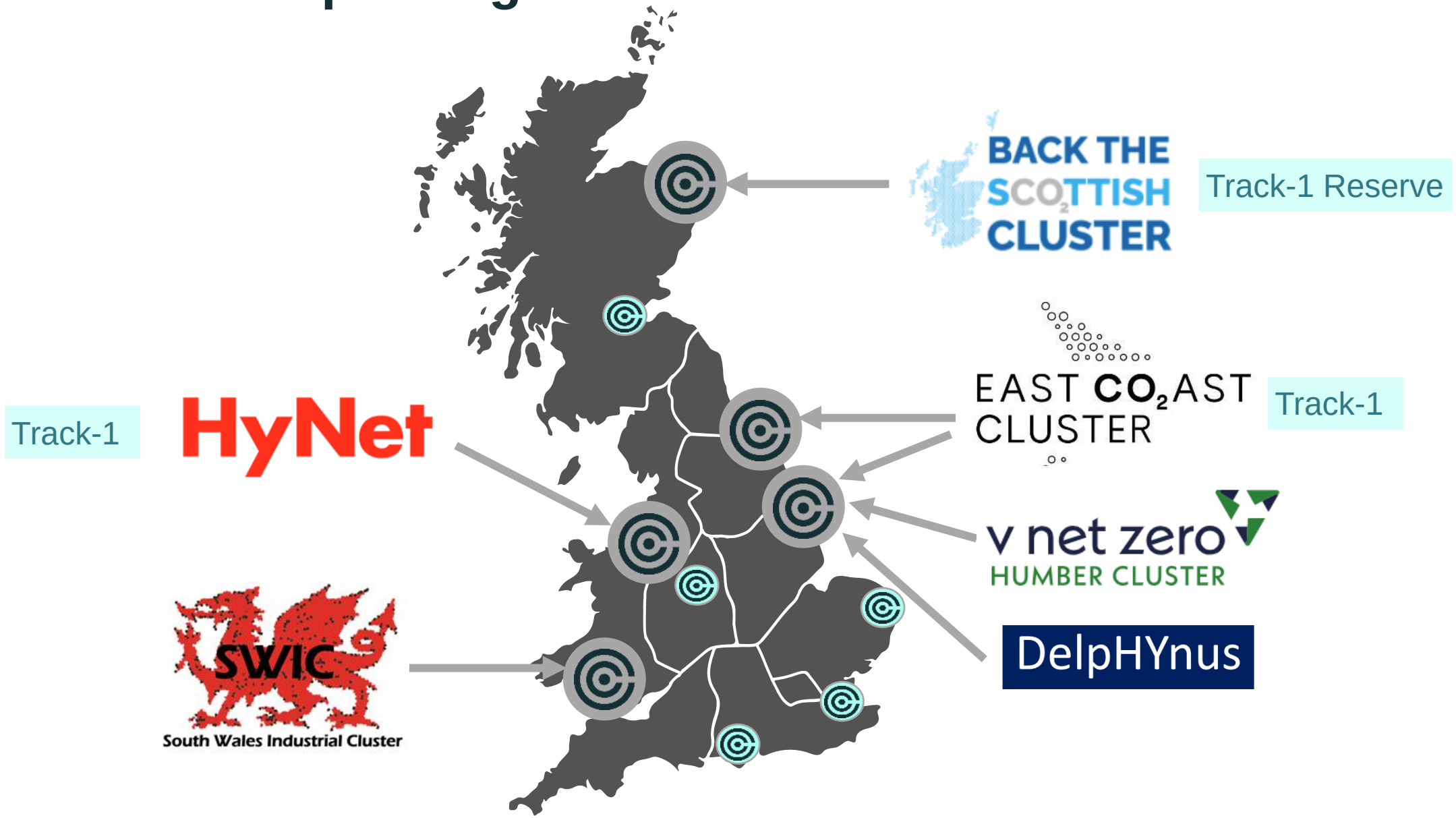
CCUS Clusters Operating from mid-2020s



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