

Hydrogen and Fuel Cells: what can they add to the energy mix and where is it happening?



Representing the UK Hydrogen and Fuel Cell Industry

UK HFCA Overview

- Representing the UK Hydrogen and Fuel cell industry.
- Accelerating the commercialization of fuel cell and hydrogen energy.
- Helping fuel cells and hydrogen energy to become a key component of a low carbon economy – reducing greenhouse gases, enhancing energy security and delivering ‘green collar’ jobs.

We cover:

- All fuel cell types and applications;
- The full fuel cell supply chain (from research into material science through to systems integration and distribution);
- Hydrogen production and storage;
- Hydrogen infrastructure; and
- Other issues around the delivery, storage and use of associated fuels.

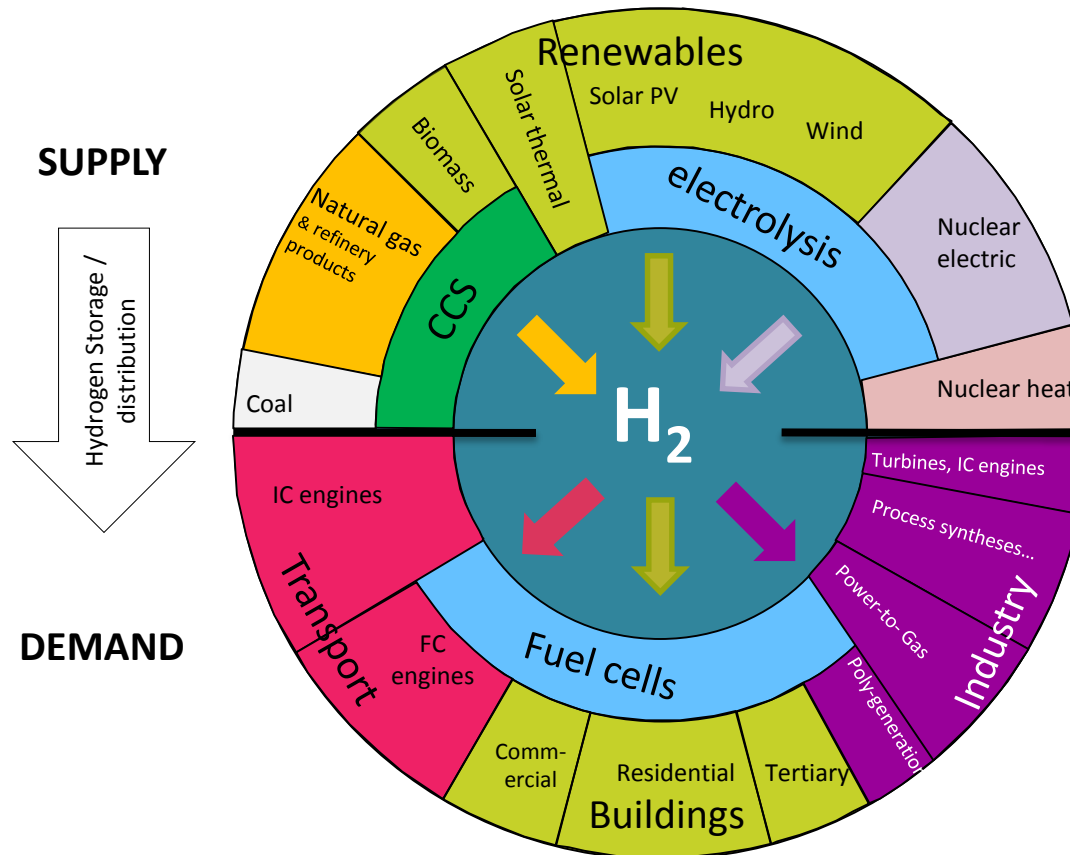


UK HFCa

Representing the UK Hydrogen and Fuel Cell Industry



Opportunities and activity across the energy and transport landscape



Source: Adapted from <http://hho-hydrogen-energy.com/html/abouthydrogen.html>

Hydrogen and fuel cells: here and now

- Over 350 MW of fuel cell and electrolyser systems were shipped globally in 2015.
- The global fuel cell industry is expected to create 700,000 green manufacturing jobs over the next decade.
- The European industry has seen turnover increase by 10% per year over the past five years.
- Annual revenues from fuel cell and hydrogen related activities already exceed £39 million in the UK.
- Fuel cells and hydrogen in transport applications are now expanding into heavy duty vehicles such as trams, trucks, light rail and buses.



Hydrogen and fuel cells in the UK (1)

Transport



Hyundai's ix35, Toyota's Mirai, Renault's HyKangoo and ULEMCo's H2ICED vans are all now available in the UK; other OEMs (Honda, Daimler, Nissan, BMW etc.) are expected to follow soon.

TfL's fleet of H₂ buses operates daily between Covent Garden and Tower Gateway. Aberdeen operates the largest H₂ bus fleet in Europe.

Hydrogen and fuel cells in the UK (2)

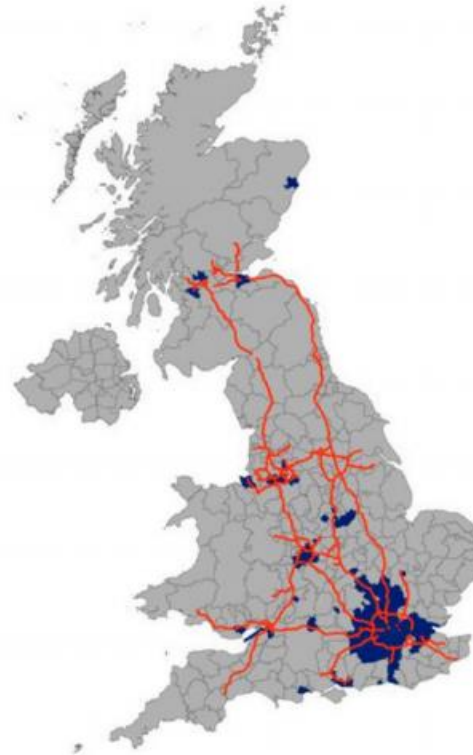
Refuelling Infrastructure



Sheffield wind powered refuelling station



Swindon solar powered refuelling station



UK H2 Mobility Roadmap: Initial deployment of 65 stations by 2020, ~300 stations by 2025, ~1,150 by 2030.



Commercial hydrogen refuelling stations are now operating at several locations in the UK



Hydrogen and fuel cells in the UK (3)

Stationary Power



Crowne Estate's Quadrant 3, Regent Street, London

- 300kWe fuel cell CCHP unit
- Reducing CO₂ by 40% and NO_x and SO_x emissions by 99.99%

20 Fenchurch Street (aka Walkie Talkie), London

- 300kW fuel cell CCHP unit
- Preventing 1,800 tons of CO₂ per year



TfL's Palestra Building, London

- 200kWe CHP unit
- Reducing CO₂ by 40%

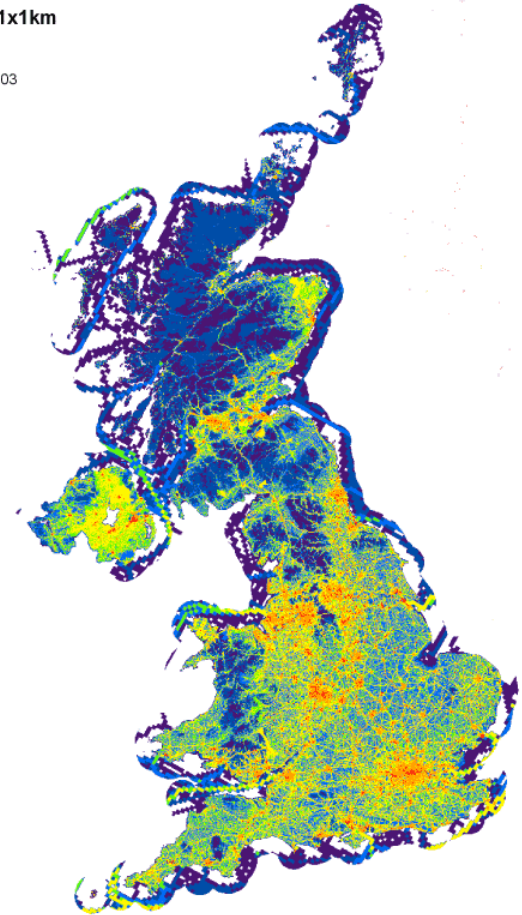
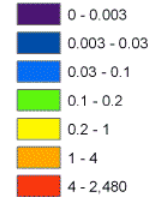
Improved Air Quality

- According to the Environmental Audit Committee, the true cost of Air Pollution to the NHS each year could be £53.58 billion



- Hydrogen and Fuel Cells offer significant Air Quality benefits in transport, heat, and power applications, eliminating emissions of pollutants such as NO_x and SO_x .

UK Emissions Map of
PM₁₀ 2009 t/1x1km



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UK HFCA activities and outcomes



Funding routes

- £23m for hydrogen-powered vehicles and infrastructure announced – competition to be launched in summer 2017:
<https://www.gov.uk/government/news/23-million-boost-for-hydrogen-powered-vehicles-and-infrastructure>
- Funding for innovative approaches to using hydrogen gas for heating:
<https://www.gov.uk/government/publications/funding-for-innovative-approaches-to-using-hydrogen-gas-for-heating>
- Investment accelerator pilot:
<https://www.gov.uk/government/publications/funding-competition-investment-accelerator-pilot/competition-brief-investment-accelerator-pilot>
- Energy Catalyst Round 5:
<https://www.gov.uk/government/publications/funding-competition-energy-catalyst-round-5>

Opportunities for the public sector

Stimulate local economic growth



Improve local air quality

Be positioned as a leading LAP / LEP
in innovation and 'green growth'



Create high value STEM jobs

The benefits

Fuel cells and hydrogen energy can:

- Deliver significant environmental and economic benefits across various sectors, including transportation, power generation, industrial equipment, military power, and consumer electronics;
- Improve urban air quality and the health of urban populations;
- Provide cost effective energy storage to overcome the intermittency of renewables and deliver improved power management;
- Enhance energy security & resilience by allowing a wider choice of fuels, extending the life of fossil fuels and optimising renewable energy sources;
- Improve the economic viability of remote communities by providing a route to self-sufficiency in energy; and
- Support the drive to alleviate fuel poverty through superior efficiency relative to conventional technologies (particularly in CHP mode).

Opportunities for the UK

Stationary Markets

Residential



Residential houses (1/2-family dwellings in urban and rural areas)

524 m tons CO₂ emissions p.a.,
equivalent to ca. 340 m new cars
2,250 TWh final energy consumption
annually

Commercial



Apartment buildings and non-residential buildings (e.g. offices, schools, agencies, hospitals etc.)

860 m tons CO₂ emissions p.a.,
equivalent to ca. 555 m new cars
2,850 TWh final energy consumption
annually

Industrial



Industrial applications (e.g. data centres, wastewater treatment facilities etc.) with heterogeneous energy needs

1,255 m tons CO₂ emissions p.a.,
equivalent to ca. 810 m new cars
3,300 TWh final energy consumption
annually

Source: Advancing Europe's energy systems: Stationary fuel cells in distributed generation, Roland Berger, 2015
http://www.fch.europa.eu/sites/default/files/FCHJU_FuelCellDistributedGenerationCommercialization_0.pdf