CAMBRIDGE ZERO $_2$

Hard to Decarbonise Technologies
Special Interest Group

Hydrogen and Carbon Capture, Challenges and Opportunities
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Panel

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Discussion Points

- The UKRI Industrial Decarbonisation Challenge funds development of low-carbon technologies at six deployment projects in energy intensive industrial regions. The target is to utilise a supply of Hydrogen (H_2) with carbon capture and storage (CCS) by the end of the decade. The UK Government has confidence in H_2-CCS readiness and plans to invest £1 billion in the infrastructure construction phase beyond 2035.
- HyNet is a project deploying H_2 and CCS for industry in NW England and N Wales. They use a standard autothermal reformation technology (adapted from methanol synthesis) for conversion of hydrocarbon gases released during oil refining into H_2 with CCS.
- CO_2 is also being captured from other local industries for storage in repurposed gas wells.
- H_2 is usefully deployed on transforming sectors, such as steel, glass, etc. In HyNet, H_2 fuels industrial processes and is mixed with the existing domestic gas supply (20% H_2). The latter is not ideal thermodynamically but helps where installation of other technologies is unfeasible.
- Turquoise H_2 is implemented in the Humber region. The technology uses a thermally efficient plasma torch to crack hydrocarbons into H_2 and solid carbon. 40% of the energy comes out in the solid carbon, so finding good uses for the carbon is key.
- Green H_2 solutions receive more funding than those of blue H_2. Increasing support for blue H_2 needs public perception to be addressed. A popular misconception is that most H_2 is green (<4% in reality). Also, the public tend to mix up fossil fuel use and CO_2 from fossil fuels.
- Green H_2, although popular, has energy efficiency as low as 10-30%, making it realistic only in locations with abundant green electricity and a plentiful clean water supply. It is likely that a greater climate payback would result from using green electricity to improve the efficiency of the grid, rather than to produce green H_2.

Challenges

- The biggest risks to implementation of H_2 and CCS are in receiving permits for planning and operation
- Can we make Golden H_2 using biowaste to produce H_2 with a negative carbon footprint?
- Quickly reduce implementation to a 10-year timescale rather than the typical 30-40 years.
- H2 and CCS safety and perception.
- Public understanding of the different hydrogen colours and their actual proportions.

Opportunities

- UoC research on novel catalytic systems to produce green ammonia (H_2 storage, avoids the Haber process)
- Understanding limits to efficiency of green H production via electrochemistry, and the use of high efficiency electrodes.
- UoC collaboration with industry to calculate CO_2 impacts and various hydrogen pathways.
- UoC collaboration on turquoise H_2 and carbon production to find useful means of solid carbon utilization that permanently sequester carbon.
- Study to determine the best uses of H_2 in different sectors if CO_2-free H_2 is likely to be limited in production.

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