Hydrogen Energy Association

Action Plan for Electrolytic Hydrogen

April 2024

Summary

The purpose of this action plan is to identify factors affecting the rollout of electrolytic hydrogen and provide recommendations for Government and other stakeholders to accelerate progress and help us to achieve our targets.

Production, demand, and supply chin and skills development are three interrelated areas of importance relating to the development of electrolytic hydrogen.

Production

- Securing sufficient UK hydrogen production capacity is critical to facilitating a stable and growing supply of green hydrogen, and accelerating the growth of the hydrogen economy.
- With our current target of at least 6GW electrolytic hydrogen production capacity by 2030, the challenge now is less so about if the commitment to hydrogen is there and more so about how it will be achieved. How subsidy mechanisms and regulatory standards evolve will be key.

Demand

- The extent to which future hydrogen demand can be effectively aligned with production, whilst accelerating the pace of rollout, will determine the success of the hydrogen economy on a national and an international scale.
- The ultimate challenge with hydrogen demand is how users can be incentivized to switch from fossil fuels to hydrogen, and in doing so trust an emerging technology to provide a reliable supply of energy in the medium to long term.
- The HEA encourages the Government to adopt a more high-level and holistic strategy for stimulating hydrogen demand in the UK, including green incentives and tax relief for end users.

Hydrogen Supply Chain and Skills Development

- Ensuring the UK has strong, home-grown hydrogen supply chains will be crucial if it is to compete internationally and play a leading role in the global hydrogen economy. A vital first step is to leverage and support the UK's collective industry expertise to maximise domestic supply chain capabilities and requirements.
- The limited availability of skilled labour within the hydrogen sector is an increasingly urgent consideration; failure to address this issue now will result in sector-wide shortages and supply chain disruption that will inevitably constrain the pace at which the UK hydrogen economy can develop.

Addressing these key areas of electrolytic hydrogen production, demand, and supply chain development will help the UK hydrogen economy to accelerate at the pace needed to reach the target of up to 6GW electrolytic production by 2030, and allow the UK to capitalize on the long-term economic benefits of supporting this industry.

If the UK is to deliver a world leading hydrogen economy, the Government must continue to act proactively in its hydrogen strategy and we hope that our recommendations will provide a valuable contribution to this.

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1.0 Background and context

1.1 Introduction

Against a backdrop of increasing urgency surrounding climate change, combined with sharp rises in global energy prices and a need to increase energy security, the UK has positioned hydrogen as fundamental in the success of its energy transition through its use as a 'clean and flexible super-fuel.'

A combination of the UK's world-leading clean energy generation and Electrolytic hydrogen presents a significant opportunity to increase the resilience, flexibility and security of the UK energy system, which could result in billions saved by 2050.[1] Electrolytic hydrogen can be used as a long-term store of clean energy, which will be invaluable in mitigating the variable electricity supply and demand of an increasingly electrified energy system looking to deliver as much as 50GW of offshore wind by 2030.[2] Electrolytic facilities can reduce electricity system impacts and network constraints, as well utilise energy, which would otherwise be curtailed, to provide additional generation capacity. As the UK scales up the deployment of renewables, we expect that increasing levels of this excess electricity generation can be used to produce hydrogen. By securing 10% of the global hydrogen technology market,the UK could achieve £70bn in annual revenue, £46bn GVA to the UK economy and 410,000 jobs in UK hydrogen technology supply chains by 2050.[3] This means that there is a significant economic opportunity in supporting this industry, which will only become more valuable once price parity with natural gas is achieved.

As the leading trade association in the UK hydrogen sector, the HEA is dedicated to accelerating the rollout of the hydrogen economy. We promote and represent the interests of our 120 members across the hydrogen space, as well as campaign for the best policy outcomes for the industry across the full range of applications and opportunities of the value chain.

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In 2021, the HEA published an initial Green Hydrogen Position Paper[4] which included a number of key messages and recommendations. Since then, we have seen encouraging early work by Government in its efforts to establish a leading hydrogen economy. Most if not all of our 2021 key messages and recommendations have been either achieved, can be achieved with minimal amendments, or are in progress. We appreciate the legislative and economic challenges of stimulating an emerging economy from the ground up, at pace; this should not be underestimated, particularly when competing for investment amongst overseas counterparts with national hydrogen policies that are equally as ambitious, if not more.

[1]https://assets.publishing.service.gov.uk/media/62e9794de90e07142da017ec/benefits-long-duration-electricity-storage.pdf
[2]https://www.gov.uk/Government/publications/british-energy-security-strategy/british-energy-security-strategy
[3]https://hydrogeninnovation.co.uk/reports/uk-hydrogen-innovation-opportunity/
[4]https://acrobat.adobe.com/id/urn:aaid:sc:eu:667f5be0-b38d-46e7-ae43-2f4130c36811

As outlined below, there has been some promising initial progress to develop hydrogen in the UK, and the recommendations in this Action Plan reflect the early stage of the industry and represent opportunities to 'smooth the path' going forward. These policy reforms can collectively support the significantly faster growth of the UK hydrogen economy and release more private investment into the market – results that are essential to deliver on the UK's hydrogen ambitions.

In this report, the term Electrolytic hydrogen refers primarily to hydrogen produced via renewable electricity and electrolysis. More broadly, Electrolytic hydrogen can also encompass Nuclear Enabled Hydrogen, which offers the potential for large scale, steady supplies of zero carbon hydrogen. And, of course, recommendations such as those relating to the scale up of demand apply across the hydrogen economy.

1.2 UK progress and vision

Following the initial release of the Hydrogen Strategy in August 2021, the UK Government published the Hydrogen Production Delivery Roadmap and the Hydrogen Strategy Update to Market in December 2023, which detail a more ambitious near-term hydrogen strategy of 10GW of low-carbon hydrogen production capacity by 2030. Up to 6GW of this will be allocated to electrolytic hydrogen production. There is also an interim target of 1GW of electrolytic production to be in operation or construction by 2025.

As shown in Figure 1,[5] there has been a significant amount of movement in the hydrogen sector, yet there remains the challenge of stimulating the early availability of electrolytic hydrogen to cultivate private sector confidence and demonstrate a commitment to hydrogen in the Government's long-term energy strategy. Since the 2021 Hydrogen Strategy, the UK Government has strived to do just this by rolling out the Hydrogen Production Business Model (HPBM), with the transport and storage counterparts currently being finalized. Delivered via funding under the 2023 Energy Act, the HPBM will deliver funding to hydrogen projects through the Hydrogen Allocation Rounds (HAR).

£390 million has been allocated to kickstarting the manufacturing and supply chain components necessary to enable the deployment of domestic hydrogen and CCUS-enabled projects

Currently restricted to only electrolytic hydrogen projects, DESNZ recently announced the 11 winners (totalling 125MW production capacity) of HAR1, who will receive HPBM revenue funding via a bespoke front-end agreement in line with the conditions detailed in the Low Carbon Hydrogen Agreement (LCHA). HAR1 winners were the largest number of commercial scale green hydrogen production projects announced at once anywhere in Europe, and the Government is looking to build on this by delivering 875MW of production in HAR2, followed by a further 1.5GW across HAR 3 and 4.[6]

The Government has also deployed the £240 million Net Zero Hydrogen Fund (NZHF). Strand 1 funding covers front end engineering design (FEED) and post-FEED activities, while strand 2 provides capital expenditure (CAPEX) support.[7] So far, DESNZ has announced 15 successful applicants from round 1 of strands 1 and 2, receiving a total of £37.9 million in support. This was followed by an additional 7 successful projects announced this year from round 2 of strands 1 and 2, receiving over £21 million.

[5]https://ukhea.co.uk/uk-hydrogen-project-map/
[6]https://assets.publishing.service.gov.uk/media/65ddc51dcf7eb10015f57f9b/hydrogen-net-zero-investment-roadmap.pdf
[7]https://www.gov.uk/government/publications/net-zero-hydrogen-fund-strands-1-and-2-successful-applicants
[8]https://www.gov.uk/Government/publications/hydrogen-production-business-model-net-zero-hydrogen-fund-shortlisted-projects/hydrogen-production-business-model-net-zero-hydrogen-fund-har1-successful-projects

The NZHF will also be providing up to £90 million in CAPEX support for HAR1 winners.[8]

There are other funding mechanisms available for electrolytic hydrogen, including the now almost £1.1 billion Green Industries Growth Accelerator (GIGA).[9] Of this, £390 million has been allocated to kickstarting the manufacturing and supply chain components necessary to enable the deployment of domestic hydrogen and CCUS-enabled projects.

Due to the speed at which the hydrogen economy must be accelerated, DESNZ has made it clear that one of its core principles will be "learning by doing" in the 2020s, and thus far we praise its willingness to openly communicate and collaborate with industry to achieve the best policy outcomes.

The work today provides important foundations that we need to build from at speed.

Our ambitions for electrolytic hydrogen production have the potential to position the UK as an international leader in the emerging global hydrogen economy. For this to be achieved, it is crucial that the UK not only meets its 2025/2030 production targets within the allocated timeframes, but adopts a long-term vision and continues to evolve the hydrogen economy as far as 2050. While production is central to ensuring the early availability of electrolytic hydrogen, sufficient consideration must also be given to stimulating demand, developing storage and transportation infrastructure and strengthening home-grown supply chains.

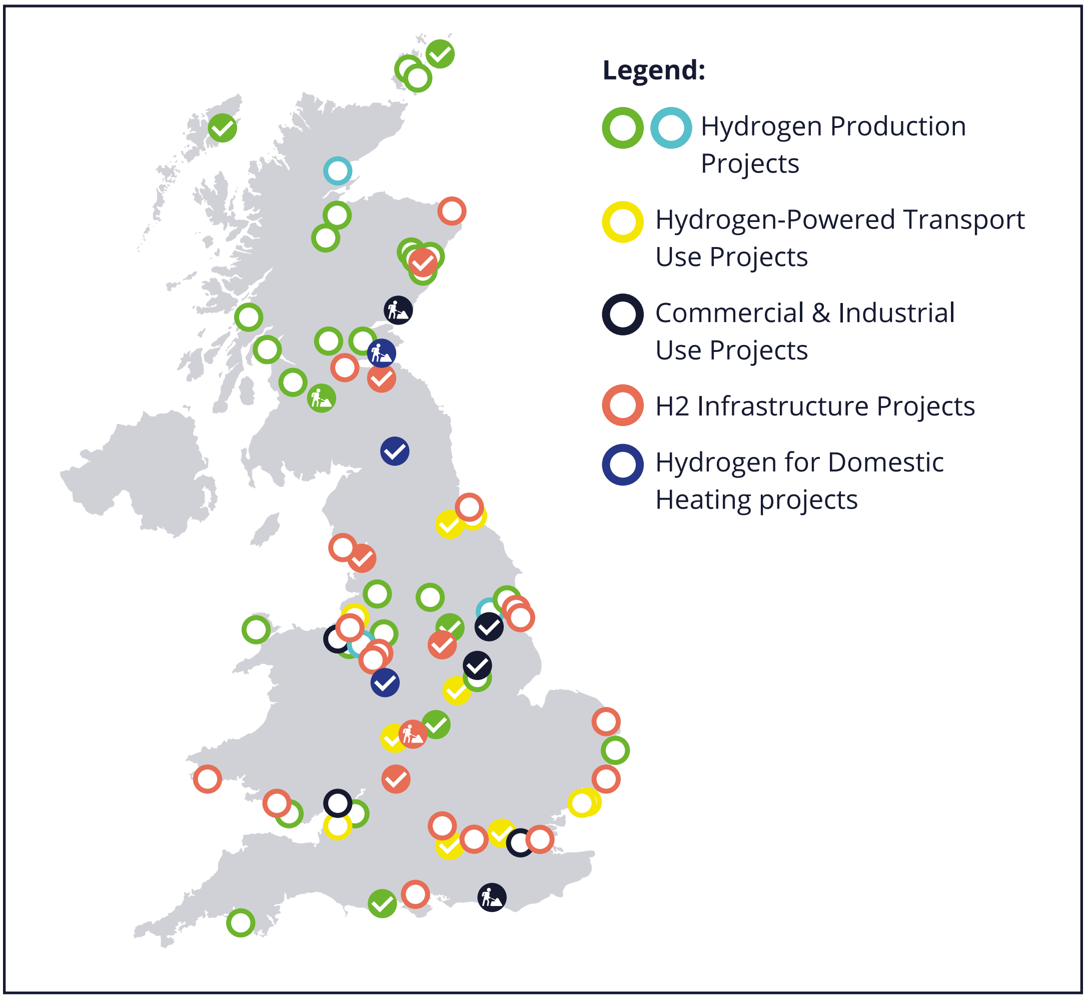

Figure 1, the HEA's UK Hydrogen Project Map of projects that have completed FEED and / or been shortlisted for public funding.

[9] https://www.gov.uk/Government/news/huge-boost-for-uk-green-industries-with-960-million-Government-investment-and-major-reform-of-power-network

2.0 Action plan elements

The purpose of this action plan is to identify key areas limiting the rollout of electrolytic hydrogen and offer a series of actionable recommendations for Government and other stakeholders, ensuring a proactive approach to the evolution of the UK's hydrogen economy.

This action plan covers 3 key areas of importance relating to the development of electrolytic hydrogen:

- **Section 2.1** focuses on electrolytic hydrogen production and delves into specific aspects of the LCHA, planning and consenting, and capital expenditure costs (CAPEX).
- **Section 2.2** covers electrolytic hydrogen use and ways in which it can be incentivised.
- The **final section 2.3** relates to the overarching topics of supply chain and skills development, and their importance to the rollout of electrolytic hydrogen.

Note that this is not a comprehensive overview of all challenges facing electrolytic hydrogen, and other key areas, such as transport and storage networks[10], have not been included as they have been highlighted in other HEA publications.

We commend the efforts and dedication of Government, and DESNZ in particular, to get hydrogen off the ground. The work to build our foundations has put the industry in a good position. Looking ahead, if we are to maximise our chances of achieving up to 6GW by 2030, and competing more effectively internationally, now is the time to address a number of issues within our policy framework. Early and robust action on the points described in this Paper will allow the UK to surge ahead with electrolytic hydrogen, accelerating the roll-out of green jobs, greater energy security and carbon reduction.

2.1 Production

Securing sufficient UK hydrogen production capacity is critical to facilitating a stable and growing supply of green hydrogen, and accelerating the growth of the hydrogen economy. Recognizing the immediate need for clean, flexible zero carbon technology, the Government has positioned electrolytic hydrogen as critical in accelerating the transition to Net Zero and greater energy security.

With our current target of at least 6GW of electrolytic hydrogen production capacity by 2030, the challenge now is less so about if the commitment to hydrogen is there and more so about how it will be achievable within the contexts of the timeline outlined by DESNZ. The extent to which the roadmap is attainable hinges on the way in which the Government delivers subsidy mechanisms and regulatory standards.

Our first set of recommendations relates to high-level considerations of the LCHA, while the subsequent sections explore specific areas of the LCHA in more detail, as well as other aspects of electrolytic hydrogen production.

[10]https://acrobat.adobe.com/id/urn:aaid:sc:EU:072a08ac-70ec-43b1-aa84-31624fbf887c

2.1.1 Low Carbon Hydrogen Standard/ Low Carbon Hydrogen Agreement

In order to ensure that hydrogen production in receipt of Government funding is genuinely low carbon, DESNZ has developed a Low Carbon Hydrogen Standard (LCHS), which limits final emissions to less than or equal 20gCO2e/MJLHV.[11] While this is a vital feature of the policy framework, at times the complexity of the LCHS risks overburdening the first wave of projects with rigorous regulation that will delay their Financial Investment Decisions (FID) and disincentivize investment.

An example of LCHS complexity is the LCHA, the front-end agreement of the LCHS, and the mechanism through which HPBM funding is delivered. Its underpinning standard terms and conditions are largely based on the UK Contract for Difference (CfD) scheme, where contracts can run to 100s of pages. Industry stakeholders previously noted the complexity of CfDs for wind and solar projects, and the LCHA is even more so - to the point that it can be disproportionately onerous for smaller electrolytic hydrogen facilities.

If electrolytic hydrogen is to be competitive, the associated risk for producers within the LCHA needs to be significantly reduced.

An aspect of the LCHA that requires urgent attention is the significant levels of open risk that producers are exposed to within the agreement. A substantial portion of this is volume risk, whereby a producer is unable to receive revenue support for qualifying units of hydrogen due to input limitations, operational failures, or reduced offtaker demand.

The LCHA specifies that it will offer producers volume support via a top-up amount (Sliding Scale Top Up Amount) when the total volumes qualifying for support are reduced by circumstances out with the producers control.[12] This will only take effect if the volumes sold drop below 50% of the volume that is expected for invoice (Reference Volume), before which a facility could suffer considerable economic losses without intervention. Strict criteria surrounding offtaker eligibility (see section below on Risk Taking Intermediaries) also increases the proportion of risk placed on producers and prohibits an effective way of mitigating volume risk.

If electrolytic hydrogen is to be competitive, the associated risk for producers within the LCHA needs to be significantly reduced. We praise the progress that DESNZ has made in stimulating hydrogen production through funding mechanisms of the HPBM and LCHA; yet, as is the case with any new policy framework, there must be the capacity for amendments.

Recommendations

- Develop a simplified and proportional adaption of the LCHS that is specific to electrolytic hydrogen, and reflects the particular attributes of this technology, such as approaches to accommodate projects at different scales.
- Increase the support threshold for the Sliding Scale Top Up Amount to reduce volume risk.

[11] https://assets.publishing.service.gov.uk/media/6584407fed3c3400133bfd47/uk-low-carbon-hydrogen-standard-v3-december-2023.pdf
[12] https://assets.publishing.service.gov.uk/media/64d380559865ab000dc8fad6/low-carbon-hydrogen-agreement-standard-terms-and-conditions.pdf

2.1.2 Production Sales Cap

The LCHA also imposes a 'LCHA Sales Cap', which is an overall limit on the total volume of hydrogen that can receive subsidy support, based on a specified volume forecasted across the 15-year contract.[13] Should the amount of hydrogen produced and sold exceed the LCHA Sales Cap before the 15 year contract is spent, LCHA support will automatically expire. Any hydrogen produced that does not qualify for LCHA support for whatever reason will not receive support but will still contribute to the total LCHA Sales Cap.

A 'Permitted Annual Sales Cap' also applies, which is 125% of the reference volume adjusted for the annual period. If the Permitted Annual Sales Cap is breached twice then the Low Carbon Contracts Company (LCCC) have the right to terminate the contract. Any volumes of hydrogen exceeding the 'Permitted Annual Sales Cap' will be considered non-qualifying volumes, meaning they will not receive LCHA support but will still contribute towards the overall LCHA Sales Cap.

A sales cap of this nature reduces the flexibility of electrolytic hydrogen producers in negotiating take or pay clauses or reacting to changes in offtaker demand. Producers with an LCHA would currently be unable to take on another newly arriving offtaker as the excess production would exceed the sales caps. In this scenario, all parties are at a loss, including the Government as it limits the pace at which the hydrogen economy can interconnect and expand. Sales caps must become more flexible, potentially through an amended strike price for additions to the Reference Volume.

Recommendations

- Increase the flexibility of the LCHA Sales Cap and the Annual Permitted Sales Cap via project-specific amendments to the strike price in order to allow for additional offtakers.

2.1.3 Risk Taking Intermediaries

Whilst electrolytic production remains in its infancy, allowing sufficient flexibility for the initial wave of projects will be crucial for securing an initial supply of hydrogen. Limiting the risks faced by the hydrogen producer is therefore key. Our members consider that the controlled eligibility of risk taking intermediaries (RTIs) within the LCHA would improve the financial security required by developers to ensure a bankable project.

RTIs are considered 'Non-Qualifying Offtakers' in the LCHA heads of terms[14], meaning that any producer supplying them with volumes of hydrogen would not receive HPBM funding due to concerns over the traceability of hydrogen and ensuring the best value for money for the taxpayer.[15] Yet, with the right measures in place, the benefits of allowing a controlled inclusion of RTIs for the hydrogen economy could outweigh any disbenefits associated with the indirect gains that RTIs might receive from selling HPBM subsidized hydrogen.

Hydrogen producers need as much offtake as possible to make their projects viable. If primary offtakers cannot take all the volume produced, then the project will under-produce and will either fail to deliver its expected returns (which will prevent further investment), or will have to increase its prices to offtakers. The eligibility of RTIs as offtakers within the HARs would allow producers to mitigate volume risk, which is crucial given that the LCHA requires producers to use almost exclusively renewable electricity of which production volumes are, to some extent, unpredictable.

The derisking benefits of RTIs are not limited to the single producer in question, and a single RTI could link a number of smaller offtakers and producers, thus improving the security of the whole supply chain. It would also encourage the formation of joint ventures between different areas of the supply chain, improving connectivity and collaboration, which will be key in determining the speed at which hydrogen ecosystems develop.

[13] https://assets.publishing.service.gov.uk/media/64d380559865ab000dc8fad6/low-carbon-hydrogen-agreement-standard-terms-and-conditions.pdf
[14] BEIS (December, 2022) https://assets.publishing.service.gov.uk/media/639c470f8fa8f5069707c0fe/Low_Carbon_Hydrogen_Production_Business_Model_Heads_of_Terms.pdf
[15] https://assets.publishing.service.gov.uk/media/657b0bcb0467eb001355f85a/hydrogen-application-round-2-market-engagement-govt-response.pdf

Whilst we note the Government's concern that allowing RTIs to resell subsidised hydrogen may not represent the best value for money, we feel it is necessary for stimulating the hydrogen economy and could be managed with price controls or limiting the volume sold to RTIs.

DESNZ has noted the need to continue to review its position on RTIs in future[16], both for existing contracts and for future allocation rounds, particularly while the hydrogen economy remains in its early stages of development. The HEA urges the Government to allow risk taking intermediaries to be considered as Qualifying Offtakers, so long as they comply with traceability requirements for the HPBM, as well as the DFT regulated RTFO / SAF Mandate schemes. Including RTIs will widen the choice of bankable offtakers willing to engage relatively early in a project lifecycle, particularly with regard to demand from the mobility sector.

Recommendations

- Reconsider the stance of RTIs as ineligible offtakers under the LCHA and introduce them in a limited and controlled capacity.
- Incorporate price controls and volume limitations to manage the inclusion of RTIs, and address concerns around value for money.
- At the very least, introduce an interim easement period where RTIs can be eligible for a number of years until the hydrogen economy establishes itself and volume risk decreases.

2.1.4 Temporal correlation

Electrolytic hydrogen is produced using either a combination of a purpose built renewable energy input and a grid supply, or an off-grid (co-located) setup. While co-located facilities are the simplest way to demonstrate that the electricity used to produce the hydrogen is 100% renewable, they require more investment to mitigate the intermittency issues of renewable electricity supply. As a result, the majority of first-wave electrolytic hydrogen projects include a grid connection to smooth their input electricity.

However, grid connections can become problematic for demonstrating compliance with the LCHS. To ensure compliance, the LCHS requires that a hydrogen production facility must have an 'Eligible Power Purchase Agreement' with the electricity generator or private network within which they must adhere to temporal correlation requirements.

The LCHS defines temporal correlation as the "requirement for a specific generator to evidence they are generating at least as much electricity during each Reporting Unit as is being claimed to be consumed by the Hydrogen Production Facility (or Electricity Storage System if applicable), factoring in any Transmission and Distribution losses".[17] This requires a hydrogen production facility to demonstrate the carbon footprint of the input electricity every 30 minutes by matching the metered generation data and the invoiced supply volumes per reporting unit. A weighted average of these 30 minute consignments is then taken over the course of a month.

The impact that such stringent temporal correlation has on the capital expenditure and operating costs of hydrogen developers can be significant. As the carbon footprint of grid electricity is typically equal to 100gCO2e/MJLHV, but can vary widely, producers are limited to a small amount of grid electricity, which restricts their flexibility and capacity utilization. The result is that CAPEX and OPEX costs soar as electrolysers are oversized and / or extra storage is added to ensure a steady output to the offtaker.

[16] https://assets.publishing.service.gov.uk/media/657b0bcb0467eb001355f85a/hydrogen-application-round-2-market-engagement-govt-response.pdf
[17] https://assets.publishing.service.gov.uk/media/6584407fed3c3400133bfd47/uk-low-carbon-hydrogen-standard-v3-december-2023.pdf

In the 2023 Hydrogen Champion Report, Jane Toogood advised the Government to ensure that "technical rules do not increase CAPEX cost of electrolytic hydrogen production."[18] It was noted how the CAPEX of an example project had been significantly increased by the UK temporal correlation regulation. Not only was extra storage needed to mitigate the intermittency of renewable electricity supply, but to fulfil their offtaker demand whilst operating at a restricted average load factor, the production facility would need to be considerably larger than needed otherwise.

In the interests of facilitating the rollout of renewable hydrogen production and incentivising investment, the UK temporal correlation regulation must be eased for early projects while production volumes are low and the hydrogen economy develops momentum. The inflated CAPEX / OPEX requirements linked to temporal correlation compliance, as well as the administrative challenges, are disadvantaging UK projects, particularly small-scale facilities, and the regulation is not consistent with that being adopted elsewhere internationally.

The HEA recommends that the LCHS compliance criteria be adjusted to require monitoring electricity input consignments on a monthly basis. This would align the UK with the European Commission's decision to only commence hourly matching from 2030.[19] We echo Jane Toogoods recommendation to "ease the temporal correlation rules for early rounds of electrolytic hydrogen production to reduce costs and allow projects to be right-sized."[20] Adopting a similar approach to mainland Europe will support both individual investment cases, and also enable UK projects to compete for capital internationally.

In the interests of facilitating the rollout of renewable hydrogen production and incentivising investment, the UK temporal correlation regulation must be eased for early projects while production volumes are low and the hydrogen economy develops momentum.

As a flexible approach to utilising electricity from the grid is essential for early sector growth, the carbon intensity of curtailed wind should be considered 0 in Version 4 of the LCHS. Version 3 currently states that curtailed wind electricity used by hydrogen production facilities has a regional electricity carbon intensity.[21] A carbon intensity of 0 would allow hydrogen producers to use more curtailed wind electricity (whilst still complying with the LCHS), which is otherwise costing the Government many £100 million to shut off.[22] While we recognise the concerns surrounding the traceability of curtailed electricity, we believe this could be resolved via metering and specific wind farm PPAs.

Recommendations

- Relax temporal correlation requirements to adopt a monthly metering basis until 2030 to reduce individual project cost and align with EU standards and increase international competitivity.
- Set the carbon intensity of curtailed wind at 0 in Version 4 of the LCHS, managing its traceability via metering and specific wind farm PPAs.

[18] https://assets.publishing.service.gov.uk/media/6564cfd7888c060013fa7db6/hydrogen-champion-recommendations-report.pdf
[19] https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/747085/EPRS_BRI(2023)747085_EN.pdf
[20] https://assets.publishing.service.gov.uk/media/6564cfd7888c060013fa7db6/hydrogen-champion-recommendations-report.pdf
[21] https://assets.publishing.service.gov.uk/media/6584407fed3c3400133bfd47/uk-low-carbon-hydrogen-standard-v3-december-2023.pdf
[22] https://carbontracker.org/britain-wastes-enough-wind-generation-to-power-1-million-homes/

2.1.5 Strike Price

Similar to the CfD scheme, the Strike Price contained within the LCHA is an agreed price per unit of hydrogen; it covers the cost of production plus an allowed return on investment and is weighted by the total hydrogen volumes expected over the 15-year contract. As shown in Figure 2, the amount payable from the LCCC to the producer (Difference Amount),[23] is determined by the difference between the price at which producers sell their hydrogen and the strike price, with the price of natural gas acting as floor. The Strike Price is expressed as £/MWh, and an average price of £241/MWh was agreed for HAR1 winners, weighted by the reference volumes of each project over the lifetime of the LCHA contract.[24]

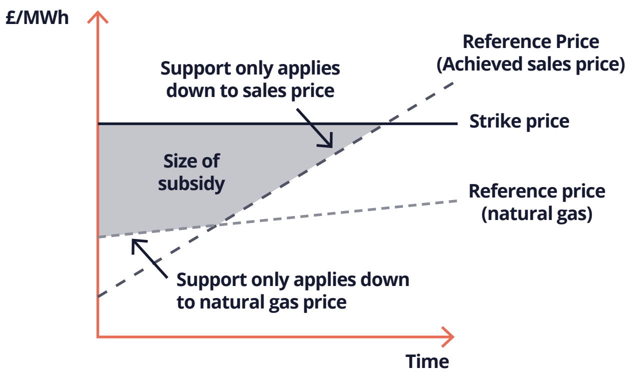

Figure 2. Strike price versus reference price in the Hydrogen Business Model[25]

Negotiating a suitable strike price over a 15-year contract is problematic as the economic context may change dramatically. While the Difference Amount will vary relative to the price of natural gas, hydrogen producers are still exposed to fluctuations in the price of electricity, which has historically been very volatile. As electrolytic hydrogen facilities rely entirely on electricity as an input, it is problematic that no allowance has been made to cover this risk.

In respects to long-term risk exposure, such as inflation, price adjustments to the Strike Price are included within the LCHA. For CCUS hydrogen production, the indexation of the Strike Price is tied to the price of natural gas, yet for electrolytic hydrogen producers, the indexation will be adjusted annually in line with the Consumer Price Index. While CPI indexation may shield electrolytic hydrogen producers from the general inflation of electricity prices, it offers no natural hedge against price fluctuations in the way that CCUS indexation does. Effectively, so long as CCUS hydrogen projects produce hydrogen, they are guaranteed to generate a profit, whereas this certainty is lacking for electrolytic hydrogen. As a result, electrolytic hydrogen producers will require more complex and costly pricing mechanics in the underlying PPAs in order to fix the price and mitigate this risk. To maintain a level of technology neutrality, the indexation of the electrolytic Strike Price should offer producers more optionality, or the same degree of certainty as with CCUS.

Recommendations

- Give electrolytic hydrogen producers the option of CPI Strike Price indexation or Strike Price indexation that is tied to electricity prices.
- Either allow electrolytic hydrogen producers more optionality around the indexation of the Strike Price or, at the very least, set it on equal terms with CCUS

[23] https://assets.publishing.service.gov.uk/media/64d380559865ab000dc8fad6/low-carbon-hydrogen-agreement-standard-terms-and-conditions.pdf
[24] https://www.gov.uk/Government/publications/hydrogen-production-business-model-net-zero-hydrogen-fund-shortlisted-projects/hydrogen-production-business-model-net-zero-hydrogen-fund-har1-successful-projects#fnref:1
[25] https://assets.publishing.service.gov.uk/media/611a801ae90e07054a62c4f8/Consultation_on_a_business_model_for_low_carbon_hydrogen.pdf

2.1.6 CAPEX Relief

It is generally the case that during the early stages of technology evolution, increased production delivers economies of scale and lower capital expenditure (CAPEX) for a given unit of output. However, in the case of low carbon hydrogen projects, a range of macro-economic issues such as high inflation, high interest rates, and supply chain disruptions, combined with regulatory constraints, have caused CAPEX requirements to remain high.[26] There has also been a tendency for the cost of the interconnections between the plant and nearby water, electricity, and offtake systems, which vary significantly by region, to be underestimated. The result, particularly for electrolytic hydrogen, is that the high CAPEX costs of production facilities limits the number of bankable projects reaching FID.

The Industrial Energy Transformation Fund (IETF) is a funding mechanism that supports industrial manufacturers seeking to deploy decarbonisation technologies, including providing study project support and upfront capital investment support for hydrogen offtakers to implement hydrogen fuel switching projects on their industrial sites. This is a particularly beneficial scheme that has the potential to address some of the aforementioned CAPEX challenges and it is hoped that with the HPBM making low carbon hydrogen an increasingly competitive option to decarbonise industrial sites, the number of hydrogen project applications to the IETF will increase. The £240 million Net Zero Hydrogen Fund (NZHF) is specific to low-carbon hydrogen projects and offers invaluable support to the CAPEX of electrolytic hydrogen projects, including £90 million towards HAR1 winners.[27]

While the IETF is a valuable scheme, it has limited funding and is not exclusive to hydrogen technology, and so will likely be reserved for the most suitable applications from the standpoint of Innovate UK. While the NZHF is specific to low-carbon hydrogen, it too has limited funding. To ensure that we bring forward electrolytic hydrogen production projects at various scales, the HEA recommends combining HAR and IETF funding with some form of temporary infrastructure tax break. This would be particularly beneficial in increasing the number of marginal projects becoming operational while the hydrogen economy is emerging. From the point where CAPEX decreases to a more manageable amount, normal taxation could be resumed.

The emphasis here is to do everything possible to make conditions as favourable for electrolytic hydrogen production during this pivotal early stage in the development of the hydrogen economy. It is worth noting that CAPEX support would also reduce downstream costs for the whole supply chain.

Recommendations

- Introduce temporary CAPEX support for electrolytic hydrogen production projects, potentially with the use of tax relief, until costs decrease to a more manageable level.
- Increase the accessibility of IETF funding for electrolytic hydrogen projects.
- Expand the funding available under the NZHF or develop a subsequent scheme.

2.1.7 Planning and consenting

It is clear that electrolytic hydrogen will have a profoundly positive net impact on the environment due to the emission reductions it will facilitate. Yet planning applications and environmental permitting processes have not kept pace with the new technological considerations that electrolytic production facilities present.

Producers and developers are obligated to have “robust integrated environmental assessments in place and to comply with the regulatory regime for environmental issues”,[28] yet there is currently no existing best available techniques reference documents (BRefs) that relate specifically to electrolytic hydrogen production. The consenting regimes within the Town and Country Planning Act (TCPA) 1990[29] and Planning Act 2008[30] that

[26] file:///C:/Users/gwool/Downloads/3048_Forecasting%20H2%20Cost%20Decreases_whitepaper_20231128.pdf
[27] https://www.gov.uk/Government/publications/hydrogen-production-business-model-net-zero-hydrogen-fund-shortlisted-projects/hydrogen-production-business-model-net-zero-hydrogen-fund-har1-successful-projects
[28] https://assets.publishing.service.gov.uk/media/659c04aad7737c000df3356d/hydrogen-production-delivery-roadmap.pdf
[29] https://www.legislation.gov.uk/ukpga/1990/8/contents
[30] https://www.legislation.gov.uk/ukpga/2008/29/contents

are applicable to gas processing, electrical infrastructure and environmental protection are a fragmented framework within which to progress a hydrogen application. The National Planning Policy Framework (NPPF) and supplementary policy notes are equally unsuitable as they contain no reference to hydrogen.

The UK 'Environmental Regulators', comprised of the Environmental Agency and Welsh, Scottish, and Irish equivalents, are drafting a 'Guidance on emerging techniques for hydrogen production by electrolysis of water'. While this guidance is a welcome interim step towards formalizing a BRef for electrolytic hydrogen production, the recommendations do not differentiate between project size, which is problematic for smaller production facilities for whom the environmental considerations become disproportionate.

The stringency of environmental permitting for hydrogen projects should not only be proportional to project size, but should also reflect the significantly lower carbon impact relative to fossil fuel alternatives. Increasing the complexity of the consenting process for electrolytic hydrogen facilities should be approached with caution to avoid slowing planning applications for smaller projects with a relatively minimal environmental impact.

Creating a standardized, yet proportional, framework for consenting electrolytic hydrogen facilities should be a Government priority and should align with the work that the British Standards Institute (BSI) and the Health and Safety Executive (HSE) are doing to create hydrogen safety standards. In the meantime, current planning frameworks including the NPPF and TCPA should be updated to include definitions of low-carbon and electrolytic hydrogen.

In spite of any developments in legislation, a fundamental barrier in the planning and permitting processes is a lack of knowledge and understanding at the local authority level. It would be beneficial for the Government to adopt a strategy of distributing targeted and accessible information to local councils and planning authorities to ensure they have sufficient information about hydrogen to make swift and informed planning decisions.

Due to the relative sensitivity surrounding hydrogen technology, particularly in terms of public perception, producers are actively seeking more guidance in the planning and permitting space to prevent any incidents that might exacerbate any concerns about hydrogen. What is needed now is more leadership from Government bodies.

Recommendations

- Incorporate a proportional criteria for electrolytic hydrogen projects in the 'Guidance on emerging techniques for hydrogen production by electrolysis of water' and any subsequent BRef documents. Rather than electrolyser capacity, this could be determined by inputs and outputs such as water usage / discharge and emissions to air / water / ground.
- Prioritize the development of electrolytic hydrogen specific BRef documents that align with the work that the BSI and HSE are doing to create hydrogen safety standards.
- Adopt a strategy of distributing targeted and accessible information to local councils and planning authorities to ensure they have sufficient information about hydrogen to make swift and informed planning decision
- Update current planning frameworks such as the NPPF and TCPA to include a definition of low-carbon and electrolytic hydrogen.
- Focus on increasing the capacity of the planning and consenting system.

2.2 Demand

According to research conducted by DESNZ, UK hydrogen demand is set to increase exponentially from minimal levels in 2022 up to as much as 500 TWh in 2050 - a similar scale to the UK's existing electricity use.[31] The extent to which this demand can be effectively aligned with production, whilst accelerating the pace of rollout, will determine the success of the hydrogen economy on a national and an international scale. The societal changes necessary for an uptake of this degree cannot be emphasized enough.

If the UK is to achieve this level of system transformation in the context of energy production and use, it is crucial to ensure that production and demand are aligned. The Hydrogen Transport and Storage Networks Pathway released by DESNZ in December 2023 presented the Government's latest view as to where, when, and for what purposes early hydrogen demand will materialise, as well as providing estimate ranges for demand across key sectors in 2030, 2035, 2050.[32]

The Hydrogen Strategy Delivery Update, also published in December, offered more detail on what steps the Government is currently taking to promote demand for hydrogen across key sectors in the UK.[33] Specific funding such as the Industrial Energy Transformation Fund (IETF) (industry), the Red Diesel Replacement Competition (construction/mining) or the Advanced Fuels Fund (aviation) are referenced as progress in stimulating demand. While these funding schemes are good incentives to stimulate the adoption of low carbon hydrogen, and it is hoped that more will become available, end uses or consumers of hydrogen are ultimately unlikely to switch unless it is economically viable or they have no choice. The UK needs a coordinated and cross-sectoral approach which links the scale up of hydrogen demand with the roll-out of production and the development of transportation and storage infrastructure.

The ultimate challenge with hydrogen demand is how users can be incentivized to switch from fossil fuels to hydrogen, and in doing so trust an emerging technology to provide a reliable supply of energy.

By way of example, DESNZ has stated that there could be as much as 30 TWh of hydrogen demand for power by 2035 and yet, besides a hydrogen for power consultation, there has been little certainty as to where this demand will come from.

The ultimate challenge with hydrogen demand is how users can be incentivized to switch from fossil fuels to hydrogen, and in doing so trust an emerging technology to provide a reliable supply of energy. This barrier is one that requires Government support to overcome and one which has received relatively less consideration. The HEA would encourage the Government to adopt a more high-level and holistic strategy for stimulating hydrogen demand in the UK, including green incentives and tax relief for end users wherever possible to make the switch to hydrogen as attractive as possible.

While greater clarity around the strategic use of hydrogen blending as an 'offtaker of last resort' does not specifically incentivise users to switch to hydrogen, as detailed below it is an aspect of hydrogen use that can mitigate risk in the electrolytic value chain.

[31] https://assets.publishing.service.gov.uk/media/65841578ed3c3400133bfcf7/hydrogen-strategy-update-to-market-december-2023.pdf
[32] https://assets.publishing.service.gov.uk/media/657ad276095987000d95e0ad/hydrogen-transport-and-storage-networks-pathway.pdf
[33] https://assets.publishing.service.gov.uk/media/65841578ed3c3400133bfcf7/hydrogen-strategy-update-to-market-december-2023.pdf

2.2.1 Climate Change Levy

The Climate Change Levy (CCL) is effectively an environmental tax charged on the energy consumed by end users and is designed to encourage businesses to operate more efficiently and reduce their overall emissions. As of 1st April 2024, the main CCL rate for gas, as well as electricity consumption, will be £7.75/MWh.[34] Certain users are exempt from the main rate, such as businesses that use small amounts of energy, domestic energy users, and road fuel and other oils that are already subject to excise duty.

A reduced rate of CCL is paid by an energy intensive business that has entered into a Climate Change Agreement (CCA) with the Environment Agency, and this can include a 92% reduction of the CCL for electricity input and 86% reduction for gas, coal, and other solid fossil fuels. Such energy intensive businesses are within hard-to-abate industries that are suitable for hydrogen fuel switching solutions. Yet, currently, the LCHA wording means that a facility switching to electrolytic hydrogen fuel would be subject to CCL charges for input electricity. Essentially, this means that end users switching to burn hydrogen, rather than natural gas, will face an additional charge. The scale at which these facilities operate means that CCL charges becomes a significant OPEX cost, making hydrogen a less feasible solution.

Under the HPBM, hydrogen is intended to be sold at the natural gas price, yet with the CCL it becomes evident that hydrogen is not at parity with natural gas but rather is £7.75 / MWh more expensive. Allowing energy intensive businesses using hydrogen to remain exempt from CCL charges in order to incentivise fuel switches by reducing electricity charges helps to address this.

As not all customers are in this situation, a strike price adjustment for any volumes sold to customers who previously had a CCA would ensure they are recompensed for the additional charge, without the need for CCL exemption. Large industrial users, such as chemical or cement facilities, may be cautious about hydrogen as an emerging technology; making the fuel switch as financially attractive as possible relative to less green solutions is crucial to stimulate demand.

Recommendations

- Allow energy intensive businesses using hydrogen to remain exempt from CCL charges in order to incentivise fuel switches by reducing electricity charges.
- Alternatively, include a strike price adjustment for any volumes sold to customers who previously had a CCA.

2.2.2 Non-Commodity Cost relief

Alongside the cost of consuming the physical energy commodity itself, the non-commodity consumer costs associated with the management and delivery of energy represent an area in which hydrogen demand would benefit from easements.

Non-commodity costs include charges for transmission and distribution, operational costs, system balancing, and environmental levies. As the UK pushes for Net Zero, these costs are rising due to a number of factors including grid infrastructure upgrades, increasing demand fluctuations, increasing number of environmental levies (which are often funded through these charges), and regulatory changes.

Similar to aforementioned CCL exemption, the Government devised the Energy Intensive Industries (EII) Renewable Levy Exemption to protect large scale UK energy users from overseas competition, carbon leakage, and job loss by shielding businesses from some non-commodity costs. For eligible energy intensive businesses, the EII exemption scheme provides financial relief of up to 85% from the indirect costs the Renewables Obligation (RO), the Contracts for Difference (CfD), and Feed in Tariff (FIT) schemes, which are funded as non-commodity costs in the electricity bills of consumers.[35]

For energy intensive businesses looking to switch to hydrogen as a fuel source, it is crucial that there is no change in their eligibility for the EII exemption scheme - the non-commodity cost associated with the extra electricity needed for a co-located electrolytic hydrogen production would be costly.

[34] https://www.gov.uk/guidance/climate-change-levy-rates
[35] https://assets.publishing.service.gov.uk/media/64492698814c66000c8d0709/cfd-ro-fit-exemption-guidance.pdf

At the start of 2023, the Government announced the British Industry Supercharger (BIS), under which the available relief available in EII exemption scheme will rise to as much as 100% for eligible businesses, starting from April 2024.[36] To ensure that hydrogen fuel switching is as feasible as possible, intensive energy businesses looking to do so should be prioritized and / or fast-tacked through the eligibility criteria to qualify for 100% relief from non-commodity costs.

The Government should consider introducing a similar exemption mechanism for the non-commodity costs of independent, large scale electrolytic hydrogen facilities.

The BIS also introduced a further Network Charging Compensation (NCC) Scheme, which offers EIIs 60% compensation on eligible network charging costs. Eligibility for this compensation is contingent upon an EII holding a valid EII Exemption Scheme certificate. As the cost of EII exemptions would be funded by an increase in costs for non-EII businesses, it must be ensured that this does not result in inflated costs for non-qualifying electrolytic hydrogen facilities. The Government should consider introducing a similar exemption mechanism for the non-commodity costs of independent, large scale electrolytic hydrogen facilities. This could further stimulate hydrogen demand by allowing more room for negotiation in the pricing of offtake agreements with hydrogen end users.

Research undertaken by Ofgem found that UK EIIs were subject to electricity prices that were 50% higher than their equivalent competitors in France and Germany between 2016 and 2020[37], even when accounting for all other support available to UK EIIs. Not only does this highlight the scale of the issue facing the UK, but it stresses the need for non-commodity cost relief for any EIIs incorporating electrolytic hydrogen solutions, which may often be vertically integrated and require large electricity inputs.

Recommendations

- Ensure that EIIs incorporating electrolytic hydrogen solutions remain eligible for and are prioritized under the EIIs Renewable Levy Exemption.
- Ensure that the increase of EII exemption relief to 100% in April 2024 does not increase electricity costs for electrolytic hydrogen production facilities unrelated to the EII scheme.
- Develop an electrolytic hydrogen specific equivalent of the EIIs exemption and the NCC scheme to shield electrolytic hydrogen producers from non-commodity costs and grid charging costs

2.2.3 Hydrogen blending

In December 2023, Government announced the strategic policy decision to support blending of up to 20% hydrogen by volume into GB gas distribution networks, depending on the outcome of ongoing industry trials.[38]

The announcement noted that targeted blending would support electrolytic hydrogen production by reducing risk at a project and energy system level. Allowing hydrogen blending to function as an ‘offtaker of last resort’ would reduce the volume risk borne by producers unable to sell sufficient volumes of hydrogen. It could also reduce cross-chain volume risks associated with hydrogen transport and storage infrastructure by acting as an interim offtaker if project operationality dates become misaligned or delayed. Wider system benefits of blending hydrogen produced by electrolytic hydrogen facilities could also be realized in geographies where the input electricity may otherwise have been curtailed. While we agree that blending could have benefits for risk reduction and wider energy system efficiency, it should be stressed that it must be implemented in a selective and limited manner to avoid detracting supply from demand centres.

[36]https://www.gov.uk/Government/consultations/british-industry-supercharger-network-charging-compensation-scheme/outcome/Government-response-british-industry-supercharger-network-charging-compensation-scheme
[37]https://www.ofgem.gov.uk/sites/default/files/2021-07/Final%20report-%20Research%20into%20GB%20electricity%20prices%20for%20EnergyIntensive%20Industries.pdf
[38]https://assets.publishing.service.gov.uk/media/6579c4c1254aaa000d050c78/hydrogen-blending-into-gb-gas-distribution-networks-government-response.pdf

If strategic locations of high curtailment were identified for electrolytic hydrogen blending it would risk distorting the offtaker market by drawing too much investment from direct end users for whom hydrogen is key for decarbonization.

Introducing blending as an 'offtaker of last resort' for any successful HAR projects where volume risk arises could be a controlled first step. As these electrolytic projects are covered under the LCHA, amendments could be made to include blending volumes within the HBPM revenue funding, potentially including a top-up on gas prices. Following this, a detailed economic analysis could be conducted to identify wider support mechanisms into which blending could be incorporated as an offtaker of last resort.

A swift introduction of targeted blending could also reduce the electrolytic production risk in the short term while the transport and storage network is in its early stages of development.

We urge that a decision on blending be made as soon as possible to reduce uncertainty among developers and producers, thus accelerating project development and FID by limiting investment risk.

Recommendations

- Accelerate decision making on the extent to which hydrogen blending will be permitted and update the market at the earliest opportunity.
- Conduct a detailed economic analysis to explore viable options for revenue support mechanisms for blending as an offtaker of last resort. Introduce blending initially as an offtaker of last resort for HAR winners, where necessary, and include blended volumes in revenue support under the HPBM.

2.3 Hydrogen supply chain and skills development

2.3.1 Domestic and international supply chains

Ensuring the UK has strong, home-grown hydrogen supply chains will be crucial if it is to compete internationally and play a leading role in the global hydrogen economy. The Government must first leverage and support the UK's collective industry expertise to maximise domestic supply chain capabilities and requirements.

The HEA urges that a sufficient a portion of the GIGA funding be designated to developing hydrogen supply chains to ensure the UK is an attractive place for manufacturing hydrogen technologies, as well as research and development. As the hydrogen economy begins to accelerate, we are at a critical point where manufacturing, infrastructure, and technology innovation will need to expand and improve rapidly.

If the UK is not proactive in fostering this expansion domestically, it will lose the economic and employment benefits that large corporations bring. The Government should offer hydrogen manufacturing companies financial relief to maintain competitivity, as well as provide favourable regulatory conditions.

Emphasis must be placed on utilizing and adapting the existing energy supply chains in the UK, and in this regard the HEA welcomes the North Sea Transition Deal, which supports workers, businesses, and the supply chain through a transition to a net zero future by harnessing the industry's existing capabilities, infrastructure and private investment potential to exploit new and emerging technologies, including hydrogen production and CCUS.

The development of a hydrogen transport and storage network is a fundamentally important for strengthening local and regional supply chains by increasing jobs and investment across the UK, ultimately creating self-sufficient hydrogen ecosystems. The HEA welcomes the hydrogen transport and storage business models (HTBM/HSBM) being developed by DESNZ. In the proposed HSBM assessment criteria, 15% is weighted for the 'economic benefits' of projects, which includes investment into skills, security of supply, and contributing to the development of hydrogen supply chains. If the UK is to secure domestic hydrogen supply chains at pace, this should be reflected in the LCHA by increasing the weighting of economic benefits in the HSBM, as well as the 'wider economic benefits' in the HTBM.

As a world leader in offshore wind energy, the UK has a chance to use offshore hydrogen production to position itself at the forefront of the growing international hydrogen market via inward investment, increasing trade opportunities, and increasing energy security.

Local cluster initiatives are a very effective way of expanding all aspects of the supply chain and forming hydrogen ecosystems, such as evolving in the East Coast Cluster and the Hynet initiative. That said, electrolytic hydrogen projects located in distributed areas have a crucial role to play in strengthening local supply chains, particularly if supported by efficient transport and storage networks that connect to regional supply chains and demand centres. This is especially the case for offshore wind production, of which the UK plans to deploy 50 GW of capacity by 2030.[39] Due to the high costs and losses associated with transmission, as well as potentially high curtailment rates in summer months, electrolytic hydrogen production could be a viable option to co-locate with offshore wind turbines and maximise offshore capacity and efficiency.[40]

Using existing port infrastructure, offshore electrolytic hydrogen production would strengthen and diversify the supply chain by increasing the connectivity and accessibility to distributed geographies through which labour and investment can flow.

As a world leader in offshore wind energy, the UK has a chance to use offshore hydrogen production to position itself at the forefront of the growing international hydrogen market via inward investment, increasing trade opportunities, and increasing energy security.

To make this a reality though the Government must first strengthen the domestic supply chain of manufacturing, skilled labour, innovation, and private investment, that can foster the domestic supply chains that can stimulate the acceleration of the offshore hydrogen industry.

Recommendations

- Ensure the £390 million of GIGA funding allocated to CCUS and hydrogen is widely accessible to a variety of electrolytic hydrogen projects to increase the supply chain coverage.
- Provide financial relief for electrolytic hydrogen manufacturing and innovation.
- Maximize the utilization of existing supply chain capabilities where possible, such as from the offshore oil and gas industry.
- Increase the weighting of 'economic benefits' in the proposed HSBM assessment and align this figure with the upcoming HTBM assessment criteria.
- Focus on establishing a domestic supply chain to support the deployment of electrolytic hydrogen production and, ultimately, establishing new export opportunities.

[39]https://www.gov.uk/Government/publications/british-energy-security-strategy/british-energy-security-strategy
[40]ttps://assets.publishing.service.gov.uk/media/64f82aed9ee0f2000db7bf35/offshore-hydrogen-regulation-government-response.pdf

2.3.2 Skills development

The limited availability of skilled labour within the hydrogen sector is an increasingly urgent consideration; failure to address this issue now will result in sector-wide shortages and supply chain disruption that will inevitably constrain the pace at which the UK hydrogen economy can develop.

The HEA welcomes the Government's creation of the Green Jobs Delivery Group, which acts as the central forum for continued action on green jobs and skills. It will produce a Net Zero and Nature Workforce Action Plan in 2024, within which DESNZ is tasked with undertaking a workforce assessment to identify the key challenges facing skills availability in the hydrogen sector and the interventions that are needed. To support this work, the HEA has been working with the Hydrogen Skills Alliance (HSA) to identify the challenges associated with hydrogen skills. 84% of employers noted an insufficient number of skilled workers for hydrogen and, 61% said this is impacting their ability to scale up. New technology demands, uncertainty of supply chain skills requirements, and limited sector and technology awareness are all contributing to an increasing shortage of skilled hydrogen labour and a lack of investment in the training pipeline.

While developing a hydrogen workforce is unique in the sense that it has to be built from scratch and at unprecedented pace, it has the advantage of skills transferability from the existing oil and gas industry. As the UK fossil fuel industry transitions, the Government should allocate sufficient funding for up-skilling and retraining, as well as collaborating with the Department for Education (DfE), devolved administrations, and the Institute for Apprenticeships and Technical Education (IFATE) to create clear career transition pathways. The HEA supports the work that the North Sea Transition Authority is doing with Government on an Integrated People and Skills Strategy to ensure the highly skilled oil and gas workforce can be deployed to adjacent energy sectors to "create a joined-up approach to people and skills right across the offshore energy industry".[42]

Shortages are already visible in the hydrogen sector and this will only intensify once the backlog of electrolytic hydrogen projects enter the construction and operation phases. Electrolytic hydrogen production will require a whole spectrum of roles and skills, including the operation, servicing and maintenance of the electrolyser and Balance of Plant (BoP) technologies, the transmission, transportation and storage of hydrogen, as well as the servicing of end user applications (e.g. fuel cells).

To mitigate intensifying downstream shortages, it is essential that Government invests in ways to strengthen the pipeline of new and existing talent into the hydrogen industry. The HEA supports the HSA's recommendation for the Government to fund a 'Holistic Hydrogen Talent Pipeline' and a 'National Hydrogen Skills Training Programme' to ensure there are the relevant and appropriate routes within educational systems for new recruits, from school to University.

All efforts to increase the security of the hydrogen workforce must also be complemented by an effort to increase sector awareness to educate and inform people of the safety, accessibility and profitability of the hydrogen sector. Failure to improve the public perception of hydrogen will counteract any initiatives to improve the pipeline of talent and will result in limited educational and training uptake. A comprehensive gap analysis of curriculum should precede efforts to stimulate a talent pipeline so that suitable areas where hydrogen awareness, education and training could be successfully incorporated can be identified.

84% of employers noted an insufficient number of skilled workers for hydrogen and, 61% said this is impacting their ability to scale up.

[42]https://www.offshoreenergypeopleandskills.co.uk/

The hydrogen skills shortage represents a significant challenge as it requires upskilling and training for technologies in a very short timescale. There is no margin for error; any bad headlines caused by inadequately trained workforce or poorly designed equipment could kill the industry. The fact that hydrogen skills are already a Government and industry priority is cause for optimism, but if it is not addressed now, retrospective action will prove very difficult.

Recommendations

- Undertake a gap analysis of curriculum to identify suitable areas where hydrogen awareness, education and training could be successfully incorporated.
- Allocate sufficient funding for up-skilling and retraining, as well as collaborating with educational initiatives and institutions to create clear career transition pathways.
- Fund a 'Holistic Hydrogen Talent Pipeline' and a 'National Hydrogen Skills Training Programme' to ensure a pipeline of new and existing talent.

3.0 Next Steps

Addressing the areas of electrolytic hydrogen production, demand and supply chain development described in this Action Plan will help the UK hydrogen economy to accelerate at the pace needed to reach the target of up to 6GW of production by 2030, and allow the UK to capitalize on the long-term economic benefits of supporting this industry.

Some initial simplification of requirements and removal of barriers whilst we are at the early stages will allow the UK to reap the benefits of being at the forefront of the global industry with minimal risk.

If the UK is to deliver a world leading hydrogen economy, the Government must continue to act proactively in its hydrogen strategy and the recommendations above present an opportunity to do so by streamlining the rollout of electrolytic hydrogen capacity and usage.

Following the publication of this Electrolytic Hydrogen Action Plan, we will work with Government and other stakeholders to take forward our recommendations to optimise outcomes for electrolytic hydrogen and facilitate the rollout of the hydrogen economy more broadly. We will look to stimulate progress through dialogue with relevant policy leads and work in partnership where appropriate.

We welcome any external engagement with this document and look forward to working with Government and other stakeholders on our recommendations.

Hydrogen
Energy
Association