Support for Hydrogen Blending under the Hydrogen Business Model

Background

The current position of the Hydrogen Business Model[1] (HBM), issued by the Department for Business, Energy & Industrial Strategy (BEIS), is to view hydrogen blending solely as a 'demand sink' to enable hydrogen production at times when higher priority off-takers e.g., industry, power, and transport, have reduced aggregate demand. This perspective limits the perceived value of hydrogen blending to the provision of an energy balancing function, with no wider system importance or strategic significance. The classification of hydrogen blending as solely a demand-sink, with the associated implications for the perceived role of hydrogen blending within the energy system, is counterproductive and likely to result in market failures.

The blending of hydrogen, up to 20 vol%, within the existing natural gas network has a multitude of strategic benefits that will accrue to a variety of stakeholders within the energy landscape. In summary:

a. **Stimulate Demand** - Hydrogen blending breaks the historical 'chicken and egg' between hydrogen supply and demand, by enabling existing appliance technologies to unlock a material hydrogen demand market to support production. We believe hydrogen blending alone could support circa. 5 GW of hydrogen production and has the lowest technology risk profile of potential off-takers.
b. **Promote Investment** – Blending makes projects more investible as hydrogen producers are looking for ways de-risk off-taker demand. Counter-party and short-term supply contract risks are mitigated if blending remains an option to the producer. Similar policy mechanisms were developed for the Feed-In Tariff, the Renewable Obligation, the Renewable Transport Obligation etc. History has shown that grid access is essential to facilitate production by providing a means to de-risk investment and provide a smooth, predictable return.
c. **Carbon Budgets** - Material environmental benefits are possible without hassle or disruption to contribute to achieving the 5th and 6th carbon budgets. 6 $MtCO_2$ pa of carbon savings are possible, equivalent to removing 2.5 million cars from the road. Without supporting this option and capturing this 'low hanging fruit' within the hardest to abate sector (domestic heating), a greater reliance will transfer to more expensive and disruptive technologies to ensure decarbonisation in line with carbon budget requirements.
d. **Consumer Focused** - Hydrogen blending can provide a tangible mechanism to engage consumers with the decarbonisation of heat. Research by BEIS and from GDN's, demonstrate low engagement from consumers with home heating as a contributor to climate change and alternative low-carbon heating technologies. Hydrogen blending would bring decarbonisation into peoples' homes and create the opportunity to build awareness of the role of natural gas heating in climate change and the role of consumers in reducing emissions by moving to cleaner options such as clean hydrogen. Social science evidence has

[1] https://www.gov.uk/government/consultations/design-of-a-business-model-for-low-carbon-hydrogen

demonstrated strong support for hydrogen blending by consumers who have experienced this energy source via consumer trials[2].

e. **Safety** - Safety evidence indicates hydrogen blending could be safer for domestic consumers compared to natural gas, due to the significant reduction in the largest hazard facing domestic consumers from gas usage – CO poisoning.
f. **Increase Competition** - It is critical for the creation of an efficient GB-wide market for hydrogen, lowering the costs of transportation and in some cases reducing the need for storage.
g. **Building Social Acceptance** - Hydrogen blending is a critical proving stage along the hydrogen for heat discovery journey. It acts as a strategic test case of social acceptance and market frameworks, enabling evidence to be gathered to better inform the 2026 strategic decision on hydrogen heating.
h. **Reduce Curtailment** - It is a strong facilitator for reducing curtailment, as the gas network can absorb variable production rate of hydrogen from renewable electricity. It could potentially drive amongst the lowest forms of levelised cost of hydrogen.

It is recognised that the role of hydrogen within the solution landscape for decarbonising heat is currently under review. Although hydrogen is widely recognised as being part of the solution, the magnitude of the contribution, alongside other solutions such as electrification, biomass, and district heating, is currently unknown. In addition, the prospect of hydrogen blending into both the transmission and distribution network is yet to be fully explored. The two key decision-making milestones which will crystallise the position of hydrogen within decarbonised heat are:

a. The 2023 policy decision on hydrogen blending, as outlined in the UK Hydrogen Strategy[3]
b. The 2026 hydrogen for heating policy decision, as outlined in the UK Hydrogen Strategy

Therefore, at present, the role of hydrogen to support the decarbonisation of heat is less certain than the role of hydrogen to support the decarbonisation of other sectors such as industry, power, and transport. The current structure of the HBM is seen as a response to this certainty asymmetry, given that the implied function of hydrogen blending is one that only has relevance in relation to other, more certain, off-takers, i.e., a 'demand sink', instead of being seen as a valuable off-taker in its own right. The resulting position of not supporting hydrogen blending as a valuable off-taker reflects the current relative certainty of off-taker hydrogen application. However, as a policy instrument, the current HBM structure could be improved to move from a binary structure - which will likely result in unintended market failures/distortions in relation to hydrogen blending – to a more flexible structure which facilitates hydrogen blending in proportion to its evolving regulatory/policy certainty.

The following sections of this policy paper describe: the resulting implications of the current HBM model; and an alternative HBM structure which addresses the underlying certainty asymmetry whilst avoiding the unintended market failures that will likely result from the existing model.

Implications of Current HBM Structure

Production Investment Cases

The UK Hydrogen Strategy recognises the need for a revenue support mechanism to enable low-carbon hydrogen to be commercially competitive with higher-carbon counterfactual fuels, principally

[2]https://www.keele.ac.uk/sustainable-futures/ourchallengethemes/providingcleanenergyreducingcarbonemissions/hydeploy/customer-perceptions-report.pdf
[3] https://www.gov.uk/government/publications/uk-hydrogen-strategy

natural gas. This recognition forms the underpinnings of the HBM and makes clear that the production of low-carbon hydrogen is contingent upon an appropriate support mechanism. The costs of production are independent of off-taker. If hydrogen blending is not supported as an off-taker, then by definition hydrogen blending will fall below this threshold. The consequence of this structure is that hydrogen blending will simply not be a feature of a producer's investment case, as there would be no incentive to invest in the marginal capital and operating costs to produce the low-carbon hydrogen. Therefore, across all production technologies, it is highly unlikely any hydrogen blending would practically result from the current commercial structure – unnecessarily forgoing the benefits described above.

Electrolytic Production

The above general issue becomes more acute when considering electrolytic production powered by renewables. The reference design case for electrolytic production is to link hydrogen production with renewable electricity generation, such as wind and solar. Therefore, the production curves of the resulting electrolysers will be inherently volatile, as production will be based on the prevailing load factor of the upstream generator on any given day. This production volatility is a natural feature of electrolytic production and therefore must be absorbed by either off-takers or intermediate buffer storage. Applying the above generic issue to electrolytic production investment cases - a significant quantity of intermediate buffer storage will be a necessary requirement of investment cases. Given that the higher-priority off-takers (industry, power, and transport) will be much less able to absorb any hydrogen production volatility/uncertainty compared to the gas-network via blending. This requirement to produce on-demand hydrogen via buffer storage will make electrolytic production less financeable and either result in less electrolytic production being built; or increase the total support necessary through the HBM and Net Zero Hydrogen Fund[4] (NZHF). We note that this may not apply in the instances of electrolytic production via baseload sources such as nuclear.

Blending Policy

The UK Hydrogen Strategy makes clear that the role of hydrogen blending will be determined by the end of 2023, with the outlined policy decision. It is likely that, if the decision is supportive, a regulatory process will be instigated to incorporate hydrogen blending within the existing gas quality envelope of the Gas Safety (Management) Regulations[5].

If the HBM does not provide appropriate financial support for the production of hydrogen for hydrogen blending, the practical reality is that no meaningful blending of hydrogen will occur, if any. Therefore, the continuation of the existing proposals within the HBM will render the 2023 hydrogen blend policy decision moot, as the commercial framework will inhibit hydrogen blending independent of an enabling regulatory framework.

Alternative Solution

The current lack of support for hydrogen blending as an independent off-taker within the HBM is seen as a response to the relative difference in application certainty of different off-takers, particularly resulting from the current policy uncertainty of hydrogen for heating. This is a legitimate concern, however both concerns will evolve over the short-term into clear positions. Therefore, a more appropriate support structure would be one that can respond to this evolution, instead of viewing support for hydrogen blending as a binary decision.

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[4] https://www.gov.uk/government/consultations/hydrogen-business-model-and-net-zero-hydrogen-fund-market-engagement-on-electrolytic-allocation

[5] https://www.legislation.gov.uk/uksi/1996/551/contents/made

A more targeted solution is possible that recognises the underlining difference in off-taker certainty but provides a suitable framework to stimulate production for hydrogen blending to capture the strategic and environment benefits on offer. This alternative solution is based on the following two principles:

a. All hydrogen off-takers to receive equal p/kWh financial stimulus, inclusive of hydrogen blending
b. A 'blending materiality threshold' is established which limits the proportion of hydrogen that can be provided for hydrogen blending, relative to total production.

This model would prevent investment cases anchoring in hydrogen blending - which would potentially pose a long-term liability if hydrogen for heating is not supported in subsequent policy decisions - but would provide an appropriate framework for producers to contract for hydrogen blending. The blending materiality threshold could either be a flat proportion applied equally, or a tracker threshold based on underlying market factors. The latter would provide BEIS with optionality to tune the materiality threshold to be responsive to market conditions, however the former would provide producers with a greater degree of certainty. Both options would require due consideration to understand the optimal solution.

The proposed alternative solution based on a blending materiality threshold is deemed to overcome the significant market failures/distortions that will likely result from the current HBM framework, whilst also addressing the underlying uncertainty and liability concerns that would result from blending being an anchor off-taker for hydrogen production investment cases.

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