INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

# IPHE Country Update Nov 2018: United Kingdom

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| **Covered Period** | May – November 2018 |

## 1. New Initiatives, Programs, and Policies on Hydrogen and Fuel Cells

The Clean Growth Strategy (published in October 2017) and the Industrial Strategy (published in November 2017) continue to frame the UK Government's approach to hydrogen.

In April 2018, the Department for Business, Energy and Industrial Strategy formed a new Hydrogen Economy team to develop a strategic approach to the UK Hydrogen Economy.

In May 2018, the UK Government consulted on a draft Clean Air Strategy. The draft strategy sets a clear direction for future air quality policies and goals, including the uptake of cleaner fuels such as hydrogen. A final version of this strategy will be published shortly.

In July 2018, the UK Government published the Road to Zero Strategy, which sets out plans to enable a massive expansion of green infrastructure across the country, reduce emissions from the vehicles already on the UK's roads, and drive the uptake of zero emission cars, vans and trucks.

In Nov 2018, the UK Government published the 'UK Carbon Capture Usage and Storage (CCUS) Deployment Pathway: An Action Plan' which sets out steps needed by Government and industry in partnership to enable the UK's first CCUS facility, commissioning from the mid-2020s. The UK's ambition is to have the option to deploy CCUS at scale during the 2030s, subject to costs coming down sufficiently.

Work to deliver the UK Government's commitment to decarbonising heat is ongoing. The focus is on developing evidence across a range of potential approaches ahead of strategic decisions in the first half of the next decade. These approaches include electric heat pumps, hydrogen conversion, heat networks, hybrid heat pumps and biogas. It is not yet clear which will work best at scale and at lowest cost.

In November 2018, the Committee on Climate Change (CCC), the independent, statutory body established to advise the UK Government and Devolved Administrations on emissions targets, published a report assessing the potential role of hydrogen in the UK's low-carbon economy. It concludes that hydrogen, used selectively, has the potential to help decarbonise the UK's energy system by 2050 and recommends decisions for the Government to take in order for hydrogen to become a credible option for the future.

The UK is a member of the Mission Innovation, Renewable and Clean Hydrogen Innovation Challenge (IC8)

The UK attended the Hydrogen Energy Ministerial held in Japan in October 2018 and gave support to the Tokyo Statement on Hydrogen.

## 2. Hydrogen and Fuel Cell R&D Update

Nothing new to report this period.

## 3. Demonstration, Deployments, and Workforce Developments Update

Nothing new to report this period.

## 4. Events and Solicitations

The world's first dedicated CCUS Summit was co-hosted by the UK Government and the IEA in November 2018. The summit re-ignited discussions on CCUS at a senior international level between Governments, a diverse group of CEOs and business leaders, and investors. There was a universal call to start a new era of CCUS, recognising that CCUS will be critically important for meeting climate goals and that urgent and collective action is needed. Following the Summit, a Global CCUS Conference took place hosted by the UK Government and the Global CCUS Institute. Attended by over 300 participants from governments, industry and academia, the purpose was to discuss the value of CCUS, including as an enabler of a low carbon hydrogen economy, explore business models and the future of CCUS technologies, and seek practical solutions and actions to accelerate the deployment of CCUS globally.

## 5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

The UK government is investing in the development of hydrogen and associated technologies from 2015-2021 under the Energy Innovation Programme. These projects will help to support decisions for UK policies on the decarbonisation of heat, carbon capture and storage and energy system flexibility. A number of large-scale innovation competitions focused on demonstrations are currently underway, including:

- Hydrogen Supply (£20m, ~$26m) aims to accelerate the development of low carbon bulk hydrogen supply solutions in industry, power, heat and transport.
- Industrial Fuel Switching (up to £20m, ~$26m) aims to stimulate early investment in fuel switching processes and technologies, which could include low carbon hydrogen.
- Hy4Heat (£25m, ~$23m) aims to establish if it is technically possible and safe to replace natural gas with 100% hydrogen to fuel gas appliances in commercial and residential buildings.

Innovate UK, part of UK Research and Innovation, is a non-departmental public body funded by a grant-in-aid from the UK government. Innovate UK funds business and research collaborations to accelerate innovation and drive business investment into research and development. In the period May - November 2018, Innovate UK and industry funded new R&D programmes valued at approximately £2million (~$2.5m) on hydrogen and fuel cells. These include:

- Project Centurion – This £389k (~$500k) project aims to explore the options, costs, and key design elements of a large-scale P2G system, using a 100Mw electrolyser, which could be deployed in Cheshire.
- Frankenstack - This £168k (~$220k) project seeks to assess the feasibility of re-using electrolyser stack components.

- Hydrogen Ambient Pressure Electrochemical Reversible Energy Storage (HYAPEREST) – This £279k (~$360k) project will focus on integrating a Manganese Hydrogen Flow Battery system with patent-pending solid-state hydrogen storage.
- Hydrogen Storage to Energise Robotics In Air Applications (HyStERIAA) - This £363k (~$470k) project aims to develop a technical and commercial feasibility study into large-scale hydrogen storage system that is safer, lighter and half the volume of commercially available pressure tanks.
- Waste Ammonia to Hydrogen Production using Electrochemical and Ecological Processes (WAHEEP) – This £212k (~$275k) project will focus on the production of hydrogen through electrolysis of ammonia-rich waste water
- Hydrogen Diesel Injection in a Marine Environment (HyDIME) - This £430k (~$555k) project aims to design, integrate and trial an innovative hydrogen / diesel dual fuel conversion system for a 50kW diesel auxiliary power unit on a car ferry operating between Shapinsay and Kirkwall in Orkney. It builds on two previous innovation projects.

UK Research and Innovation also includes the seven Research Councils in the UK who have funded earlier stage research and development into hydrogen and fuel cells. This includes live funding for H2FC SuperGen, a multidisciplinary hub of researchers working on hydrogen including 100 UK-based academics, and individual projects including a £684k (~$880k) project on Powering Carbon-free Autonomous Shipping.

In November 2018, the HyDeploy project entered its build phase on securing a statutory exemption from certain requirements of the Gas Safety (Management) Regulations 1996 (GSMR) from Great Britain's Health and Safety Executive (HSE). HyDeploy is a live energy trial at the closed gas network at Keele University, which aims to establish the potential for blending up to 20% hydrogen into the natural gas. The project is led by Cadent and Northern Gas Networks, with £6.7m (~$8.6m) funding from OFGEM, the government regulator for the electricity and downstream natural gas markets in Great Britain, and £750k (~$970k) of private sector investment.

Also in November 2018, OFGEM, approved £14.9m ($19.2m) for HyDeploy2. This will take the trial onto two public networks in the North of England in the early 2020s.

In November 2018, an industry-led feasibility study "H21 North of England" was published which presents a detailed engineering solution for converting the gas distribution networks across the North of England to 100% hydrogen as a potential route to long-term heat decarbonisation. The project was led by the Northern Gas Network and received £9m (~$11.6m) funding from OFGEM and £1.3m (~$1.5m) from gas distribution networks, building on the work of the 2016 H21 Leeds City Gate project which established hydrogen conversion is technically possible and economically viable.

A number of industry-led projects are ongoing (see previous updates).

**6. Regulations, Codes & Standards, and Safety Update**

The UK gas industry, through the Institution of Gas Engineers and Managers (IGEM) and the Energy Networks Association (ENA) is gathering supporting evidence to amend the Gas Safety (Management) Regulations 1996, to allow a wider range of Wobbe indices in the gas network. The evidence gathered for this could also contribute to the safety case for increasing (to 2-3%) the limit on hydrogen that can be blended in a natural gas network

As part of the Hy4Heat project, The Institution of Gas Engineers and Managers (IGEM) have been commissioned to review all relevant existing standards on hydrogen for heat in UK homes and businesses and will bring together a group of technical specialists to identify knowledge gaps, both in the UK and internationally.

HSE contribute to the work of the European Fuel Cells and Joint Undertaking (FCH JU) Hydrogen Safety Panel, leading one of its task groups. It is also part of the IPHE's new working group on tunnel safety and have entered into a Memorandum of Understanding with the IPHE.

# Summary Country Update Nov 2018: United Kingdom

| Transportation | Target Number | Current Status | Partnerships, Strategic Approach | Support Mechanism |
|---|---|---|---|---|
| Fuel Cell Vehicles[1] | No target | ~100 as of December 2018 | A further circa 200 vehicles will be deployed over the next year. | Funding via Office for Low Emission Vehicles (OLEV) for vehicles and infrastructure under the £23m Hydrogen for Transport Programme. |
| FC Bus | No target | 20 as of December 2018 | Buses being supported via UK and European funding programmes | £48m of Ultra-Low Emissions Bus Scheme (ULEBs) funding is available for the purchase of ULEBs and the infrastructure to support them between 2018/19 and 2020/21.<br><br>Further circa 50 buses to be deployed under the European Jive funding programme |
| Fuel Cell Trucks[2] | No target | None | No activity | No support policy |
| Forklifts | No target | Not known | Some deployment e.g. at Honda UK manufacturing | No support policy |

[1] Includes Fuel Cell Electric Vehicles with Range Extenders

[2] As above

| $H_2$ Refueling Stations | Target Number | Current Status | Partnerships, Strategic Approach | Support Mechanism |
|---|---|---|---|---|
| 70 MPa On-Site Production | No target | 13 publicallly accessible Hydrogen Refuelling Stations (HRS) as of December 2018, includes both 35 and 70 MPa sites | Stations to built and operated by private developers with support offered via UK and European infrastructure programmes | Additional new HRS to be built and upgrades to existing stations under the under the £23m Hydrogen for Transport Programme. |
| 70 MPa Delivered | | | | |
| 35 MPa On-Site Production | No target | | Stations generally developed and operated by private developers with a proportion of EU funding. For example Aberdeen's HRS owned by local authority, operated by BOC | None |
| 35 MPa Delivered | | | | |
| **Stationary** | **Target Number[3]** | **Current Status** | **Partnerships, Strategic Approach** | **Support Mechanism** |
| Small[4] | No Target | Various demonstrations and commercial installations, however no formal process | Various approaches adopted from pure commercial to funding through innovation support programmes | Government support provided through existing mechanisms e.g. CHP feed-in-tariffs and more targeted innovation support through UKRI and BEIS |
| Medium[5] | | | | |
| Large[6] | | | | |
| District Grid[7] | | | | |
| Regional Grid[8] | | | | |

[3] Targets can be units installed and/or total installed capacity in the size range indicated
[4] <5 kW (e.g., Residential Use)
[5] 5kW – 400 kW (e.g., Distributed Residential Use)
[6] 0.3MW – 10 MW (e.g., Industrial Use)
[7] 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)
[8] 30MW plus (e.g., Grid Storage and Systems Management)

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| Telecom backup | | to track their introduction | | |
| **$H_2$ Production** | **Target[9]** | **Current Status** | **Partnerships, Strategic Approach** | **Support Mechanism** |
| Fossil Fuels[10] | No target | | | |
| Water Electrolysis[11] (PEM, Alkaline, SOEC) | No target | | | |
| By-product $H_2$ | No target | | | |
| **Energy Storage from Renewables** | **Target[12]** | **Current Status** | **Partnership, Strategic Approach** | **Support Mechanism** |
| Power to Power[13] Capacity | No target | | | |
| Power to Gas[14] Capacity | No target | | | |

[9] Target can be by quantity ($Nm^3$, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target
[10] Hydrogen produced by reforming processes
[11] Please indicate if targets relate to a specific technology (PEM, Alkaline, SOEC)
[12] Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity
[13] Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity
[14] Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)