# Written Evidence Submitted by UK Hydrogen and Fuel Cell Association (HNZ0011)

## Summary


The key messages from our response are as follows:

- Recognising the role of hydrogen in delivering net zero, many countries have announced ambitious plans for hydrogen, with Australia, Japan, South Korea, Canada, China, Norway, Germany, Portugal, The Netherlands, Spain and France all having Hydrogen Strategies and plans in place. Without rapid and ambitious progress, the UK is at substantial risk of falling behind.

- More broadly, hydrogen and fuel cells offer a pathway to revitalise manufacturing capabilities in the UK and improve the skill base for workers. The UK was a leader in discovering hydrogen and creating fuel cells, and today has several world leading manufacturers and supply chain businesses that with the right support could become global leaders and engines of economic growth for the UK economy.

- UK industry is committed to investment at scale for both blue and green hydrogen production where viable commercial cases for either can be established, and we recommend that Government's low carbon hydrogen production target for 2030 be raised to 25GW.

- Investment is needed now to both scale up supply and stimulate demand. It should encompass and reflect the full range of opportunities for hydrogen including transport, heat, industrial decarbonisation and adaptable distributed power, and include business models and a policy framework to incentivise supply and demand and kick-start the switch to low carbon hydrogen.


## About the UK HFCA

The UK Hydrogen & Fuel Cell Association is the oldest and largest pan UK association, dedicated to supporting stakeholders across the entire value chain of both the Hydrogen sector and the Fuel Cell industry. Our members represent over 200,000 employees globally, with combined revenues over £400 billion, and cover the entire value chain from raw material sourcing, to supply chain and components, financing, professional services, B2B and consumer facing solutions. With over 15 years of experience, the UK HFCA is a leader in advocating for and accelerating the transition to Net Zero in the UK through the deployment of hydrogen & fuel cell solutions.

## Responses to Inquiry Questions

### 1. The suitability of the Government's announced plans for "Driving the Growth of Low Carbon Hydrogen", including:

- **the focus, scale and timescales of the proposed measures;**
- **how the proposed measures—and any other recommended measures—could best be co-ordinated;**

- **the dependency of the Government's proposed plans on carbon capture and storage, any risks associated with this and how any risks should be mitigated; and**
- **potential business models that could attract private investment and stimulate widespread adoption of hydrogen as a Net Zero fuel.**

- Many countries have announced ambitious plans for hydrogen, with Australia, Japan, South Korea, Canada, China, Norway, Germany, Portugal, The Netherlands, Spain and France all having Hydrogen Strategies and plans in place. At the European level, there are targets of 6GW of electrolyser capacity by 2024 and 40GW by 2030. Whilst we support the Government's recently announced target of 5GW low carbon hydrogen production by 2030, we believe that there is scope for greater ambition. UK industry is committed to investment at scale for both blue and green hydrogen production where viable commercial cases for either can be established, and we recommend that the target be raised to 25GW. Without rapid and ambitious progress, the UK is at substantial risk of falling behind. It will be important to embrace and encourage all forms of low carbon hydrogen in the near term (to 2025) to kick start the UK hydrogen economy as a key component of the net zero transition, with a subsequent shift to net zero / zero emission hydrogen by 2040-2050.

- As an example of the short-term progress needed, given the UK's world leading position in offshore wind and aspiration to stay ahead with this, there is a need for immediate action to ensure that the next round of off-shore wind investment is made ready for the hydrogen economy (and vice-versa as these clean energy technologies are mutually compatible).

- There is a specific need to clarify how industry can work alongside Government to invest, and how the risks associated with substantial scale-up can be minimised for all parties.

- With regard to plans around CCUS, key risks are the abandonment of funding streams and poor business model construction, both of which would be critical to the role of blue hydrogen. Moreover, this would have much wider implications for the UK's Net Zero target than just the hydrogen production capacity. At a practical level, whilst the development of CCUS and hydrogen business models is being lead within the same team in BEIS - which should help to ensure that the implications of one for the other is understood - the disconnect on timing is of concern. We would welcome accelerated progress on the business models for hydrogen to ensure compatibility.

- Investment is needed now to both scale up supply and stimulate demand. It should encompass and reflect the full range of opportunities for hydrogen including transport, heat, industrial decarbonisation and adaptable distributed power. More detailed recommendations are provided in Appendix A.

- The establishment of the BEIS Hydrogen Economy Team has been a welcome development to provide a focus within BEIS for hydrogen activity. However, with hydrogen's whole system role in the transition to net zero, there is now a strong need for wider co-ordination. We recommend both a cross departmental Taskforce and a Minister with sole responsibility as key next steps.

### 2. The progress of recent and ongoing trials of hydrogen in the UK and abroad, and the next steps to most effectively build on this progress

We would describe the Government's current approach to investment in hydrogen technology as fragmented and, to a large degree, short term in nature. For example, whilst Hy4Heat is doing commendable work to explore the practical considerations around the role for hydrogen in decarbonising heat, there is no apparent pathway beyond the current suite of activities. Clear next steps need to be defined, including trials for industrial heat, and wider communication of the path to decarbonisation of heat through hydrogen.

On the transport side, the UK's small investment in hydrogen mobility has amounted to ~£21 million since 2014, a fraction of that committed for EVs, and with forward plans being similarly unambitious. A recent report from Ballard and Deloitte also found that "*UK Government support for hydrogen and the fuel cell market was less consistent and coordinated compared with other European countries*"[1]. Appendix A includes specific policy recommendations to stimulate progress.

The UK Hydrogen Strategy should include a Roadmap for the roll-out of hydrogen and fuel cells to deliver the transition to net zero. This should include recognition of the particular infrastructure benefits of hydrogen and fuel cells compared to an all-electrification route – see also Question 6.

### 3. The engineering and commercial challenges associated with using hydrogen as a fuel, including production, storage, distribution and metrology, and how the Government could best address these

The key commercial challenge is cost, and there is a need for business models and a policy framework to incentivise supply and demand and kick-start the switch to low carbon hydrogen. Solutions include short-term support and policy levers / investable funding mechanisms needed to build capacity and reduce cost (for example, a direct production price support such as a Feed-in-tariff, and / or Contracts for Difference (CfD)), as well as more specific measures, such as extension of the RTFO for transport modes other than cars, allowing hydrogen to qualify for the green gas levy etc.

There are also practical challenges around the development / adaptation of safety regulations and standards, public safety misconceptions and overcoming the limitations of hydrogen's energy density, such as storage, compression etc. The former include the development of a robust and commercially viable UK/ISO specification for pipework used with hydrogen (including tube fittings/mechanical joints, tubing and components such as valves, filters, pressure measurement devices etc based on safety, training, quality and defined material chemistry) and the development of hydrogen system metrology (including measurement of flow, pressure and gas analysis and sampling).

In overcoming engineering challenges, there are opportunities to both utilise the extensive experience and consultancy expertise of existing manufacturers who have been involved in many hydrogen applications in relation to safety, performance and design standards, and to build on current specifications used in hydrogen such as EC-79 for on-vehicle applications as so not to 'reinvent the wheel'.

### 4. The infrastructure that hydrogen as a Net Zero fuel will require in the short- and longer-term, and any associated risks and opportunities

Much early hydrogen infrastructure development will be focused in regions of the UK covered by the 'levelling up' agenda, with decarbonisation of industrial clusters via hydrogen in areas

[1] https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/finance/deloitte-cn-fueling-the-future-of-mobility-en-200101.pdf

such as the Humber, North East and North West. These clusters can then form the focus for further hydrogen infrastructure development, for example in transport. As infrastructure evolves there will be a shift from localised production and dispensing to a pipeline network, including a role for the gas grid.

## 5. Cost-benefit analysis of using hydrogen to meet Net Zero as well as the potential environmental impact of technologies required for its widespread use

Aurora's 'Hydrogen for a Net Zero BG' study considers the range of costs involved in ensuring that hydrogen and fuel cells fulfil their potential role in delivering net zero and highlights the importance of risk-hedging policies in reducing cost of capital of heavily frontloaded investments, such as hydrogen supply. Balanced against these costs, there is not only the clear path to net zero, but also a range of other system benefits such as '*increase the low-carbon power value pool by reducing and shortening low price periods and minimising both economic and system curtailment, which could be used to produce green Hydrogen'*. Other factors to consider include the opportunity for hydrogen distribution via the gas grid, or local production and use, as opposed to the major investment and disruption linked to full electrification – grid reinforcement, new local cabling etc. Combining solutions to maximise the overall efficiencies of power and heat output from hydrogen and fuel cells represents a cost-effective way forward and will accelerate progress in cost reduction and scale-up.

## 6. The relative advantages and disadvantages of hydrogen compared to other low-carbon options (such as electrification or heat networks), the applications for which hydrogen should be prioritised and why, and how any uncertainty in the optimal technology should be managed.

There is widespread global recognition of the role for hydrogen in delivering both net zero and clean growth and exports – see Appendix 2 for further details. Key application areas include industry, heavy transport and heat. In all of these, hydrogen is seen as the main route to cost-effective decarbonisation.

There are major technical and economic hurdles to meeting the UK's Net Zero goals without hydrogen, particularly for heating and transport applications. The country's gas grid supplies 3x more energy than the electricity grid today[2], and the transport sector accounted for over 1/3rd of final energy consumption in 2019[3]. Whilst there is significant renewable power generation potential in the UK, notably from offshore wind, electrifying all heating and transport is likely to be an unsurmountable challenge by 2050. Mass electrification would require an overhaul of the current electrical energy system, and massive scale up of batteries, improved transmission systems and smart metering. Alternatively, hydrogen can be integrated into current energy distribution and end-use systems and utilize high renewables potential in the UK by converting green electrons into green molecules, that can be widely transported and stored seasonally, making use of existing gas infrastructure.

More broadly, hydrogen and fuel cells offer a pathway to revitalise manufacturing capabilities in the UK and improve the skill base for workers. The UK was a leader in discovering hydrogen and creating fuel cells, and today has several world leading manufacturers and supply chain

[2] ARUP, 2019 speech at the World Energy Council
[3] DUKES, 2019, page 5
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820277/DUKES_2019_Press_Notice_GOV.UK.pdf

businesses that with the right support could become global leaders and engines of economic growth for the UK economy.

Looking ahead, some of the challenges facing hydrogen are quite similar to those in the electricity space; thus, once fed into a network / grid, the origin of the hydrogen (fossil fuels, renewables) is not apparent. As such, there are lessons that can be learned from the experience of efforts to decarbonise electricity, including incentives, opportunity costs, the need to avoid incompatibilities between power markets and subsidy regimes etc.

The three sectors with the greatest potential decarbonisation opportunities via hydrogen are:

1. **Transportation** – Transport is the single largest source of UK emissions. Hydrogen will be crucial for decarbonisation road and off-road applications such as buses, commercial vehicles and heavy-duty transport, trains, maritime shipping, aviation and other non-road mobile machinery.
2. **Industrial heat** – BEIS has recognised that hydrogen presents the greatest industrial fuel switching potential compared to other technology alternatives[4] for boilers, burners and other high temperature processes. Given the high energy density of hydrogen gas, there is an opportunity to reduce emissions from hard-to-decarbonize industrial and manufacturing processes with high heat requirements. The CCC in its 6$^{th}$ carbon budget[5] called for up to 25TWh of manufacturing fuel switching via hydrogen and electrification, with funding mechanisms to support Capex and Opex for hydrogen use in manufacturing from 2022.
3. **Industrial processes: Existing users of hydrogen** – The UK produces approximately 700,000 tonnes of hydrogen per year, 99% of which comes from hydrocarbons and is associated with significant emissions. The bulk of this hydrogen is used as a process gas for the manufacturing and refining sectors. Green hydrogen can play a key role in reducing these emissions and creating new "green chemical" products in an existing hydrogen market.

A key benefit of hydrogen in its role in delivering net zero is the range of applications and solutions. Any roadmap for deployment should build on the synergies across these rather than look to prioritise one over another. For example, as industrial clusters are decarbonised through hydrogen, the associated infrastructure can be cost effectively rolled out across a range of transport modes.

***(January 2021)***

[4] BEIS 2018 Industrial fuel Switching report
[5] CCC, 2020, https://www.theccc.org.uk/publication/sixth-carbon-budget/

## Appendix A – Policy and Support Recommendations

- The most obvious supply side measure for green hydrogen production would be to facilitate electrolyser's access to wholesale electricity prices, during low demand periods due to the rising penetration of variable renewables. Green hydrogen production can provide a substantial and firm market for low-cost renewable energy while also offering flexibility to the system operator, in managing the future high-RES grid without incurring curtailment fees. Co-location of new utility-scale renewable energy projects with electrolysers can also help maximize the economics of power projects. Beneficial supply policies could include partially waiving grid fees, giving preference in the electricity capacity market to flexible electrolysers over CO2-emitting gas turbines, and establishing favourable electricity tariffs for electrolysers that operate on a demand-response basis or only during designated periods.

- Additional new mechanisms could be introduced to bolster green hydrogen supply in the UK. The most tried and tested method for securing long term investment and rapid scale for non-transport projects is a direct production price support mechanism such as a Feed-in-tariff (FIT), which could incentivise gas grid operators to increase their share of renewable gas. Over the longer term, a contract for differences (CfD) model for dedicated offshore wind to green hydrogen projects could deliver enormous volumes of 100% renewable hydrogen whilst also offering stability services for the power grid. Greater volumes of green hydrogen supply will drive down costs, offering an economic alternative to traditional hydrocarbon-based transportation fuels.

- An important demand side measure would be to reflate the true cost of energy in the UK by reflecting the actual cost of carbon across energy vectors. Current government policies act as a tacit subsidy on fossil fuels, with some policies providing an overt subsidy such as the red diesel scheme and the continued deferral of planned fuel duty increases. Research conducted by BNP Paribas Asset Management suggests that for the EU to credibly meet its 2050 Net Zero goal it must impose a carbon tax of between Eur 79- Eur 103 per tonne by 2030[6]. There is some early evidence that UK Treasury are supportive of this approach, and is amenable to the case made by the Zero Carbon Campaign that the UK should have an average carbon price of £75 a tonne by 2030. This would incidentally align with the BEIS Base Case forecasts for a UK carbon price of £80 a tonne by 2030 that have been used in their modelling assumptions for the past three years.

- Beyond direct investment, there are a range of existing policies that, if amended, could deliver significant growth in green hydrogen production without requiring substantive and complex changes in policy. These include:
  - A ten-year moratorium on VAT for green hydrogen production,
  - Enhanced Capital Allowances that apply to the whole CAPEX for an electrolysis, compression, storage and distribution project,
  - A partial exemption for electrolysers from the use-of-system fees that apply to the electricity sector,

[6] BNP Paribas Asset Management, 2020, https://mediaroom-en.bnpparibas-am.com/news/new-bnp-paribas-asset-management-research-shows-potential-impact-of-green-hydrogen-on-carbon-pricing-357b-0fb7a.html

- Inclusion of rail, maritime, aviation and non-road machinery within the RTFO mechanism,
    - Allowing hydrogen produced from existing renewables, but which are curtailed to qualify for the RTFO even when the electrolyser is not connected via a private wire.
    - Allowing hydrogen produced from grid-connected electrolysers via PPAs with renewable power providers
    - Allowing hydrogen from biowaste, (with carbon capture) to qualify under the RFTO dRFTC mechanism.
- Extension of RTFO requirements on fuel suppliers after 2032.
- Allowing green hydrogen to qualify for the green gas levy, whether injected into the gas grid or consumed on client site in-lieu of other fossil fuels.
- Inclusion of hydrogen fuelled vehicles in Ultra Low Emission Vehicle (ULEV) programmes and subsidies on an equal footing to Battery Electric Vehicles.
- Inclusion of hydrogen fuelling infrastructure for funding available from the Office of Low Emission Vehicles (OLEV), in addition to direct funding of hydrogen fuelling station (HRS) capital costs
    - Co-location of green hydrogen production and HRS with EV rapid charging mega sites.

## Appendix 2 The role for hydrogen in delivering net zero

There is widespread global recognition of the role for hydrogen in delivering both net zero and clean growth and exports:

- The Committee on Climate Change[7]: '*the difference [between existing targets and net zero] is striking. Low-carbon hydrogen moves from being a useful option to a key enabler. Updates to policy alongside adoption of our recommended target should reflect that'.*

- The International Energy Agency[8]*: 'The time is right to tap into hydrogen's potential to play a key role in a clean, secure and affordable energy future'* and '*Hydrogen can help tackle various critical energy challenges*'.

- WSP Global[9] :'Hydrogen produced through the gasification of biomass with CCUS will be carbon negative, i.e. there will be an associated net reduction in atmospheric CO2 over the growth cycle and conversion/CCUS process.'

- The European Commission[10]: '*Hydrogen is an essential element in the energy transition and can account for 24% of final energy demand and 5.4m jobs by 2050*.'

- The UK Energy Research Centre[11]: calls for '*policies for widespread deployment of low carbon heat (including demonstrating hydrogen at scale*)' in its 2019 Review of Energy Policy.

- The World Energy Council[12]: '*Hydrogen is a potential paradigm shifter. Hydrogen can play a major role alongside electricity in future low-carbon economies, with the versatility to provide mobility, power system, heat and industrial services*.'

- Bloomberg New Energy Finance independent global study[13]: '*clean hydrogen could be deployed in the decades to come to cut up to 34% of global greenhouse gas emissions from fossil fuels and industry – at a manageable cost'***.**

- The National Infrastructure Commission: has identified hydrogen as one of the most viable alternatives to diesel in the freight sector[14].

The reports referenced above provide comprehensive detail on the role for and benefits of hydrogen, as well as options and pathways for scale-up.

***(January 2021)***

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[7] https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/
[8] https://webstore.iea.org/download/direct/2803
[9] https://www.wsp.com/en-GB/insights/zero-carbon-hydrogen-is-it-achievable
[10] https://www.fch.europa.eu/news/hydrogen-roadmap-europe-sustainable-pathway-european-energy-transition
[11] http://www.ukerc.ac.uk/publications/rep19.html .
[12] https://www.worldenergy.org/assets/downloads/WEInnovation-Insights-Brief-New-Hydrogen-Economy-Hype-or-Hope.pdf
[13] https://about.bnef.com/blog/hydrogen-economy-offers-promising-path-to-decarbonization/
[14] https://www.nic.org.uk/our-work/freight-study/