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Carbon Capture and Storage, including Nature Based Solutions

Taster Session with Estelle Dehon KC

May 2024

Taster Session

01

CCS and CCUS

Simple explanation of a few of the most common CCS/CCUS technologies

02

The Controversy

Why CCS/CCUS are controversial

03

UK's Plan

Brief overview of the UK's plans

CCS & CCUS

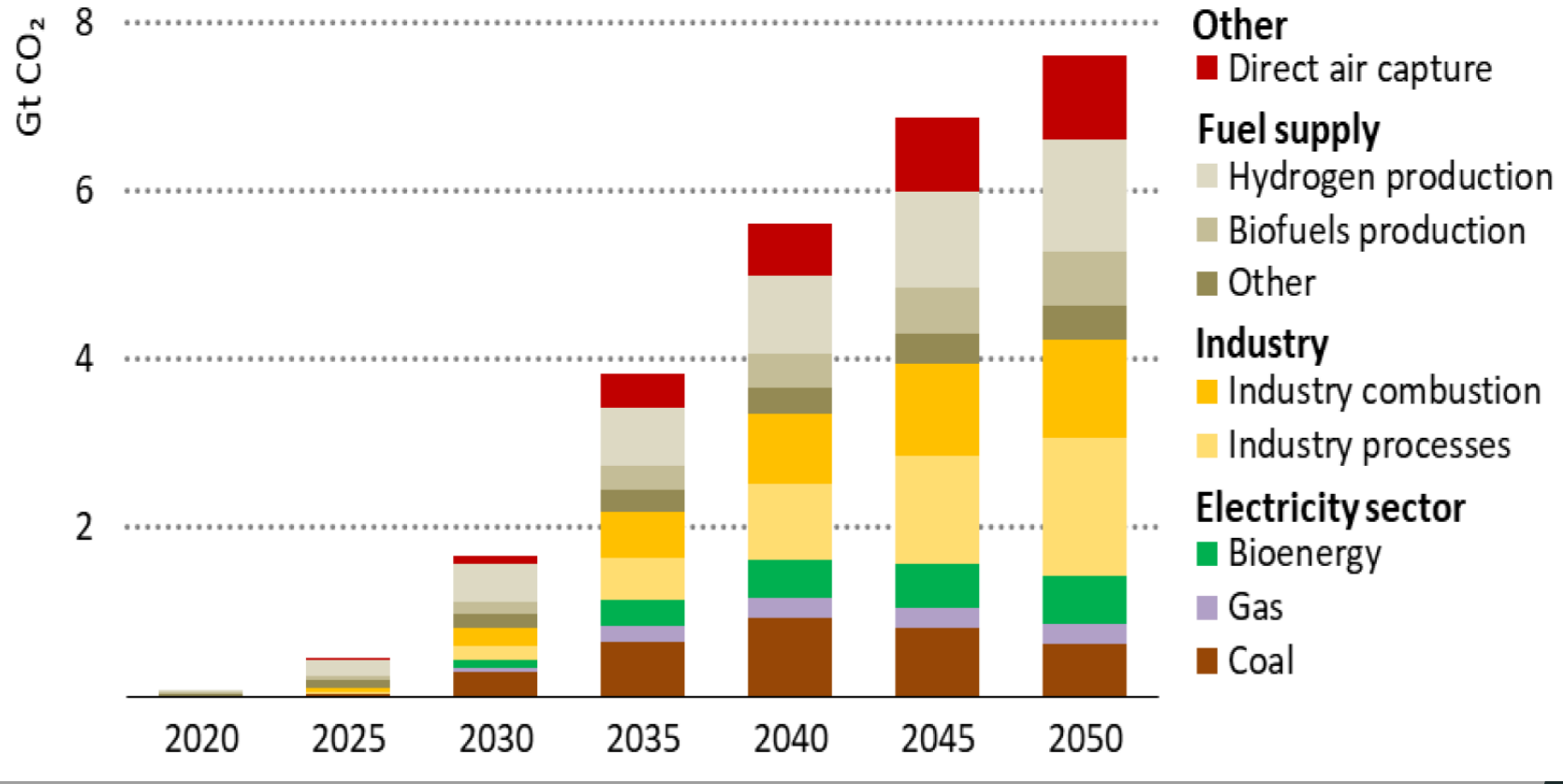
CCS

- Carbon Capture and Storage
- This involves capturing CO2 from sources like power plants or industrial processes and then transporting it to a storage site, usually deep underground, where it is stored permanently. The goal is to prevent the CO2 from entering the atmosphere and contributing to climate change
- Example: Boundary Dam Carbon Capture Project (Canada) - CO2 is captured from a coal-fired power plant and then stored in a deep geological formation. First power station in the world to deploy the technology (2014). May 2023 CCS available 70% of the time

CCUS

- Carbon Capture, Use and Storage
- This process also captures CO2 but, instead of just storing it, some or all of the captured CO2 is used in various applications before being stored. This might include using CO2 in industrial processes, making chemicals, or even producing synthetic fuels. After its use, the CO2 is then stored to prevent it from entering the atmosphere.
- Example: Petra Nova Project (USA) - CO2 captured from a coal-fired power plant is used for enhanced oil recovery (EOR) in nearby oil fields. The CO2 is injected into the oil fields to help extract more oil and is then stored underground.

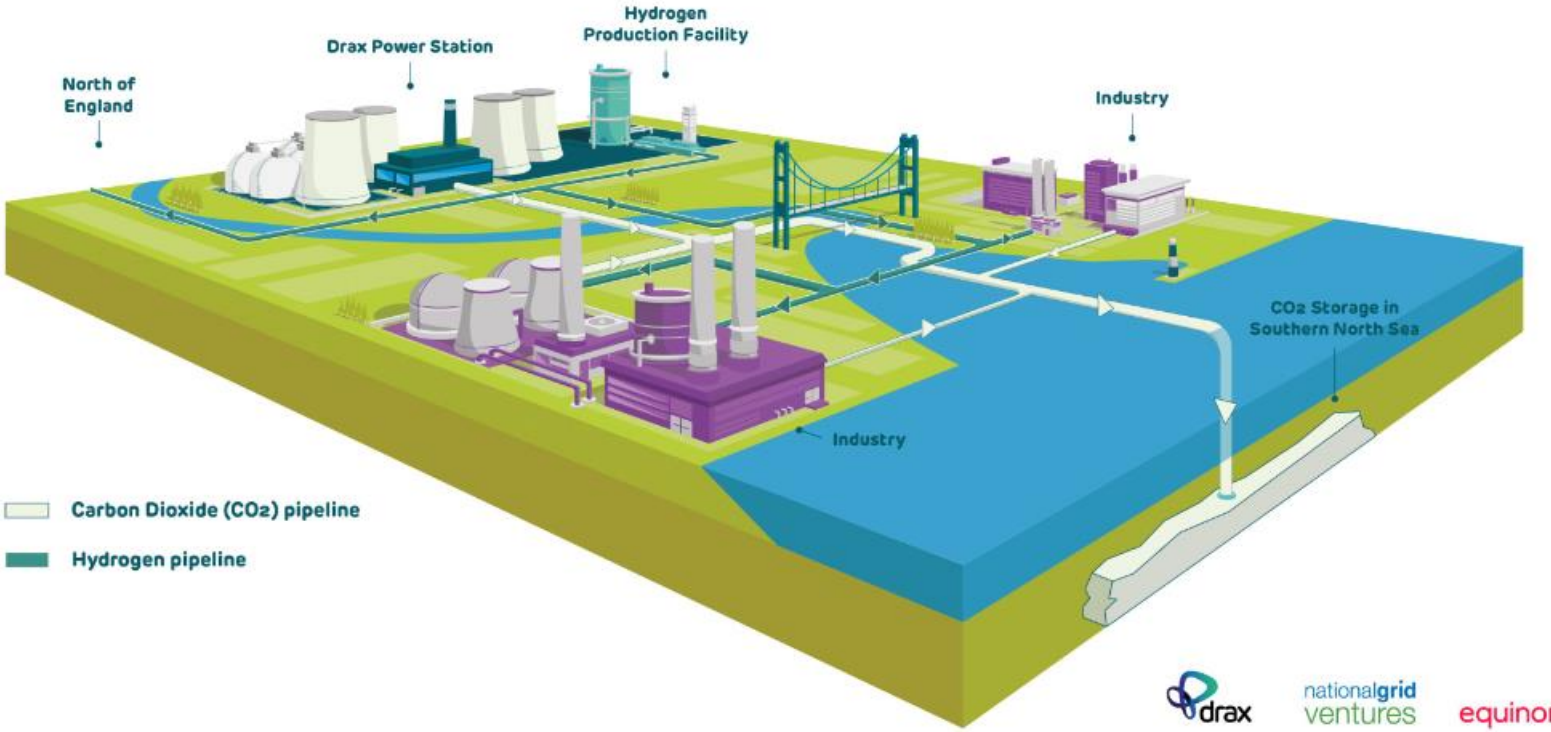
Global CO_2 capture by source in the IEA Net Zero by 2050 Scenario



BECCS - Bioenergy with carbon capture & storage

- Sequesters underground the emissions resulting from the burning of biomass for power
- Prevents the “re-release” into the atmosphere of the carbon sequestered by the plants that are burned
- BECCS has yet to be proved at a commercially viable scale
- Drax – January 2024 consent for CCUS: capture, use, transport and store via Humber Low Carbon Pipelines Project

WHAT A ZERO CARBON CLUSTER COULD LOOK LIKE IN THE HUMBER REGION



drax
nationalgrid
ventures
equinor

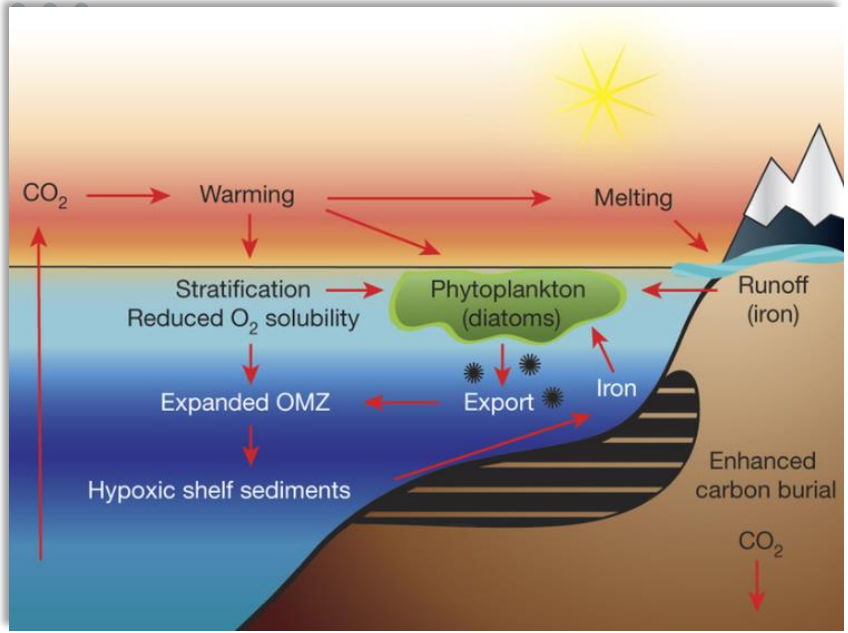
DAC - Direct air capture

- Sucking CO2 out of the air and either burying it or using it in chemical processes
- Several proposed ways to capture CO2 from air. The most common approach is to pass air over a special liquid. CO2 sticks to this mixture while the rest of the air does not. The mixture is then recycled by releasing the CO2, using heat.
- HUGELY energy intensive: Capturing a billion tonnes of CO2 a year from air would need the energy equivalent of 16 gigawatts (GW) of power plants running 24/7, if the system was perfectly efficient.

Enhanced weathering

- Natural rock weathering absorbs around 3% of global fossil fuel emissions.

- Enhanced weathering ramps up this process. Pulverising rocks bypasses the slow weathering action, and spreading the resulting powder on large areas of agricultural land makes use of microbes in the soil to speed up the chemical reactions. At the same time, adding minerals to the soil boosts nutrient levels in the soil, providing a benefit for crops. The powder can also be spread directly onto the ocean surface.



Enhanced ocean productivity

- Artificially increasing the rate at which tiny microscopic marine plants photosynthesise could, in theory, accelerate the removal of atmospheric CO2 and slow the pace of climate change.

- One idea is to inject the nutrient iron into parts of the ocean where it is currently lacking, triggering a “bloom” of microscopic plants called phytoplankton. Other studies suggest fertilising the ocean with nitrogen or pumping nutrient-rich, deep water into the nutrient-depleted surface ocean could do a similar job in terms of stimulating plant growth.

Biochar

- Biochar is the name given to charcoal that is added to soils rather than burned as a fuel. The charcoal is produced by burning biomass, such as wood, crop wastes and manure, while cutting off the supply of oxygen.
- Making and using biochar can serve several purposes in addition to sequestering carbon. Adding it to soils can improve its fertility – acting as a slow-release sponge for water and nutrients – and boost crop yields.
- However, as adding biochar makes soil darker, it reduces its albedo (how much of the sun's energy is reflected by a surface), meaning the land will absorb more of the sun's energy and warm more rapidly.

Intersection with Nature Based Solutions

- **Afforestation** - planting trees where there were previously none.
- **Reforestation** - restoring areas where the trees have been cut down or degraded.

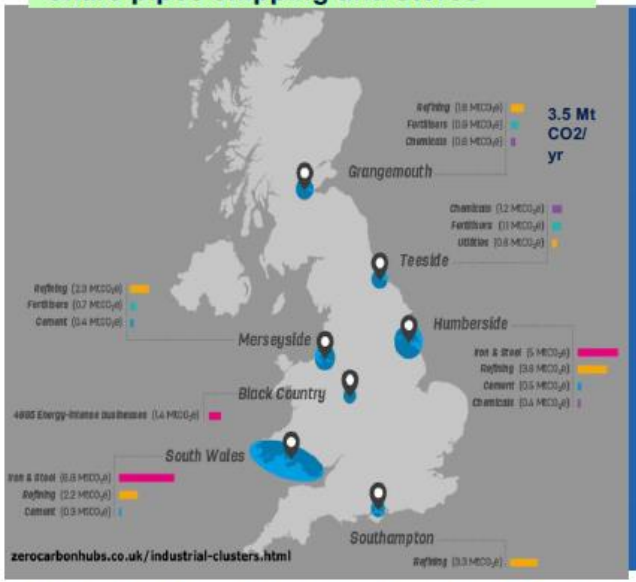
- Because trees take up CO2 from the atmosphere as they grow, planting more trees means boosting how much CO2 forests absorb and store. As a method of removing CO2 from the atmosphere, this is one of the most feasible options, although it still has drawbacks and uncertainties.

‘Blue carbon’ habitat restoration

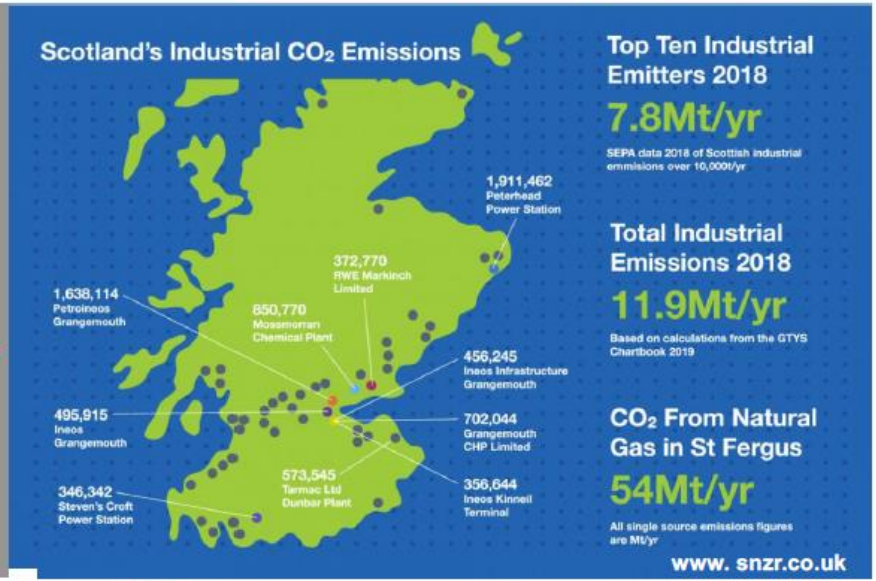
- Conserving and restoring coastal ecosystems so that they can continue to draw CO2 out of the air.
- Salt marshes, mangroves, and seagrass beds act as natural defences against climate change, capturing CO2 from the atmosphere – even faster than terrestrial forests – and storing it in their leaves, stems and in the soil.
- Carbon stored in coastal or marine ecosystems is known as ‘blue carbon’.

UK Net Zero 2050 – industrial strategy

CO2 capture and transport in clusters – share pipes shipping and stores



CO2 capture and transport example cluster – share pipes shipping and stores



£1 Bn UK-wide funding to support CCS kit in 4 industrial clusters

£20 Bn to operate 4 clusters. Extensions and add-on capture – including BECCS and blue H2

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Questions

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Cornerstone Climate Month

Still to come!

- 22-5-24 (am) From Old to Gold: challenges in retrofitting
- 23-5-24 (pm) Climate Change and the Law: The Basics #2: the international perspective
- 28-5-24 (am) Financing the Green Transition
- 29-5-24 (am) Climate and the right to protest
- 29-5-24 (pm) Climate litigation in the civil courts
- 30-5-24 (pm) Climate Change and Human Rights

Catch up on previous sessions:

Climate Change and the Law: The Basics #1
Policy Making: How to Plan for Net Zero
Real estate and ESG
Climate as a material planning consideration
Ecocide and greenwashing
Carbon Delivery Budget Plan
UK Progress towards Net Zero
Power to the People: renewable energy