

SH Hydrogen Quarterly Insight – April 2022

Welcome to Stephenson Harwood's fourth hydrogen quarterly insight which is aimed at bringing you up to speed on all new legal updates in the UK hydrogen sector and some of the most exciting hydrogen developments across the world.

As hoped (and needed), the last quarter was an extremely busy period for hydrogen in the UK in particular, as the UK Government issued several important hydrogen publications. If you have not read them already, do not worry - we have summaries of each publication and links to original publication below.

The last quarter also saw the announcement of a number of very exciting hydrogen projects across the UK.

Sit back, grab a cup of coffee and let us bring you up to speed on the most important issues you should be aware of in the sector.

UK Government Publications

1. British Energy Security Strategy

Published in April 2022, the British Energy Security Strategy confirmed that the UK has doubled its ambition from 5GW to 10GW of low carbon hydrogen production capacity by 2030.

Importantly, BEIS also confirmed that at least half of the 10GW would come from electrolytic hydrogen, and that it aims to run an annual allocation round for this electrolytic hydrogen by 2025. If successful, hydrogen would then move to a price competitive allocation as soon as legislation and market conditions allow. Whilst the updated strategy is of course subject to affordability and value for money assessments, it is hoped that it will drive significant private sector investment into hydrogen produced in the UK.

One announcement that lawyers are paying particular attention to is the UK Government's confirmation that it will produce a hydrogen certification scheme by 2025.

To accompany the strategy, the UK Government unveiled a funding package of £375million. Within this package, £240million will support hydrogen as a means to decarbonise the industrial sector, and £100million will establish a "Hydrogen Business

Model" to encourage electrolytic hydrogen production, mainly through covering the difference between production costs and the hydrogen sale price. The rest of the funding will support an "Industrial Hydrogen Accelerator" innovation programme in producing cutting-edge technologies.

A key theme of the strategy is the synergy found between hydrogen and the increased targets across other sectors, such as the recently raised target to produce 50GW of offshore wind energy by 2030. For this reason, the updated strategy is generally welcomed by the hydrogen industry, but also the renewables and nuclear industries.

The link to the original publication can be found here: [British energy security strategy - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/consultations/british-energy-security-strategy)

2. Indicative Heads of Terms

BEIS published draft heads of terms for the low carbon hydrogen business model. The draft terms, whilst preliminary, aim to provide a framework for the principal terms and conditions that will or are expected to be included in the low carbon hydrogen agreement for initial projects in the UK.

The link to the publication can be found here: [Indicative Heads of Terms: agreement for the Low Carbon Hydrogen Business Model \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/105222/Indicative-Heads-of-Terms-agreement-for-the-Low-Carbon-Hydrogen-Business-Model.pdf)

3. Government response to consultation on the UK Low Carbon Hydrogen Standard

The UK Government published new guidance under the Low Carbon Hydrogen Standard (LCHS). This guidance defines what constitutes "low carbon hydrogen" at the point of production by setting a maximum threshold for the amount of greenhouse gas emissions allowed in the production process. The guidance also sets out the methodology for calculating the emissions, and the steps that producers should take to prove that the hydrogen produced is compliant with the standard. Components in this greenhouse gas emissions calculation include items such as feedstock, electricity supply, and input materials. The new guidance should clarify standards around hydrogen quality and safety.

The link to the publication can be found here: [UK Low Carbon Hydrogen Standard: government response \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/105222/UK-Low-Carbon-Hydrogen-Standard-government-response.pdf)

4. Future Systems Operator

The UK Government announced a new public body called the Future System Operator (FSO). The FSO will bring together the existing capabilities of the Electricity System Operator (ESO) and, where

required, the National Grid. The FSO is tasked with improving the UK's energy security, accelerating zero-emission technologies (such as hydrogen), providing impartial advice to Ofgem on key strategic decisions, and encouraging long-term holistic thinking to deliver an affordable and reliable transition to clean energy. The implementation of the FSO follows extensive consultation with the energy industry and is expected to improve the interface between the public and private sector.

5. Hydrogen Investor Roadmap

Usefully for those seeking investment and those who wish to invest in the UK hydrogen sector, the Government also published its investor roadmap. The roadmap outlines helpful timelines and details about projects announced to date, and sets out what the Government expects the industry to deliver. Please see the extremely insightful visual summaries from the report at figures 1 and 2 below. Our understanding is that the purpose of the roadmap is to increase investor confidence in the UK hydrogen market.

Of particular note, the roadmap confirms the Government's ambition to have up to 2GW capacity in operation or construction by 2025. To achieve such a target, as addressed in our previous articles and quarterly updates, the relevant stakeholders need to be successfully achieving final investment decisions and the relevant planning approvals relatively soon.

The link to the original publication can be found here: [Hydrogen Investor Roadmap \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/105222/Hydrogen-Investor-Roadmap.pdf)

Our 2035 Delivery Plan

Critical activities and milestones on a path to developing the UK hydrogen economy

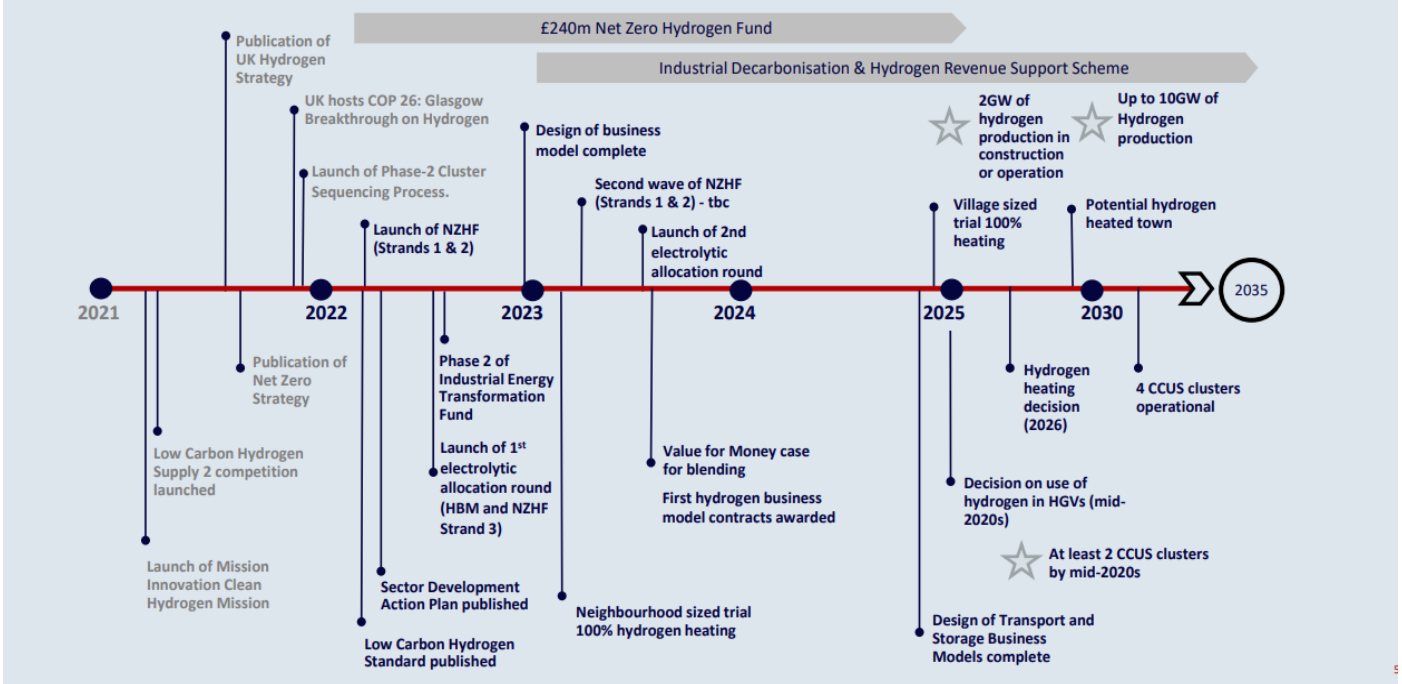


Figure 1: Hydrogen Investor Roadmap, p.5, Department for International Trade

Sample of potential hydrogen projects across the UK

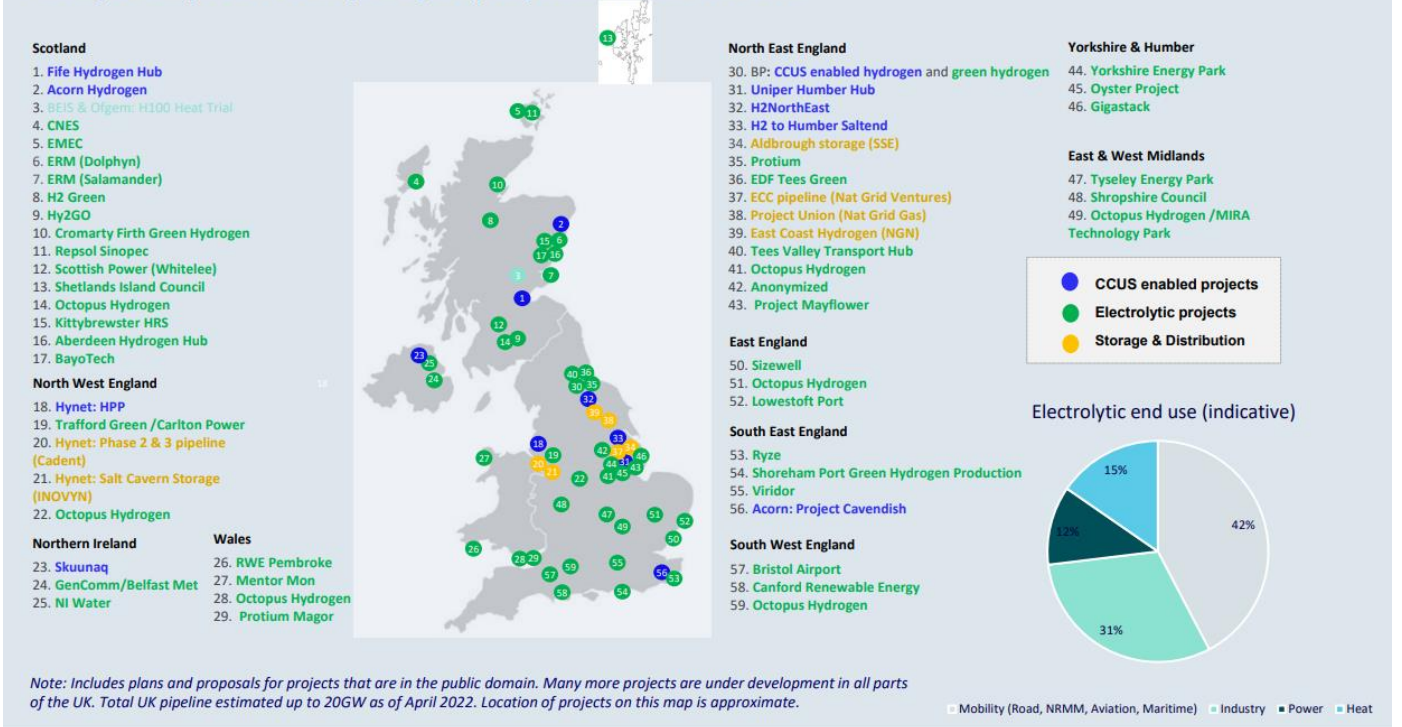


Figure 2: Hydrogen Investor Roadmap, p.9, Department for International Trade

Automotives

The British Energy Security Strategy confirmed the Government's continuing interest in low-emission transportation. In particular, it introduced a zero-emission vehicle mandate. This sets targets for a percentage of manufacturers' new car and van sales to be zero-emission each year from 2024. In addition, it committed to take forward the pledge to end the sale of all new, non-zero emission road vehicles by 2040, from motorcycles to buses and HGVs, subject to consultation.

As discussed in previous updates, it will be difficult to achieve these targets (particularly when it comes to larger vehicles such as HGVs) without using hydrogen. From a regulatory perspective, the scene has been set for this sector to continue developing.

Buses

- Last year, the Zero Emission Bus Regional Areas (ZEBRA) scheme was launched to allow local transport authorities to bid for funding to purchase zero-emission buses. On 26 March 2022, £198.3million of funding was announced through the scheme, under which 12 areas in England will receive grants to deliver electric or hydrogen-powered buses, as well as charging or fuelling infrastructure. The funding means that private sector bus operators will begin to view the uptake of hydrogen buses as part of their fleets as an increasingly viable commercial proposition.
- One example of the impact of this announcement is the West Midlands. Through the ZEBRA package, the area has secured 124 new buses, meaning the area will have a total of 144 hydrogen buses on the streets (the "largest in the Western world").

HGVs

- The use of hydrogen is becoming a commercial reality for heavy goods vehicles as well. In March 2022, truck maker Hyzon signed a Memorandum of Understanding with John G Russell Transport (a British logistics group). Under this new initiative, the two companies will provide vehicle sales, leasing, and service support for hydrogen-powered commercial trucks for fleet owners and operators.

Refuelling

- March 2022 also saw the announcement that ITM and Vitol will form a hydrogen refuelling joint venture. Vitol will acquire 50% of ITM's subsidiary Motive, which owns ITM's refuelling infrastructure in the UK. Vitol will invest up to

£30million in the JV, with ITM Power to make a similar investment. Motive will sell green hydrogen produced by ITM Power's electrolyzers, first in the UK and then across Europe, and is initially expected to serve HGVs. ITM Power said the business seeks to develop standard 4MW sites around the UK.

Marine

The marine industry continues to develop renewable, green and low-carbon fuels as an alternative to traditionally high-carbon bunkers. Further, whilst the technologies available for storing and transporting hydrogen continue to be developed, some pioneering projects are removing the need to store or transport hydrogen altogether.

Bunkering solutions

- HeidelbergCement, Felleskjøpet AGRI, and shipping company Egil Ulvan Rederi, have received 100MNOK in support from the Norwegian government enterprise Enova to build the world's first zero-emission bulk carrier. The vessel will run on compressed green hydrogen stored in exchangeable containers. This project is seen a primary bunkering solution for bulk and container vessels.
- Swedish designer FKAB Marine Design has received Approval in Principal (AiP) from RINA for its hydrogen powered MR Tanker. The vessel will combine LNG with steam in an on-board Helbio gas reformer to produce hydrogen (for propulsion) and CO₂ (which is captured and stored). This removes the difficulty of storing hydrogen and is the first AiP of a design using currently viable technology and fuels that achieves IMO 2050 targets.
- UK-based Attollo has announced its "Project Zero" by setting out plans for three autonomous ships to hit the seas in 2030 which will utilise zero-emission hydrogen fuel cells, benefitting from onboard renewable power generation (solar and wind power) and built-in state-of-the-art technology from computer vision to AI. The vessels will also utilise newly developed ergonomic equipment

to increase fuel efficiency, thereby reducing fuel consumption.

Fuel cell developments

In the UK, the Cornwall Marine Hydrogen Centre began a tender for the purchase of a proton exchange membrane (PEM) fuel cell that can provide 20-50kW of power. This project is devoted to developing hydrogen fuel systems for small to medium commercial vessels. Initial testing is predicted to take place later this year.

Hydrogen transfer

Gen2 Energy and Sirius Design and Integration have contracted to design and develop two 190-meter-long hydrogen carriers, which will also use hydrogen in their propulsion systems. The vessel specifications state that the vessels will be able to carry 500 x 40-foot containers of hydrogen, a giant leap forward from the current carriers in the market which are able to carry approximately 100 containers.

Hydrogen production

Danish nuclear developer Seaborg Technologies and Samsung Heavy Industries have announced they are developing turn-key floating nuclear power plants which will utilise Seaborg's compact molten salt reactor. These vessels will power on and off-shore hydrogen production facilities for fuel production.

Projects

Tees Green Hydrogen

EDF Renewables UK and Hynamics, an EDF subsidiary, have announced plans to significantly invest in their Teesside operation. The Tees Green Hydrogen project will use green electricity from wind and solar farms to power its hydrogen electrolyser, and supply local business customers with hydrogen. Initially, the electrolyser will be 30-50MW in size. However, the ambition does not stop there as the electrolyser will be designed to scale to over 500MW.

This development builds on BP's plans for a 600MW green hydrogen production facility in the area – see our December edition for more details.

Blue hydrogen developments

A new agreement between Shell and Uniper codifies plans for a blue hydrogen production facility in the UK – known as the Humber Blue Project – at Killingholme in North Lincolnshire. The facility will have a capacity of up to 720MW. Blue hydrogen production at this site could lead to around 1.6million metric tonnes of carbon being captured a year. The project is planned to reach front-end engineering and design by 2023. This is a significant step towards decarbonising the UK's largest industrial cluster.

Equinor has formally submitted plans for its Hydrogen to Humber (H2H) Saltend project. H2H Saltend will sit within the Zero Carbon Humber Project. It will lead the production of a 600MW gas reformer which will produce "blue" hydrogen, with 95% of emissions resulting from this being captured. A demonstration is due to come online by 2026. The plan is backed by six prospective industrial operators who have signed agreements for the development and commercialisation of the project, including potential future hydrogen supply.

Aviation

The UK as a centre for hydrogen aviation innovation

HyPoint is one of many UK companies to take advantage of the green hydrogen impetus by opening a new hydrogen R&D and production site in Kent in February 2022. HyPoint specialises in air-cooled fuel cells for a variety of aviation and air mobility uses including logistic drones, air taxis, electric vertical take-off and landing vehicles (eVTOLs) and fixed-wing airplanes. Together with its affiliate ZeroAvia (see below), HyPoint is part of a growing community of hydrogen and sustainable aviation specialists in the UK. The UK's relatively large cohort of academics with expertise in fuel cell technology, together with funding opportunities presented by organisations such as the Aerospace Technology Institute (ATI) and BEIS, present ripe opportunities for further development.

Cameras for hydrogen combustion engines

Engineers at German aerospace research centre DLR have developed an endoscopic camera to observe combustion performance in hydrogen-burning gas turbine engines. Previously, optical probes able to withstand the high-temperature and high-pressure conditions inside these combustors had not been available, but the new probe features a separate protective shield to avoid damage to it. As hydrogen flames are colourless, unlike kerosene or gas flames, the engineers needed to deploy an ultraviolet camera within the probe. Following a two-year development process, the probe was trialled at a high-pressure combustor test facility in Cologne, in co-operation with Dutch aftermarket gas turbine component supplier Thomassen Energy. These tests provided information about flame position in different operational settings: the first time such data has been available.

ZeroAvia

Hydrogen powertrain developer ZeroAvia announced in April that it has signed a memorandum of understanding with hydrogen fuelling start-up ZEV Station to develop green hydrogen refuelling infrastructure for airports in California. It is hoped that the project could pave the way for entire zero-emission airports connected to a large central hydrogen production hub, in a 'hub-and-spoke' refuelling system. This would remove one of the current obstacles to large-cycle implementation of hydrogen as aircraft fuel, namely lack of infrastructure. ZeroAvia recently garnered much press attention when it completed the world's first hydrogen fuel cell-backed flight of a commercial-grade aircraft last year. Numerous aviation industry participants have purchased shares in ZeroAvia, including British Airways, United Airlines, Shell and Amazon.

Airbus enters JV for hydrogen engine demonstrator trials

Airbus plans to partner with CFM International, a leading global supplier of jet engines for commercial aircraft, to trial a hydrogen-powered turbofan engine in flight tests onboard a modified A380 by the end of 2026. The engine will be powered by 400kg of liquid hydrogen stored in four cryogenic tanks in the rear section of the A380's main passenger deck. The tanks, which need to keep hydrogen at -253°C to maintain its liquid state, will be hermitically encased in a container. The tanks will supply the fuel in liquid form, which will then be converted to a gaseous state via a heat exchanger before injection into the engine. Modified combustor, fuel and control systems will all need to be developed because hydrogen burns 10 times faster and at a much higher temperature than kerosene.

Turboprop-meets-hydrogen-fuel

A De Havilland Dash 8-300 aircraft, designed for regional flight and powered by turboprop (a turbine engine driving an aircraft propeller), may soon be fuelled by hydrogen alone. In a partnership between Irish lessor Elix Aviation Management and LA-based Universal Hydrogen (which offers hydrogen-based fuel services and related logistical solutions), the latter will convert one of these Dash 8-300s to run on hydrogen at its facility in Washington State. Elix has also signed a letter of intent to purchase 10 of Universal's hydrogen conversion kits for installation in Elix's existing and future turboprop aircraft fleet, an exciting development for the retrofit market.



Cathal Leigh-Doyle
Senior associate
T: +44 20 7809 2658
E: cathal.leighdoyle@shlegal.com



Darren Fodey
Partner
T: +44 20 7809 2388
E: darren.fodey@shlegal.com



James Collins
Partner
T: +44 20 7809 2687
E: james.collins@shlegal.com



Jonathan Cripps
Partner
T: +44 20 7809 2687
E: jonathan.cripps@shlegal.com



Bertie Chilton
Senior associate
T: +44 20 7809 2094
E: bertie.chilton@shlegal.com



Andy Ross
Associate
T: +44 20 7801 4166
E: andy.ross@shlegal.com



Francesca Cadoux-Hudson
Associate
T: +44 20 7809 2846
E: francesca.cadouxhudson@shlegal.com



Nick Abel Smith
Associate
T: +44 20 7809 2177
E: nick.abelsmith@shlegal.com



Annabel James
T: +44 20 7809 2691
E: annabel.james@shlegal.com



Josh Wilkins
T: +44 20 7809 206
E: josh.wilkins@shlegal.com

Staying in touch

Having already been instructed on a high number of UK and EU-based hydrogen projects over the last 18 months, Stephenson Harwood has a leading team of specialist lawyers with true strength in depth in all aspects of hydrogen production, storage and transportation across a broad range of sectors.

If there is anything arising from our newsletter or if you have any questions about the content covered in our online seminar series, we are very happy to set up a zoom call to discuss or, alternatively, please email us.

Our previous hydrogen seminars can be found [here](#).

Episode 1 discussed the terminology, technology and why hydrogen is becoming an essential part of sustainable energy strategies.

Episode 2 explored major UK hydrogen projects with hydrogen developers, who discussed feasibility

studies, construction, production, storage, usage and other project considerations.

Episode 3 discussed the use of hydrogen and batteries in the energy transition and what issues must be addressed for the technology to achieve its market potential.

We will shortly be announcing episode 4 which will involve some of the largest hydrogen developers discussing how best to meet short term goals and long term supply.

Information contained in these insights and seminars should not be applied to any set of facts without seeking legal advice.

If you would like your technology, company and/or project listed in our next insight, please let us know and we will happily discuss it further.