

Hydrogen & The Energy Transition

*Observations from the
Front Line*

21st February 2023



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Agenda

- Hydrogen & Energy Transition
- Hydrogen – *What & Why?*
- The Hydrogen Economy & UK Projects
- Challenges & Observations
- Final Thoughts
- Q&A

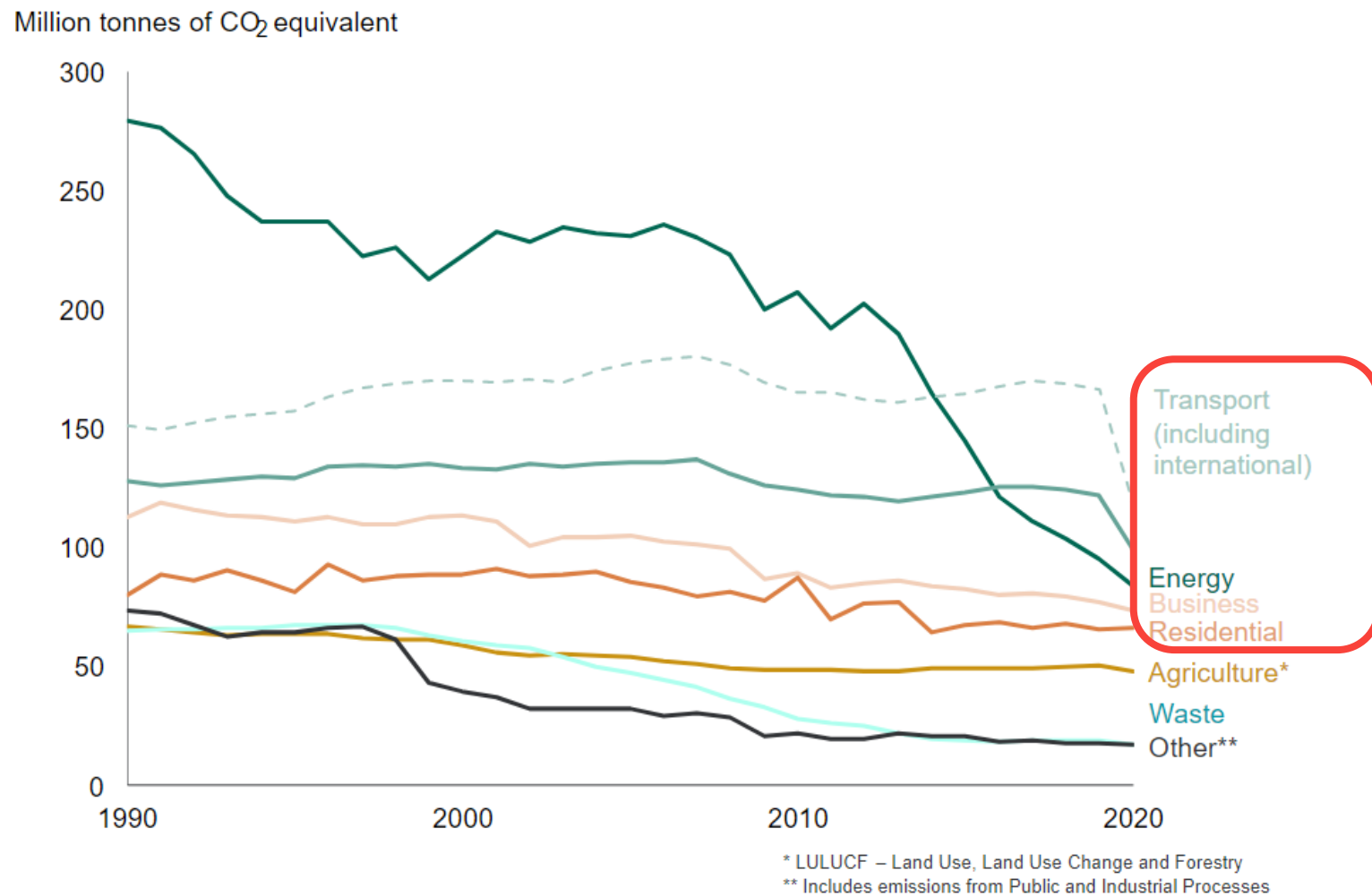
Hydrogen & The Energy Transition

Global Warming & Climate Change



UK Emissions Overview

Figure 2: Greenhouse gas emissions by sector, 2020 (BEIS, 2022)



Hydrogen What & Why?

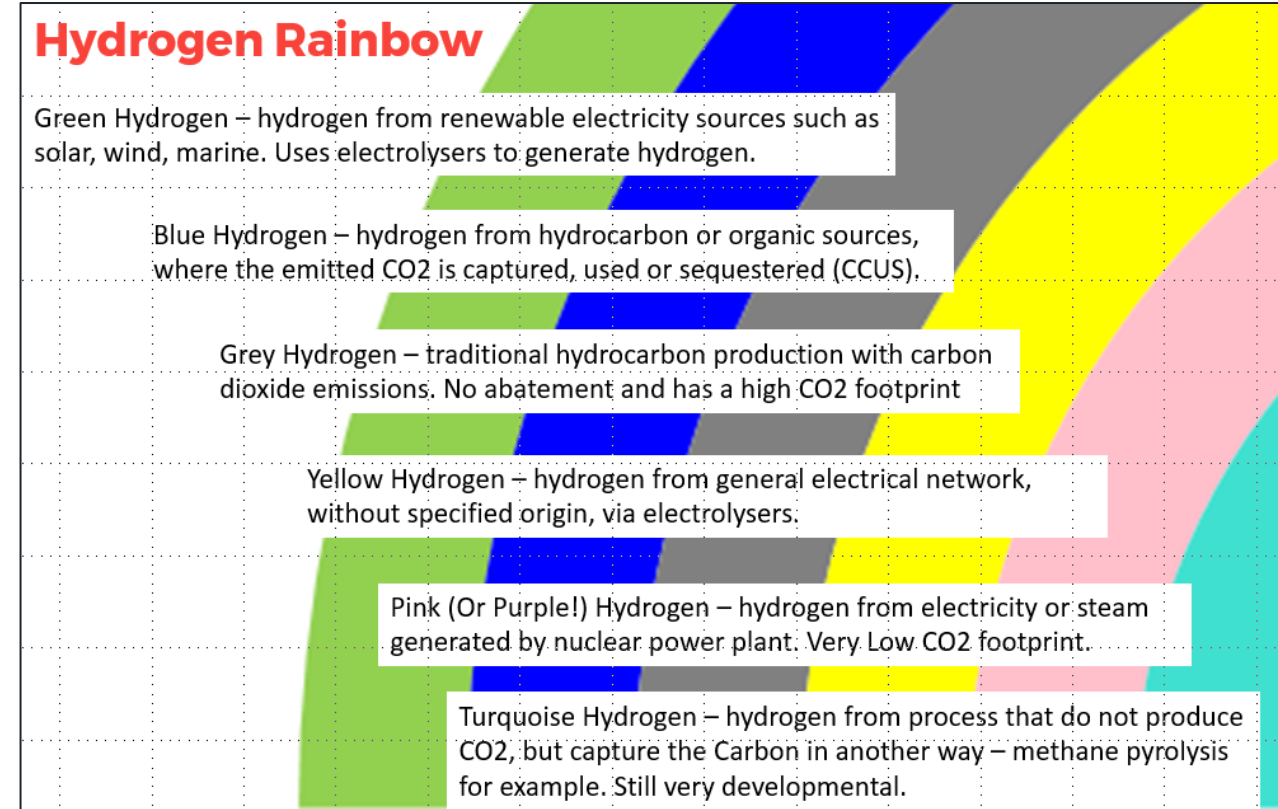
H2 – What & Why?

What is it?

- 1st element in periodic table
- Estimated makes up 90% of all atoms in universe, BUT, production has carbon impact

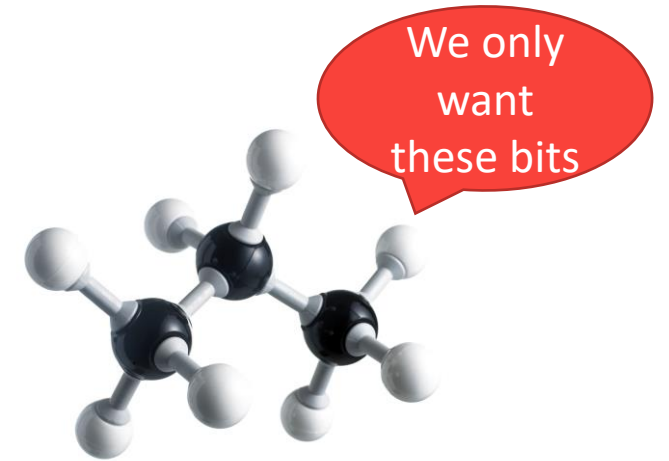
Why are we so interested?

- “Swiss army knife of energy”
- When burned it generates heat with water by-product, i.e. no emissions at point of use
- Can be used for Energy, Industry and Transport fuel switching
- Can also be used for energy storage and balancing



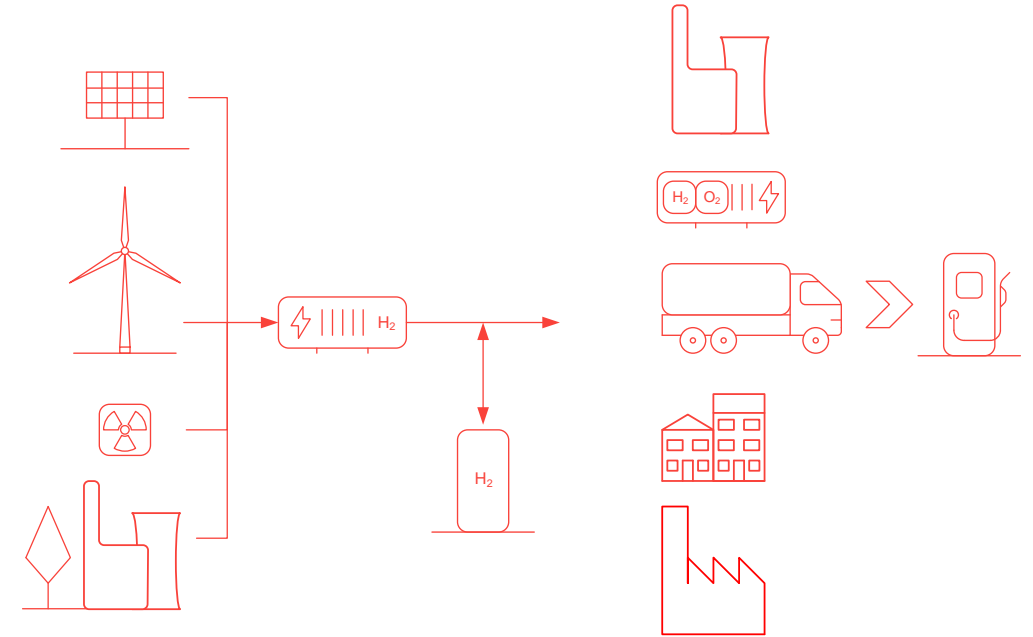
H2 Production from Hydrocarbons

- Standard method of production
- Technology options
 - Steam reforming
 - Autothermal
 - Gasification
- Large industrial scale at high technical maturity levels
- Produces CO₂ which needs to be captured
- CCS + reforming solutions required



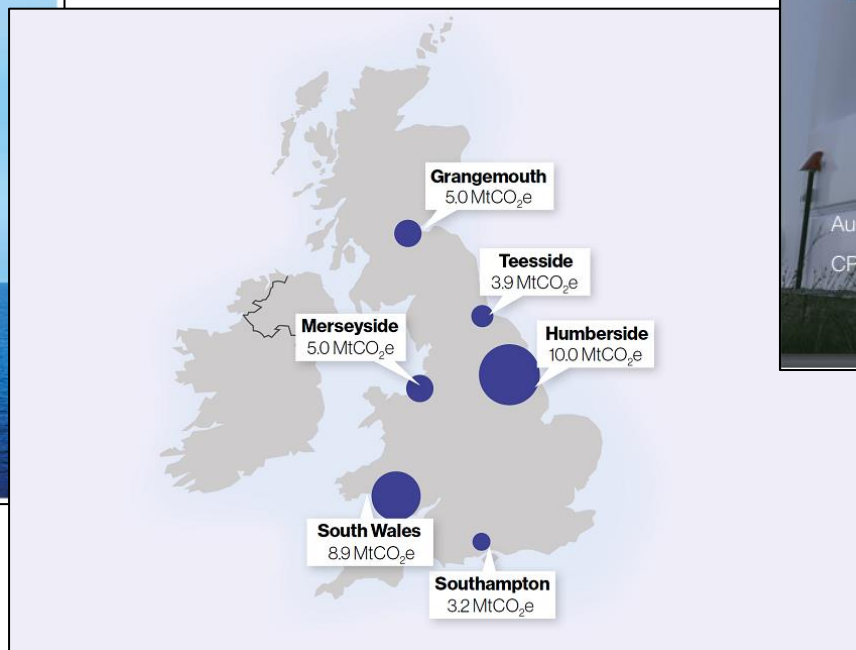
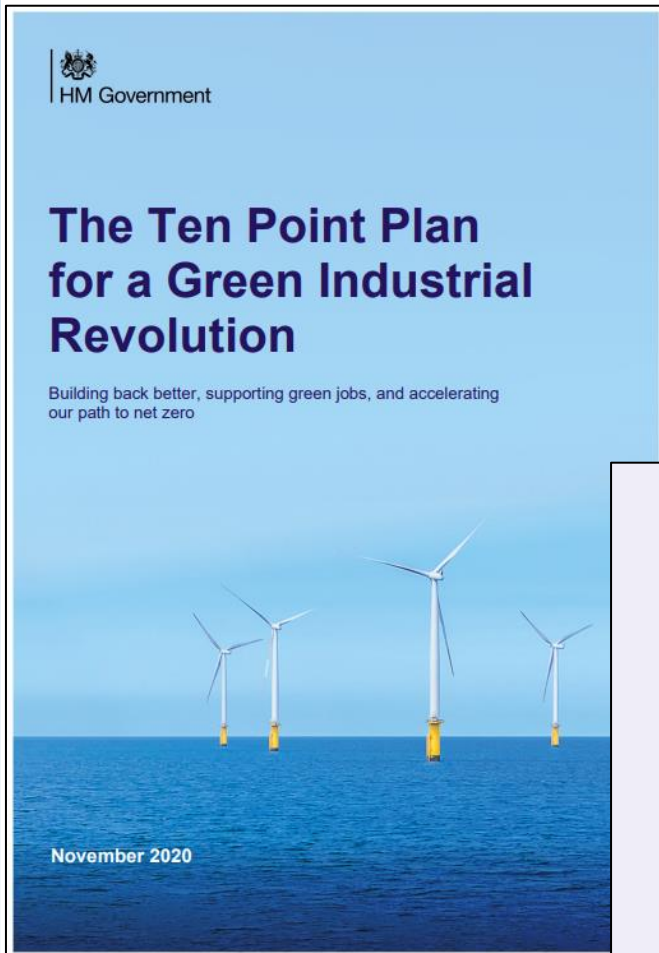
H2 Production from Electrolysis

- Uses electricity to separate water
- Dedicated power or green certified for remote operations
- Proven technology
- Can provide hydrogen to:
 - Grid
 - Local users (fuels)
 - As energy storage
 - Power generation



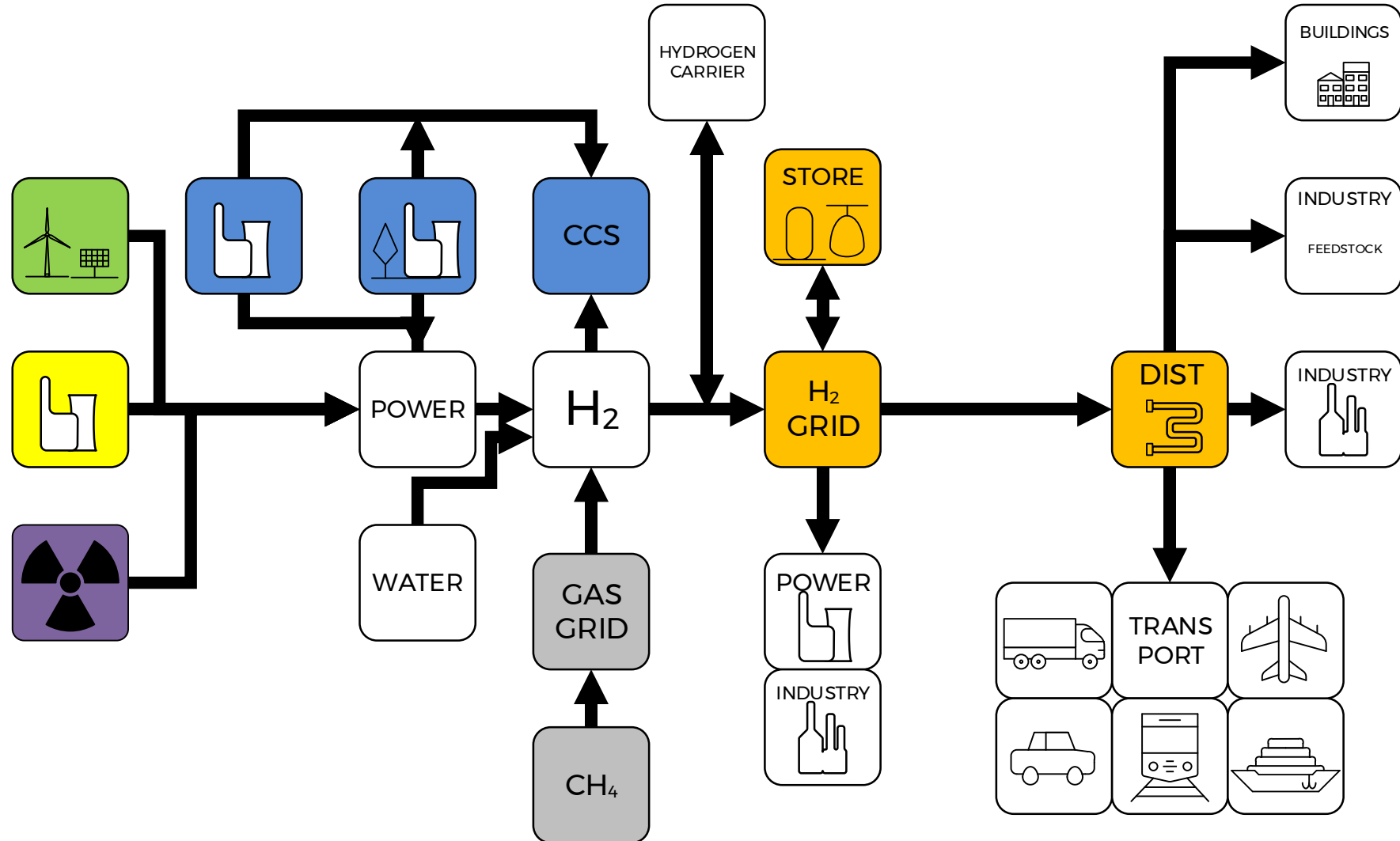
Hydrogen Policy

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Hydrogen Economy & UK Projects

What might the H2 economy look like?



H2 Potential & UK Projects

Gas Grid

Hydrogen
Transport

PtG /
Generation

Fuel
Switching

- Approach
 - Blended (up to 20%) or 100% H2
 - New v Existing infrastructure
- Blending H2 with natural gas approved by the UK HSE (HyDeploy 1&2)
- July '19 – H2 testing facility to establish if hydrogen gas network would be safe as natural gas network (H21).
 - Material testing
 - Existing infrastructure and Appliances
 - Odour & Flame colour
 - Gas escape management & detection

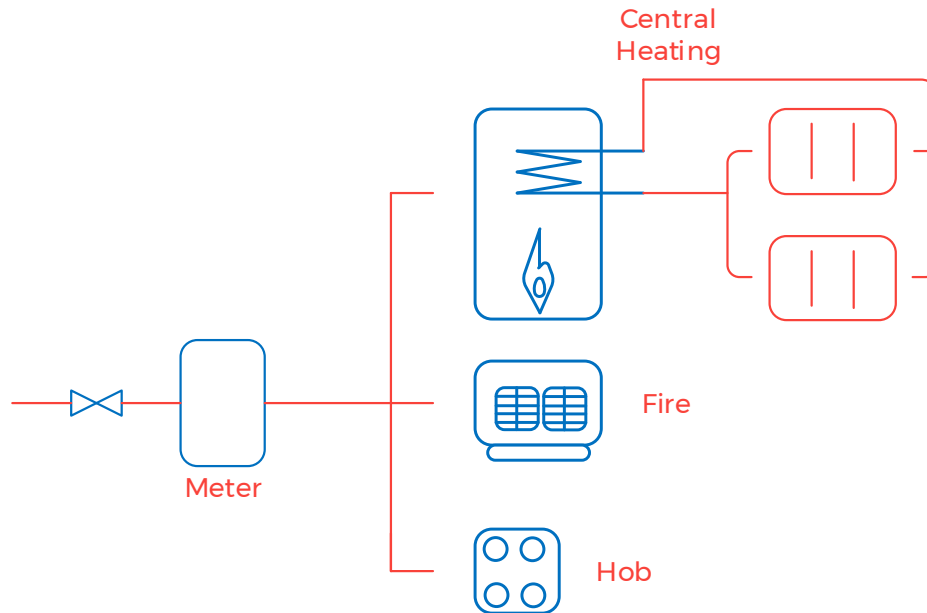


Spotlight on Gas Users

- H21 Trials at Spadeadam
- HyGrove in Gateshead
- H100 in Fife
- Hydrogen Experience centre Whitby



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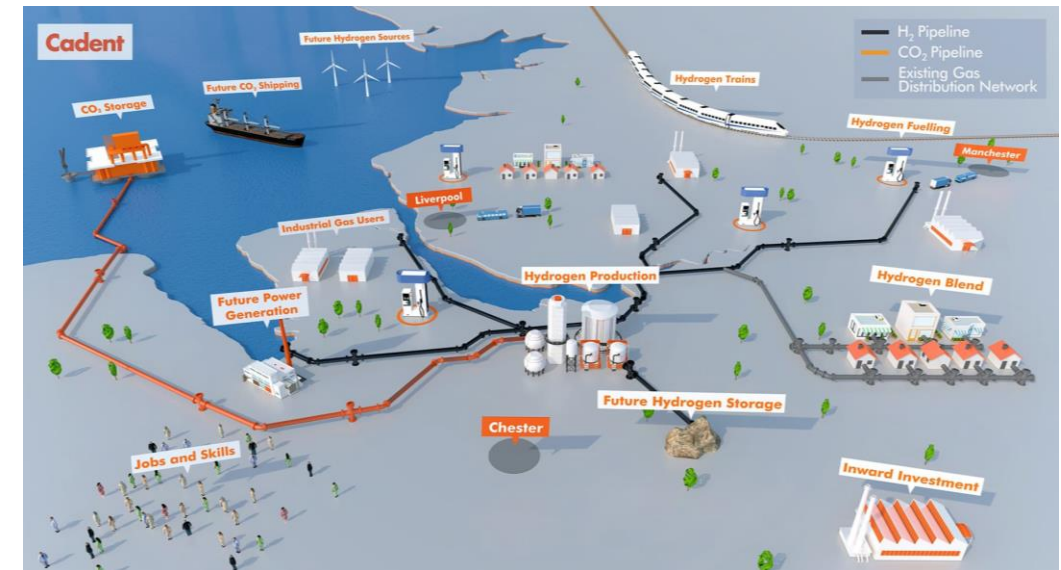
Clusters

- East Coast Cluster
(BP, Equinor, Others)
- HyNet North West
(PEL, ENI, Cadent, Others)
- Acorn, St Fergus
(Pale Blue Dot)

EAST CO₂AST
CLUSTER

HyNet

acorn



H2 Potential & UK Projects

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- £23M grant for new hydrogen vehicles announced from a Department for Transport & 11 filling stations in operation



- Multiple bus fleets, actual & planned (Aberdeen, London, Belfast, Birmingham, Merseyside)



- Alstom Breeze & HydroFlex
Tees Valley Hydrogen Hub



- Orkney Surf 'n' Turf
Fuel ferries and heating



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Potential

UK Projects

- Renewables
 - Excess power to generate hydrogen
 - Dedicated offshore wind farms with H2 pipelines to shore (lower costs)
- Hydrogen as energy storage to balance grid (low load factor)
- Hydrogen-ready gas turbines / Large scale fuel cells

- Project Dolphyn (ERM)
- Vattenfall Offshore Wind H₂



H2 Potential & UK Projects

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Fuel Switching

- HyNet – Pilkington (glass), BEIS funding
- “HySpirits” – Orkney Distillery

International

- (Sweden) H2 Green Steel
- (ME, Norway etc) – 1 GW+ Scale H2 productions



Hydrogen Challenges & Observations

H2 Challenges

- Evidence base being developed and technology is there but needs to speed up to “win debate”
 - Public acceptance (or even buy in) – especially on....
 - Safety
 - “Google objectors”

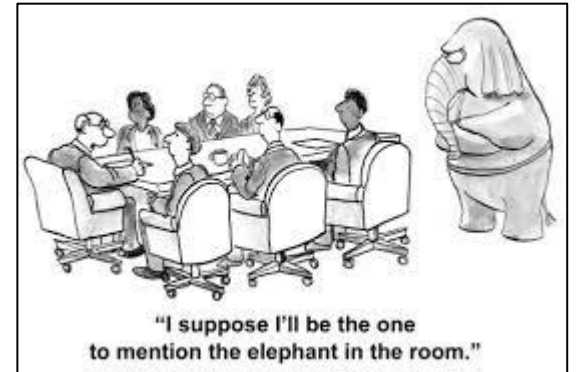
The logo for 'hello hydrogen' features the word 'hello' in orange and 'hydrogen' in teal, both in a lowercase, rounded sans-serif font.

- Scale, the volume of H2 required is huge, which needs
 - Supply Chain
 - Financial certainty, which comes from...
 - Government policy (consistently) & support
- Skills & Knowledge
- H2 Economics



H2 Economics

- Cost Considerations (£kg)
 - Production Methods (“grey” v “green” v “blue”)
 - Decarbonised electricity costs
 - CAPEX, OPEX and Water
 - Falling Cost trends (2030 - £1.50/kg),
- Decarbonisation
 - Compare to future costs not current
 - Efficiency gains of heat source pumps
 - GDP/GVA growth or loss in industrial areas
 - Emissions export
- Security & Resilience



Final Thoughts

Final Thoughts

- Hydrogen is here and will play a role in the Energy Transition, but
 - There is more to be done in policy for a truly joined up ecosystem
 - Focus must be on Delivery
 - Storage will be needed for true system
- Educating Consumers is key
 - We don't need "Twitter Wars"
 - We do need all solutions, i.e. "not Electrification v H2" but "Elec & H2" (and everything else as well....)
 - Project Freedom (Hybrid Heat Pump System)
 - Energy Efficiency & Resilience
- Engineering Skills & Knowledge

Any questions?

