Building a Strategy: Hydrogen's role in energy security and the decarbonisation of the UK's energy sector

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Building a Strategy

Against the backdrop of the UK's Hydrogen Strategy, which was announced in 2021 and was hailed as a 'green industrial revolution', hydrogen has played an increasingly critical role in the decarbonisation of the UK's energy system.

Pilot projects

Across the UK, a number of pilot projects have used hydrogen. For instance, last year Centrica Business Solutions announced that it will commence a 12-month trial to inject hydrogen into its existing 49 MW gas peaking plant in Brigg, Lincolnshire, England, with the use of HiiROC's technology that produces so-called 'emerald hydrogen' – a type of hydrogen created using a process known as methane pyrolysis to produce hydrogen and solid carbon.

This is the first time that hydrogen will be used within a grid-connected, gas-fired power plant. Blending hydrogen with natural gas will reduce the overall carbon intensity of the plant. Additionally, the byproduct of emerald hydrogen is a form of solid carbon called carbon black, which can be captured easily and has commercial value, as it is used in the production of tyres, rubbers and toners, and also in building materials and soil enhancers.

The outcome of this trial will be important in informing future use cases of this technology and its wider deployment across gas-fired peaking plants.

Hydrogen is also being trialled in the quest to develop a cleaner and more efficient transportation sector in the UK. The first phase of a pilot project kickstarted at Teesside Airport in Darlington, England, with the use of vehicles fitted with 100% hydrogen, zero-emission engines.

The UK's Hydrogen Strategy

The raft of pilot projects in the hydrogen sector has been propelled by the UK's commitment to work with industry to meet its ambition to develop the country's low-carbon hydrogen production capacity. The UK announced a £105 million funding package through its Net Zero Innovation Portfolio as a first step towards building the UK's low-carbon hydrogen economy. The funding package takes the form of various grants to businesses and developers to support the development and trials of solutions to switch industry from high- to low -carbon fuels such as natural gas to clean hydrogen, for instance.

Additionally, in April 2022 the British Energy Security Strategy was published, outlining the government's plan to double its hydrogen production target from 5 GW to 10 GW by 2030. In order to meet this target, the Net Zero Hydrogen Fund (NZHF) was announced, whereby £240 million of available funding will be distributed to eligible low-carbon hydrogen projects across four strands.

Which strand a project can apply for depends on its maturity and the level of support required:

- Strand 1: DEVEX support for early projects to cover FEED studies and post-FEED studies.
- Strand 2: CAPEX for projects that do not need a hydrogen business model (HBM). A project applying for this strand must exist on its own merit and solely require CAPEX support.
- Strand 3: CAPEX for projects requiring an HBM.
- Strand 4: CAPEX for carbon capture, utilisation and storage (CCUS) projects requiring an HBM.

The HBM is a financial support mechanism incorporated into strands 3 and 4, and is designed to subsidise operational costs to encourage and support the hydrogen market. It is provided together with funds granted through the NZHF, as a long-term revenue support contract.

The HBM has many similarities with the Standard Contracts for Difference Terms and Conditions for Allocation Round 4 for low-carbon electricity, as well as the Heads of Terms for the Dispatchable Power Agreement and the Heads of Terms for the Industrial Carbon Capture Contract for the CCUS programme. Based on the government's published indicative heads of terms for the HBM (Indicative HBM Terms), it is clear that the intention is to proceed with a contractual, producer-focused business model that is applicable to a range of hydrogen production pathways. Some of the key elements include:

- A variable premium price support model where the subsidy is the difference between a 'strike price' reflecting the cost of producing hydrogen and a 'reference price' reflecting the market value of hydrogen.
- Setting a reference price based on the producer's achieved sales price, with a floor at the natural gas price, and a contractual mechanism to incentivise the producer to increase the sales price and thereby reduce the subsidy.
- Providing volume support via a sliding scale in which the strike price (and therefore subsidy) is higher on a per unit basis if hydrogen offtake falls.
- Allowing small-scale hydrogen transport and storage costs to be supported through the business model where necessary, taking into account affordability and value for money.
- Introducing a levy to fund the business model from 2025 at the latest, subject to consultation and legislation, with the first electrolytic projects being funded through general taxation if they are operational before the levy is in force.

Allocation of risk, and potential legal issues

Different stakeholders of low-carbon hydrogen projects, whether it be the investors or developers, will have to consider a number of issues when allocating and managing potential risks, as set out in the following sections:

Investability

In order to apply for a particular strand under the NZHF, the project will need to meet certain eligibility criteria.

For instance, in terms of strands 1 and 2, the business must be registered in the UK, the project must be completed in the UK, it must use technology tested in a commercial environment at a Technology Readiness Level 7 or above, and the business must intend to exploit results from or in the UK.

Projects that are successful in applying for strands 1 or 2, for instance, will receive grants that are paid quarterly, and only after quarterly audits are completed (which would include a visit from the appointed monitoring officer).

In addition to the lack of certainty in receiving each quarterly grant, due to the dependence on the successful satisfaction of an audit, another ongoing – and perhaps bigger – concern may be whether there would be a change in policy and thereby the framework of the aforementioned low-carbon hydrogen business model, if and when there is a change in government.

These are issues that would need to be taken into account when calculating the project metrics and determining the risk allocation when negotiating relevant agreements for the project.

Structure of hydrogen projects

As demonstrated through pilot projects using hydrogen (such as the collaboration between Centrica Business Solutions and HiiROC to inject hydrogen into a gas peaking plant), the development of hydrogen may require the collaboration of investors and developers/technology providers.

A point worth noting is that the Indicative HBM Terms provide for a term of between 10 – 15 years which reflects, amongst other things, a balance between providing price support certainty for producers for a proportionate and reasonable period, whilst not locking in production pathways for the long-term. It also serves as an indication as to the possible or potential duration of a joint venture (JV), if it is entered into.

Some of the usual list of issues for investors to consider when entering into a JV include the obligation to contribute funds to the JV company, the ownership of intellectual property rights, the mechanics of funding (whether by way of shareholder loans or the issue of preferred shares), voting rights, tag and drag along provisions, and deadlock resolution mechanisms.

Adaptability of existing plants

The use of hydrogen by power generators will raise a number of issues that need to be addressed and considered in advance. The first and main concern will be to ensure that the technology being used to generate power, such as a gas-fired turbine, can be adapted to run on blended fuel. This is important to ensure that the owner of the plant does not invalidate the performance and defect warranties that the technology provider offers with its equipment, for instance.

The owner of the plant will also need to ensure that the reliability and performance of the plant are not affected in a way that negatively impacts any obligations it has to provide power under the terms of any existing power sales contracts.

If the plant's performance is negatively affected by the use of blended fuel, the owner of the plant may be penalised for under-performance of its plant and failure to meet its generation obligations.

Looking forward

The aim will be for hydrogen to replace fossil fuels, with green hydrogen (a type of hydrogen that produces no harmful greenhouse gas emissions) being the sole produced type. However, green hydrogen is still in its infancy, and hydrogen has so far not been used at scale due to the costs associated with its production and the maturity of the various technologies already in existence for other forms of energy.

Fortunately, with the UK government's commitment to and backing of the hydrogen industry, in the form of various grants and subsidies, the development of low-carbon hydrogen projects across the UK has witnessed strong growth. Low-carbon hydrogen will no doubt play a very important part in the UK's energy security and the country's aim to create a diverse and secure decarbonised energy system – ultimately helping the UK to meet its commitment to achieve net zero by 2050.

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