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UK Government Publishes Long-Awaited Hydrogen Strategy

Article By:

James Green

The UK government, through the Department of Business, Energy and Industrial Strategy (DBEIS), published its long-awaited hydrogen strategy on 17 August 2021. The strategy, presented by DBEIS Secretary Kwasi Kwarteng, builds on Prime Minister Boris Johnson's "Ten Point Plan for a Green Industrial Revolution" (Ten Point Plan) released in 2020, and it details plans for the United Kingdom to develop a thriving low-carbon hydrogen sector.

The keystone of the hydrogen strategy is the reinforcement of a target of 5 gigawatt (GW) of hydrogen production by 2030 from the prime minister's 2020 Ten Point Plan. This matches the 2030 targets of other major European nations, including Germany (5 GW), Spain (4 GW), France (6.5 GW) and the European Union itself, which has a 6 GW target by 2024 and a 40 GW target by 2030. The dual emphasis on both blue and green hydrogen sets the United Kingdom's approach apart from other European nations that have primarily emphasised green hydrogen. Another key point of difference is that the United Kingdom places more emphasis on catalysing private investment through revenue support mechanisms in the Hydrogen Business Model (see later) rather than the very significant public expenditures envisaged in the hydrogen strategies of other major European countries (€7 billion each for France and Germany). The 5 GW commitment is stated to be a key mechanism to help the United Kingdom meet its carbon emission reduction commitments and to create substantial economic benefits and jobs growth for the United Kingdom and its constituent countries.

The strategy is in five chapters:

- *Chapter 1* sets out the case for low-carbon hydrogen, particularly in assisting the United Kingdom in meeting its emissions reduction commitments and creating jobs and economic growth (stated to be £900 million and 9,000 jobs by 2030 and £13 billion and 100,000 jobs by 2050). It sets out the vision for 2030, addresses the challenges to be faced, and concludes with the role of the devolved administrations within the United Kingdom (Scotland, Wales, and Northern Ireland).

- *Chapter 2* sets out the core of the UK hydrogen strategy, including a road map of how the UK hydrogen economy should evolve over the 2020s and past 2030 and what measures need to be in place in order for this to be achieved. This chapter addresses each part of the hydrogen value chain—production, networks, and storage, and use across industry, power, buildings, and transport. It considers the regulatory and market frameworks and the interaction with the

wider energy system necessary to achieve its low-carbon hydrogen objectives by 2030 and beyond.

- *Chapter 3* sets out how the UK government will work to create an environment to maximise the economic opportunities arising from a low-carbon hydrogen economy, including building sustainable supply chains, skills training, research and innovation, and the maximisation of export opportunities.

- *Chapter 4* deals with the international dimension, including how the UK government intends to assume global leadership in the development of hydrogen through its presidency of the G7, co-presidency of COP26 and co-leadership of the Mission Innovation Clean Hydrogen Mission (launched in June 2021 with the goal to achieve end-to-end clean hydrogen costs of US$2 per kilogram in certain regions by 2030).

- *Chapter 5* concludes the strategy, setting out how progress will be tracked and monitored in developing a low-carbon hydrogen economy in the United Kingdom.

The plan supports both “green hydrogen” produced from the electrolysis of water into hydrogen and oxygen using renewable electricity sources (building on the great progress the United Kingdom has made and continues to make in renewable energy, particularly in offshore wind production) and fossil fuel-derived “blue hydrogen” with carbon capture usage and storage (CCUS) to reduce emissions.

The plan provides the top-line targets and a framework to take the broad strategy of developing a low-carbon hydrogen economy in the United Kingdom forward, but much of the detailed implementation mechanisms, including the market and regulatory frameworks, which would incorporate the crucial “Hydrogen Business Model,” await further consultation and development with a committed target date of 2022.

The report highlights the parallel expansion of renewable generation necessary for green hydrogen announced in the “Energy White Paper” of 2020 through a quadrupling of offshore wind capacity to 40 GW by 2030 and the increase in other low-carbon sources of generation, including nuclear. The report also builds on CCUS initiatives also announced in the Energy White Paper, with £1 billion of government support until 2025 with an aim to establish CCUS in four industrial clusters by 2030.

The report acknowledges some of the key challenges to be overcome in order to produce and use hydrogen at scale in the United Kingdom, including:

- The relatively high levelised cost of hydrogen when comparing green to blue, and of both green and blue against more carbon-intensive energy sources.

- Demand uncertainty due to the current limited use of low-carbon hydrogen in the United Kingdom.

- High technological and commercial risks for maintaining operation of first-of-a-kind projects.

- The need for enabling physical infrastructure such as pipelines.

- The need for policy and regulatory certainty to underpin the required scale of investment.

- The need for supply and demand coordination.

The report sets out 2020's road map with a whole-system approach to developing a hydrogen economy. Some of the key commitments in the 2020 road map are as follows:

- Ambition for 5 GW of low-carbon hydrogen production (green or blue hydrogen) by 2030, with a "soft" target of 1 GW by 2025.
- Launch of £240 million Net Zero Hydrogen Fund for developing and scaling new technologies, due in early 2022.
- Finalise design of a UK standard for low-carbon hydrogen by 2022.
- Finalise the Hydrogen Business Model in 2022, allowing first contracts to be allocated by Q1 2023.
- Study of the network and storage infrastructure for hydrogen and assessing the feasibility, safety, and cost effectiveness of blending up to 20 percent hydrogen in the existing gas supply.

The UK hydrogen strategy emphasises a wide range of use cases in the early and mid-2020's, including domestic heating and transportation (particularly buses, heavy goods vehicles, rail, and aviation) with wider uses in industry and power later in the 2020s.

One of the most closely watched of the policy mechanisms to be determined by 2022 is the development of the "Hydrogen Business Model," details of which are set out in the simultaneously released Hydrogen Business Model Consultation paper. The closing date for comments from interested stakeholders is 25 October 2021.

The Hydrogen Business Model Consultation document builds on work with a wide range of stakeholders, including the Hydrogen Advisory Council co-chaired by Mr. Kwarteng and Sinead Lynch, the UK country chair of Shell.

The aim of the Hydrogen Business Model is to overcome one of the major challenges to the development of the low-carbon hydrogen economy, namely the higher cost of low-carbon hydrogen compared to higher carbon fuels. The consultation document implicitly acknowledges that there is a role for government involvement in the Hydrogen Business Model, as there has been a market failure in that the social cost of carbon emissions is not captured in the market price for high-carbon fuels. The consultation document envisages that revenue support will be needed in the short term, but the need for such support will reduce as the hydrogen market matures.

The consultation document contains consideration of three potential mechanisms to provide revenue support to hydrogen producers: (1) policy-based, (2) economic regulation, and (3) private law contract. The paper favours private contract for a number of reasons, not least precedent from the delivery of renewables investment in the period since the Energy Act of 2013.

The Hydrogen Business Model addresses two main risks: (1) market price risk (the risk that the price received by hydrogen producers for their product is lower than the cost of production), and (2) volume

risk (the risk that the volume of sales falls below a level that allows producers to recover their production costs).

The Hydrogen Business Model proposes a long-term contract for difference (CFD), which involves setting a “strike price” that is intended to represent the price the hydrogen producer needs to cover production costs and a “reference price” that is intended to represent the market value of hydrogen for which seven options are put forward.

The CFD will require the nominated counterparty (see below) to make a payment to the hydrogen producer equal to the amount of the difference (if positive) between the strike price and the reference price. If the strike price exceeds the reference price, the counterparty makes a payment to the hydrogen producer of the amount of the difference. If the reference price exceeds the strike price, the hydrogen producer will make the payment to the counterparty.

This is a model with precedents in the successful UK rollout of renewable power and in the large-scale nuclear programme.

The proposed counterparty to manage the contract is still under assessment by the government. It is noted that a special-purpose vehicle company wholly owned by DBEIS, the Low Carbon Contract Company, manages CFDs in the offshore wind and nuclear sectors.

The Hydrogen Business Model also proposes options for the indexation of the strike price, to incorporate different hydrogen production technologies, and for issues such as contract duration, volume scaling, allocation mechanisms (private contract or competitive auction), and the treatment of other key risks.

DBEIS has committed to provide a response to the consultation, details on the allocation process for projects that are not part of the CCUS sequencing process, and indicative heads of terms in Q1 2022.

CONCLUSION

Hydrogen industry stakeholders will welcome the high-level objective the UK government has set in creating a low-carbon economy in the United Kingdom. They will also welcome the commitment to low-carbon hydrogen, both green and blue, and the parallel commitments to renewable energy, the CCUS technology, and the stretch target of 5 GW of low-carbon hydrogen capacity by 2030.

Much still needs to be done on the details of mechanisms to implement the policy and create the conditions to “de-risk” projects in the crucial build up to 2030, particularly in the development of the proposed Hydrogen Business Model.

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