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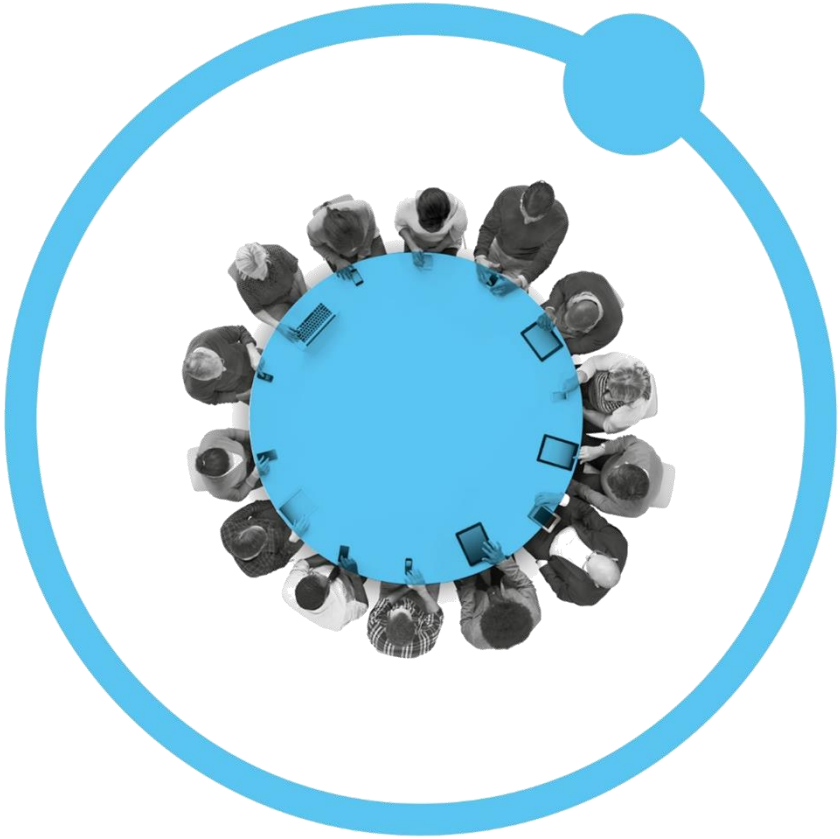
Article

Hydrogen: the UK business case



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Introduction

World events recently have shown us the need to focus efforts on realising the Hydrogen potential. Hydrogen is key to the decarbonisation of the energy system and could, in a decade, power vehicles, generate electricity and provide long-term energy storage. This requires wise policymaking and heavy investment by the government and private sector.

In the UK government policy, the publication of the Hydrogen Strategy in August 2021 and the Ten Point Green Plan for a Green Industrial Revolution in November 2020, which we discussed in our briefing, shows clear support going forward. However, in 2022, a range of market barriers continue to inhibit the development of the low-carbon hydrogen economy, including:

(a) the high cost of low carbon hydrogen compared to alternatives;

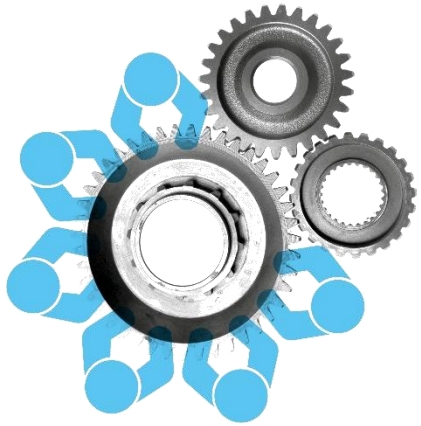
(b) demand uncertainty;

(c) absence of policy and regulatory framework; and

(d) lack of infrastructure for distribution and storage of hydrogen.

It was with a view to addressing certain of these barriers, that the government consultation on the Low Carbon Hydrogen Business Model (the "**Consultation**") for UK hydrogen projects was published along with the Hydrogen Strategy. The Consultation aimed to elicit views from stakeholders involved in low carbon hydrogen project development to proposals on a business model, with the ultimate objective of formalising a subsidy framework to incentivise the production and use of low carbon hydrogen.

As the need to focus policy and investment attention on hydrogen increases, in this briefing, we would like to discuss the proposals that were set out in the Consultation (including the government's preferred approach).

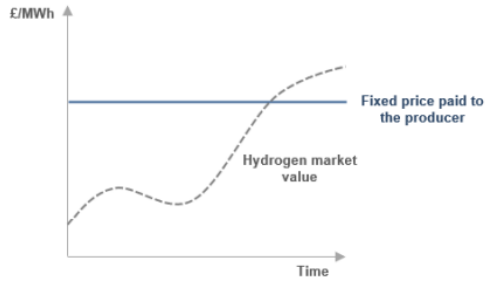


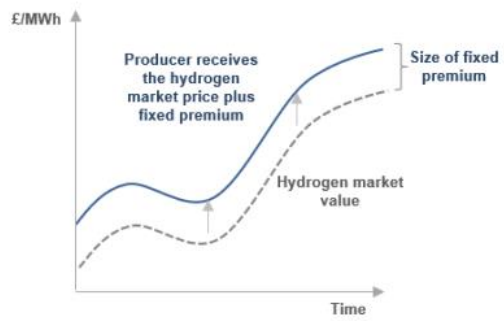
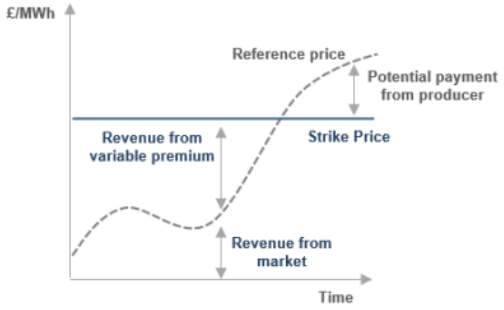
The Consultation

Though the Consultation details the various options considered by the government in the Consultation, it makes clear that the preferred hydrogen business model is similar to the Contract for Difference scheme (**"CfD"**) used for UK offshore wind projects. The CfD scheme is evidently considered a success for offshore wind, and the government clearly wants to replicate such success with hydrogen.

Price support options

The Consultation sets out (and provides analysis on) various price support options to support investment in hydrogen projects – we set these out below, together with the advantages and disadvantages of each approach as specified in the Consultation:

Price Support Option	Diagram Explanation	Advantage	Disadvantage	Summary
Fixed price	*Figure 3: Fixed price*  	– Removes uncertainty for producers – Simple to implement	– Requires a high level of government intervention – Setting the fixed price is difficult – Implications for which end users can afford to switch to hydrogen – Government support does not have potential to reduce over time	*"this approach would require the creation of a loss absorbing market making entity…in doing so we would be introducing complexities that might undermine the formation of a genuine market for hydrogen."*

Price Support Option	Diagram Explanation	Advantage	Disadvantage	Summary
Fixed premium	*Figure 4: Fixed premium*  	– Higher confidence in terms of profitability for the producer – Simple to implement	– Not flexible to changes in market conditions – Risks of overcompensation of sales into certain end use sectors	*"unlikely to represent value for money."*
Variable premium	*Figure 5: Variable premium*  	– The subsidy adjusts as the market evolves, which is likely to deliver greater value for money for government – Adaptable to different end use cases	– More complex than other approaches	*"this option is the most advantageous with clear benefits over the alternatives. In particular, it provides the opportunity for the level of subsidy to adjust to the evolution of the hydrogen market…. We consider this has the potential to provide better value for money, but requires careful selection of the reference price to be effective."*

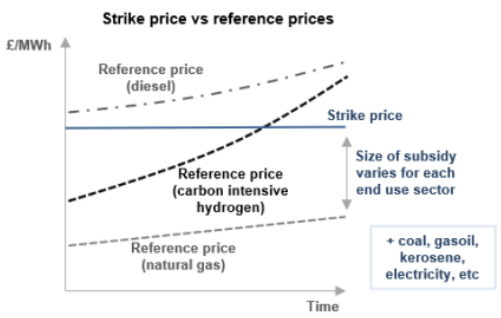
In summary, the government's preferred price support approach is the variable price support model, despite this approach perhaps being more complex than the other approaches. However, the Consultation notes that the reference price needs to be wisely selected in order for this approach to work. We cover the reference price options in the next section.

Reference price options

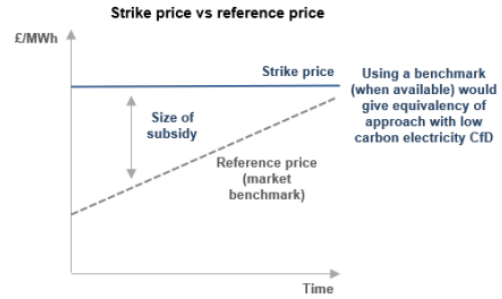
As with the price support options, the Consultation also sets out (and provides analysis on) various reference price options – we set these out below, together with the advantages and disadvantages of each approach as specified in the Consultation:

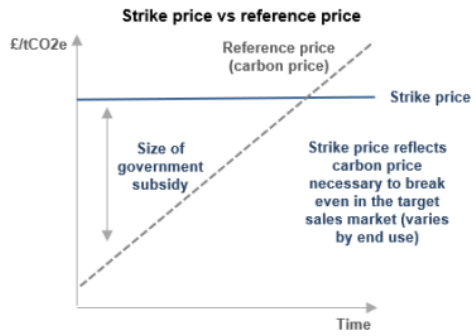
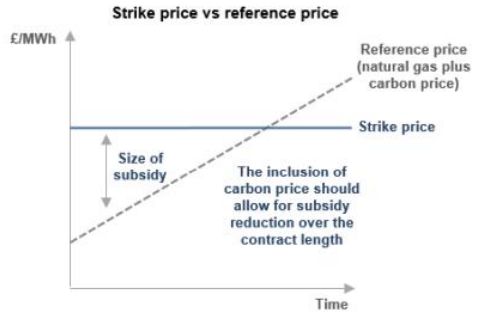
Reference Price Option	Diagram Explanation	Advantage	Disadvantage	Summary
Input energy price		– Transparent and easy to understand – Distortions in the hydrogen market and wider energy markets may be avoided by linking to the input energy price	– Input energy prices are not necessarily positively correlated to the value of hydrogen – Different production technologies may not be able to compete in the same markets – Although producers have an incentive to sell for higher than the reference price, ie input energy costs, this risks over-compensation to the producer – There is no guarantee that the level of subsidy reduces over time within a contract – May encourage transfer pricing	*"Using the input energy price has the advantage of being relatively simple to understand and transparent given the link to liquid energy markets or contract prices. The main drawbacks are that producers of different production technologies may not be able to compete in the same markets due to the reference price that they are subject to, and that support payments would not be linked to the price that the producer receives for their hydrogen."*

Reference Price Option	Diagram Explanation	Advantage	Disadvantage	Summary
Natural gas price	*Figure 6: Natural gas as a reference price*  	– Natural gas is a liquid market and therefore using it as a benchmark has transparency benefits – The value of hydrogen to the market can be expected to be strongly correlated to the natural gas price in end user sectors where natural gas is the counterfactual fuel is being replaced – Distortions in the hydrogen market and wider energy markets may be avoided as the hydrogen plant is not subsidised for sales below the natural gas price – A floor price at the natural gas price provides incentives for certain end users to switch to low carbon hydrogen	– Linking to natural gas could potentially lead to excessive subsidy for sales to certain end users – There are fewer incentives to switch to hydrogen in non-ETS markets where natural gas is the primary input fuel – There is a risk this option overcompensates the producer – The level of subsidy may not reduce over time	*"Natural gas as a reference price is simple to apply but the probability of the subsidy reducing over time is likely to be limited and could lead to excessive subsidy to certain end users and/or the producer…"*

Reference Price Option	Diagram Explanation	Advantage	Disadvantage	Summary
Counterfactual fuel prices	*Figure 7: Counterfactual fuels as a reference price*  	– Using counterfactual fuel prices in theory enables each end user to pay the same for hydrogen as the fuel they have switched from	– The main challenge is that there are a lot of different fuels, which introduces complexity to this mechanism – Difficulties arise from charging different prices to different customers for a chemically identical product – This approach diminishes the incentive to sell into higher value markets for the producer – This reference price option eliminates the price incentive to switch for many end users – The ability for the producer to use pricing to build volumes would be limited	*"likely to hamper market development as well as adding significant complexity… likely to be unworkable…"*

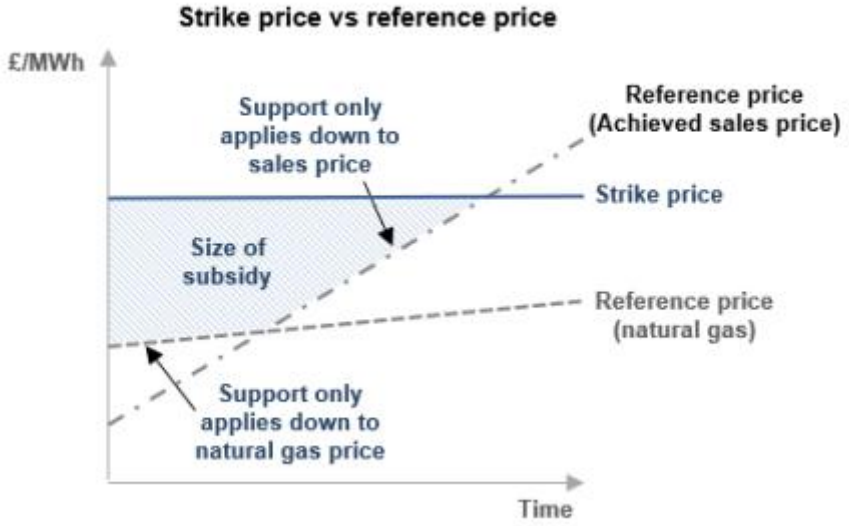
Reference Price Option	Diagram Explanation	Advantage	Disadvantage	Summary
Achieved sales price	*Figure 8: Achieved sales price as a reference price*  	– Relatively simple – Pricing flexibility ought to lead to a faster rate of market penetration	– There is no reward for price discovery and subsequently the level of subsidy is not likely to reduce over time – The lower incentive for producers to generate higher market prices for hydrogen may result in overcompensation – Producers may be incentivised to focus on generating revenue by focusing on sales volume instead of the sales price – There is a potential for energy rather than hydrogen to be subsidised, leading to market distortions – Information is required from producers on their achieved sales price	*"While actual sales prices are a proxy for market value, they may have a distortional effect if used as a reference price by discouraging the producer from seeking higher prices, and encouraging the building of volume through discounting prices…"*

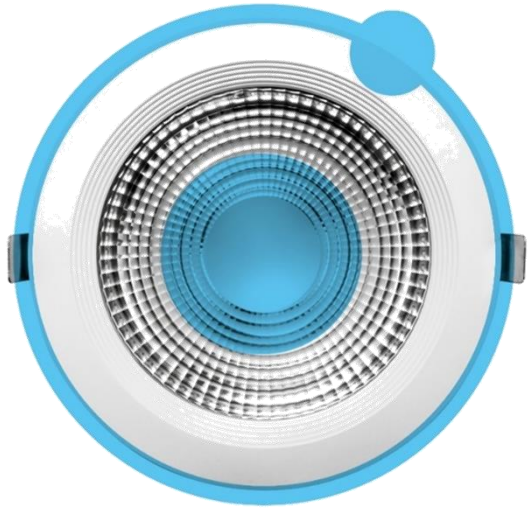
Reference Price Option	Diagram Explanation	Advantage	Disadvantage	Summary
Market benchmark price	*Figure 9: Market benchmark as a reference price* 	– A liquid market benchmark price would provide the clearest indication of the market value of hydrogen – Incentivises plants to maximise their market revenues – Enables the hydrogen plant to potentially create a competitive – Advantage over other plants by developing and selling into higher value market segment – The level of subsidy should reduce relatively quickly over time	– We do not have certainty over when a benchmark for hydrogen would become available – This option may disincentivise sales into the lowest value markets	*"offers simplicity and brings an external and independent view on hydrogen prices. It would be the logical choice for a reference price as it is a reflection of the price which end users are willing to pay for hydrogen and is what we are seeking to proxy in the absence of a market benchmark…"*

Reference Price Option	Diagram Explanation	Advantage	Disadvantage	Summary
Carbon price	*Figure 10: Carbon price as the reference price*  	– Likely the market value of hydrogen and the carbon price in the initial stages of development will be correlated – Carbon prices are likely to rise over time and therefore the subsidy is likely to reduce over time	– May not perfectly reflect the market value of hydrogen – The correlation between carbon price and market value of hydrogen will weaken over time – There is potential for gaming by producers to maximise their revenues – The carbon price is not expected to be strongly correlated with costs of producing and therefore having a strike price as the carbon price may not reflect the right level of subsidy needed by producers	*"The carbon price approach may appear to be relatively simple but there is potential for overcompensation to the producer if the target market changes…."*
Natural gas plus carbon price	*Figure 11: Natural gas plus carbon price as reference price*  	– Potentially the closest proxy to how the market might value low carbon hydrogen as a fuel – Producers would be encouraged to seek sales into higher value areas	– The price incentive to switch is removed for end users in the industrial sector – Reduces the flexibility for producers to price into certain markets – There may be a limit to the duration of how useful this reference price would be	*"Although this option is potentially the closest proxy for the value of hydrogen to end users, it may be less useful as a reference price as it removes incentives for end users in the industrial sector to switch and reduces producers' flexibility to sell into lower value markets…"*

The Consultation confirms that the government's preferred reference price approach is the market benchmark price, as this "*will best represent the value of low carbon hydrogen in the market*". For initial projects, the reference price is proposed to comprise the higher of the natural gas price and the achieved sales price (as shown in the diagram below):

Figure 12: Minded to position on reference price - highest of two inputs

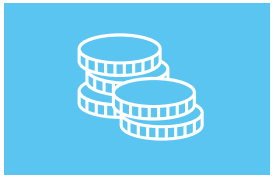




Preferred approach – summary

In summary, the Consultation states that the preferred approach is to use a hydrogen CfD scheme with a variable price support model whereby the reference price will initially be the higher of the natural gas price and sales price achieved by the producer. However, as noted above, the Consultation is just that – a consultation – and, as such, this approach may change depending on the feedback received. It should also be noted that there is much work for the government to do in terms of (i) determining eligibility of projects to the scheme, (ii) drafting the CfD contract and considering the terms of such a contract (eg contract term, further details as to the reference prices).

Whilst the CfD preferred approach as set out in the Consultation has generally been welcomed by stakeholders, others have questioned certain elements of the proposals:



How the complexities of the reference price metric will work in practice: The reference price and how it is to be set is key to the success of the proposals. The Consultation makes clear that the reference price should represent the market price received by the relevant producer for each unit of hydrogen, however, clearly flexibility will be required to cover the variety of hydrogen uses.

How the scheme will be funded: This is, of course, becoming increasingly relevant in the current "energy crisis". Initial thinking suggests that the proposals may be funded by the end consumer, which may be controversial given the recent increases in energy prices. This has been highlighted in the media, with much of the press coverage around the Consultation and the Hydrogen Strategy concentrating on the fact that the proposals will be subsidised by taxpayers.

Blue vs green hydrogen: The government has taken a "twin-track" approach and has suggested that the proposals apply to a range of production technologies, including blue hydrogen (natural gas reformation with carbon capture usage and storage) and green hydrogen (hydrogen produced by electrolysis). Whether it is appropriate to support both approaches is a point of contention, and is something we will be discussing in our next briefing.

Conclusion

It is clear that the UK still has a long way to go in terms of subsidy support and legislative frameworks for hydrogen compared to other jurisdictions and other clean energies. For example, Germany has a deep-routed history of publicly funding hydrogen projects and technologies (it launched the National Hydrogen and Fuel Cell Technology Innovation Programme in 2006 and it is envisaged that between 2016 and 2025 government funding will amount to EUR 1.4bn). In addition, on a European level, the Clean Hydrogen Alliance was introduced in March 2020 to promote and explore investments in hydrogen projects and it is approximated that by 2030 the European hydrogen sector will profit from investments of EUR 430bn. Further, Austria has focussed subsidies on green hydrogen projects by subsidising electrolysis plants used for green hydrogen.

Whilst the Consultation and Hydrogen Strategy provides much needed detail on the government's plans to develop the UK hydrogen economy, the lack of physical and regulatory infrastructure for distribution and storage is likely to be a barrier to meaningful investment (at least in the short-term). The Consultation closed on 25 October 2021, and the government is currently analysing feedback on the Consultation that has been received before finalising its business model proposals during 2022 and issuing the first contracts under the relevant business models in Q1 2023. In the meantime, stakeholders involved in low carbon hydrogen project development eagerly await full details of the finalised subsidy regime, which, it is hoped, will kick-start activity in this sector.

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