IDRIC

From Evidence to Action: Scaling Hydrogen with Research-Driven Solutions

Panel Reflections

Hydrogen and electrification (or CCUS) should not be seen as binary choices; different regions present different opportunities, and an integrated, "and" approach is essential to enable successful industrial decarbonisation. Whilst the CCC's successive Carbon Budgets show an increasingly reduced role for hydrogen, prematurely narrowing our options could risk us missing our net zero targets.

The core technical knowledge for hydrogen exists, but major challenges lie in policy and market structures – particularly in creating conditions that make switching to hydrogen commercially viable. Current policy focus leans heavily on hydrogen generation, with insufficient attention to transport, storage, and end-use. This imbalance has exacerbated a "chicken and egg" scenario where producers hesitate to invest without clear demand, whislt potential offtakers won't commit to switching without guaranteed supply. Blending hydrogen into domestic gas networks could help stimulate early demand.

Hydrogen benefits from existing gas infrastructure, making it relatively cost-effective to store and transport, compared with electricity. There is growing interest in alternative transport methods – such as using ammonia as a carrier which already has an established global market.

IDRIC

Green Industrial Futures
Centre for Doctoral Training

Green Industrial Futures: Strategies and Solutions

Hydrogen

IDRIC

Green Industrial Futures Centre for Doctoral Training

Conference 2025

Green Industrial Futures: Strategies and Solutions

From Evidence to Action: Scaling Hydrogen with Research-Driven Solutions

From Evidence to Action:
Scaling Hydrogen with Research-Driven Solutions

Jonathan Oxley
CBI

Hydrogen UK

Azhar Juna
Hydrogen UK

Jon Maddy
University of South Wales

Keith MacLean
Providence Policy

Ask a question with Slido

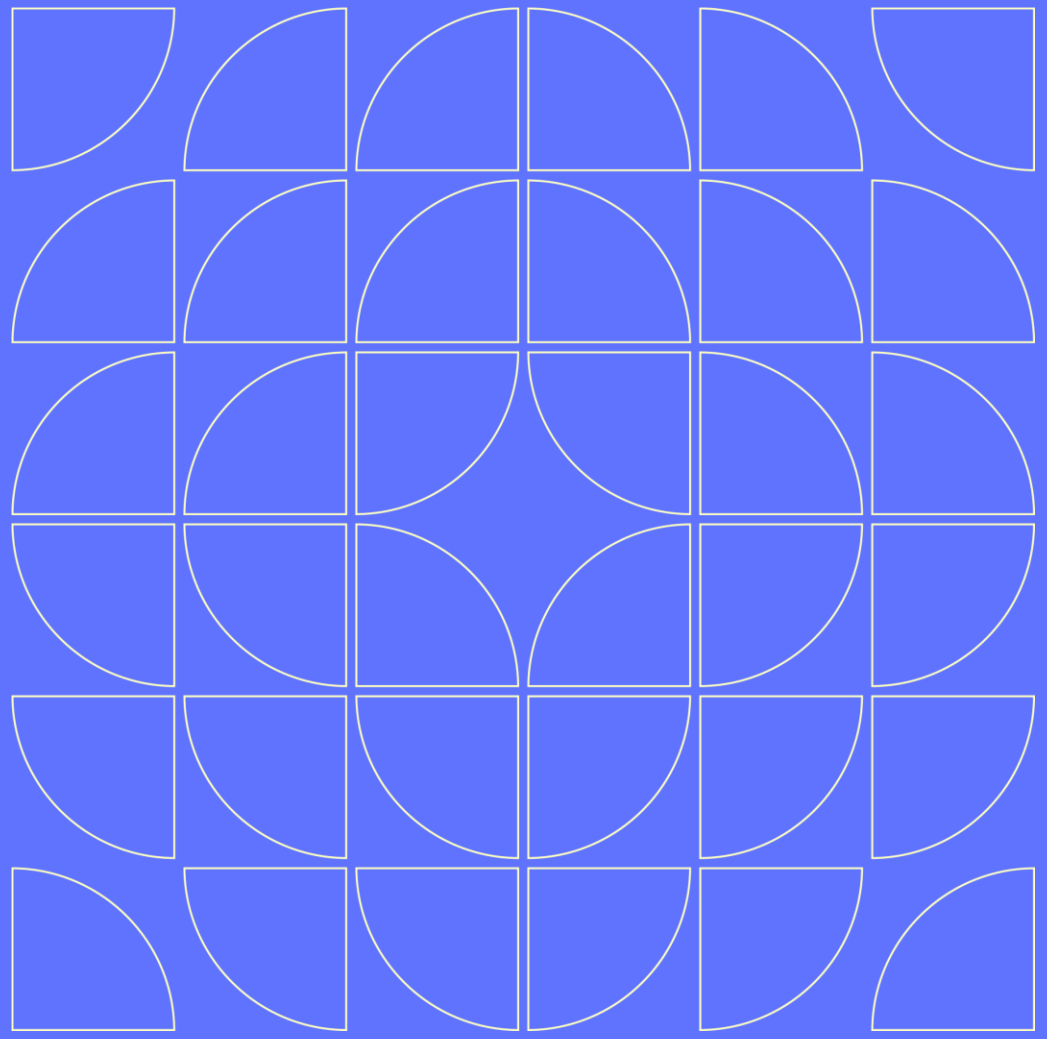
IDRIC

Green Industrial Futures
Realised.

Hydrogen Generation

Overview of Industrial Decarbonisation Frontiers Report

12th June 2025

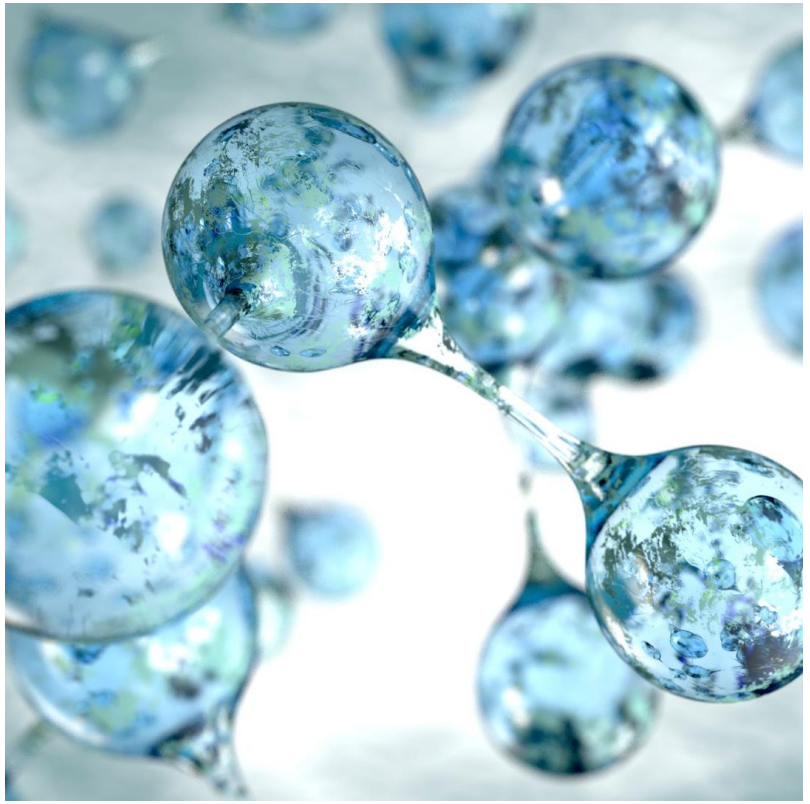


Funded by

UK Research and Innovation

The Role of Hydrogen in Net Zero

- Hydrogen is central to the UK's net zero strategy
- Essential for decarbonising hard-to-electrify sectors & energy storage
  - UK Target: 10 GW clean hydrogen by 2030
  - Scaling to 250–460 TWh by 2050
- Start from a low base – Existing 'grey' production
- Emerging clean hydrogen production with government support



Technology Insights – Opportunities and Challenges

IDRIC research:

Energy and environmental analysis

- *Assessing energy efficiency and balance in large-scale hydrogen deployment*
- *Environmental impacts of large-scale hydrogen deployment*
- *Guidance for hydrogen value chain safety cases*

Electrolysis and Co-Products

- *Electrolysis for green hydrogen and co-produced chemicals at scale*
- *Utilisation of co-produced oxygen from electrolysis to enable deep decarbonisation*

Hydrogen recovery

- *Advanced techniques for Hydrogen and CO_2 recovery from industrial gas streams*

Hydrogen carriers

- *Solid Oxide Electrolysis for clean hydrogen recovery from ammonia*
- *Ammonia as a hydrogen carrier for the Humber Cluster*

Sustainability, Safety, and H_2 Recovery

- **Energy, safety and environmental analysis:**
  - Green: Up to 95% emissions savings, lower efficiency
  - Blue: Higher efficiency, 4x more emissions
- Environmental: LCA methods inconsistent; harmonisation needed
- Safety: Hydrogen's unique hazards (e.g. rapid dispersal, flammability, embrittlement) require strengthened safety management & regs.
- **Hydrogen Recovery**:
  - Sorption Enhanced Water Gas Shift (SEWGS) enables efficient H_2 & CO_2 recovery from syngas
- **Hydrogen Carriers**:
  - Distributed ammonia-to-hydrogen systems showed significant promise
  - Solid Oxide Electrolysis Cells (SOEC) enable efficient H_2 recovery from ammonia

Electrolysis, Co-Product Value and H_2 Carriers

- **Electrolysis – core to clean hydrogen deployment:**
  - PEM achieving full commercial viability – scaling is improving cost and durability
  - AEM electrolysers emerging with lower cost potential
  - Solid Oxide electrolysers (High-temperature) - use of waste heat reduces electricity needs by ~ 20%.
    - Well-suited for methanol synthesis and other chemical industry processes
- **Co-Products**
  - Significant underexplored value from electrolysis co-products.
  - Oxygen co-production in wastewater, steel and others provides potential value
  - High-value oxidants (e.g., hydrogen peroxide, ozone) could significantly improve system economics for low and high temperature electrolysers.

Recommendations

- Optimise efficiency/emissions
- Co-location of electrolysis with renewables
- Emphasis on value of co-products
- Need for further development of alternative co-products
- Greater consistency required for Hydrogen system LCA
- Support hydrogen recovery, & ‘cleaning’ of existing ’grey’ hydrogen
- Sustain emphasis on safety of hydrogen developments – especially for new entrants

IDRIC

Green Industrial Futures
Realised.

Hydrogen Transport and Storage

Overview of Industrial Decarbonisation Frontiers Report

12th June 2025

Funded by

UK Research and Innovation

The Need for Scalable Hydrogen Infrastructure

- Hydrogen demand is set to rise sharply – requiring efficient, large-scale transport and storage to meet net zero targets.
- IDRIC research highlights the technical, environmental, and safety challenges of scaling infrastructure.
- Current UK storage capacity is well below 2050 needs.

Storage and Transport – Technical Realities

- **Storage Options:**
  - Salt caverns: Most mature and reliable
  - Porous rocks: High potential; lab tests show no adverse effects

- **Transport Efficiency:**
  - Pipelines are most efficient (esp. <500 km)
  - Liquefaction & long-haul trucking = least efficient

- **Knowledge Gaps:**
  - Limited LCA data
  - Fugitive emissions during storage are underexplored

Safety, Compatibility, and Infrastructure Gaps

- **Safety Needs:**
  - High flammability, pressure, and diffusivity demand adapted regulations
  - Existing infrastructure support blends & 100% H_2 in part – some new build needed

- **Storage Compatibility:**
  - Select low-reactive rocks and design infrastructure to withstand hydrogen exposure

- **Infrastructure Gaps:**
  - Clusters without halite need alternatives (e.g., lined rock caverns, offshore storage)

Strategic Recommendations

- Target salt caverns near key clusters where possible
- Explore offshore and porous rock storage
- Align infrastructure planning across producers and off-takers
- Further collaboration on modelling, pilots, and safety standards
- Regional storage pilots and further R&D (esp. for low-TRL storage)
- Include geological storage in national strategies with clear targets

IDRIC

Green Industrial Futures Centre for Doctoral Training

Conference 2025

Green Industrial Futures: Strategies and Solutions

From Evidence to Action: Scaling Hydrogen with Research-Driven Solutions

Scan the QR code to submit your questions on Slido