
Hydrogen
Energy
Association
Building
Hydrogen
Demand
An Action Plan
April 2025

Contents

Summary

Against a backdrop of our clean energy super power mission, combined with our net zero targets, increasingly unstable global energy markets and the need to enhance energy security, the UK has positioned hydrogen as fundamental in the success of its energy transition.

The production, use, storage and transportation of hydrogen presents a significant opportunity to increase the resilience, flexibility and security of the UK's energy system, which could result in billions of pounds saved by 2050.[1] By 2030, investment into low-carbon projects and supply chains could support as many as 12,000 jobs and attract as much as £11 billion of private investment.[2] This is a significant economic opportunity for the UK.

£11 bn

investment into low-carbon projects and supply chains

There has been some good initial progress to develop hydrogen in the UK, with a particular focus on production and an increasing attention on transportation and storage. It is now time to turn attention to how we scale up demand. This new HEA Action Plan considers the role for hydrogen, current status and actions needed to accelerate progress across three key use areas – industry, power and transport (all modes).

We have several recommendations that will help bring forward demand across all users. These comprise:

- Carbon pricing amendments – recognising that the current UK carbon price is failing to stimulate zero carbon solutions and needs adjustment,
- Use of Mandates
- Allowing Risk Taking Intermediaries under Low Carbon Hydrogen Agreements – to reduce risk for both hydrogen producers and users, and potentially involving GB Energy,
- Supporting the development of inland hubs – bringing together users of different types and scales to pool demand and supply,
- Blending into the gas grid – speeding up decision making to enable the gas distribution network to function as a realistic offtaker of last resort.

Our recommendations are to accelerate the use of hydrogen across industry and power generation, where the UK could build on the experience in the EU. They highlight the need for support for industrial users switching to hydrogen; this could be acheived by the use of affordable loan mechanisms, making the CAPEX investment more managable for companies of all sizes.

Hydrogen has the potential to play a significant role in decarbonising a range of transport modes. To date, support across road transport has been patchy at best, and we recommend the development of a Hydrogen for Transport Strategy. Both deployment and emissions targets will also be important, and optionality should be retained across both fuel cells and hydrogen internal combustion. The Renewable Transport Fuel Obligation is failing to deliver its objectives with regard to hydrogen, and we recommend both that the level of support is increased and that a wider range of low carbon hydrogen production options are covered, including the Low Carbon Hydrogen Standard (LCHS).

On a practical note, improving approval processes will reduce the cost of certification for hydrogen technology developers and increase the speed at which it becomes commercially available to end users. Pilot projects are invaluable for demonstrating the safety case via the operational data they produce and for helping to bring down costs.

“On a practical note, improving approval processes will reduce the cost of certification for hydrogen technology developers and increase the speed at which it becomes commercially available to end users

Addressing these key areas of hydrogen demand will help the UK hydrogen economy to accelerate at the pace needed not only to deliver our net zero objectives, but also to allow the UK to capitalise on the long-term economic benefits of supporting this industry and align with the target of up to 10GW of low carbon hydrogen production by 2030.

Introduction

Against a backdrop of our clean energy super power mission, combined with our net zero targets, increasingly unstable global energy markets and the need to enhance 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.'

The production, use, storage and transportation of hydrogen presents a significant opportunity to increase the resilience, flexibility and security of the UK's energy system, which could result in billions of pounds saved by 2050.[3] By 2030, investment into low-carbon projects and supply chains could support as many as 12,000 jobs and attract as much as £11 billion of private investment.[4] This is a significant economic opportunity for the UK.

As the leading trade association in the UK hydrogen sector, the HEA is dedicated to accelerating the rollout of the hydrogen economy. The HEA promotes and represents the interests of our 100 members across the hydrogen space, as well as campaigning for the best policy outcomes for the industry across the full range of applications and opportunities of the value chain.

There has been some good initial progress to develop hydrogen in the UK, with a particular focus on production and an increasing attention on transportation and storage. It is now time to turn attention to how we scale up demand. A system where production and use operate in harmony will be much more efficient and effective than one where there is a lack of balance.

The recommendations presented in this plan reflect the early stage of the industry and represent opportunities to 'smooth the path' going forward. These policy reforms can collectively support significant, and quicker, growth of the UK hydrogen economy and release private investment faster into the market – results that are essential to deliver on the UK's hydrogen ambitions. Better alignment across production, transportation and storage, and use of hydrogen will help accelerate cost reduction throughout the value chain.

UK progress and vision

As mentioned above, the UK government coverage of hydrogen to date has focused particularly on hydrogen production, with a target of 10GW of low-carbon hydrogen production capacity by 2030. Up to 6GW of this will be allocated to green hydrogen production and there is also an interim target of 1GW to be in operation or construction by 2025.[5]

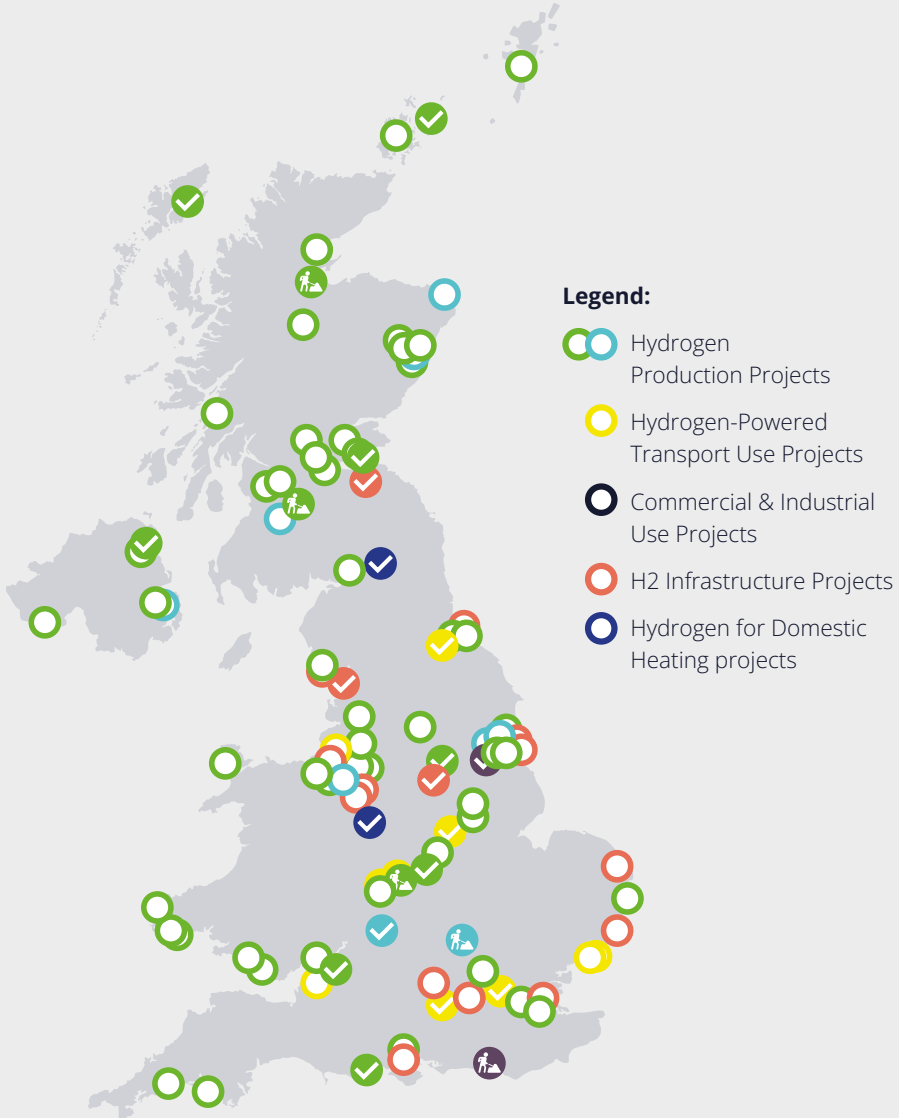
The principal vehicle to deliver the 6GW target is the Hydrogen Production Business Model (HPBM), which is delivering funding to hydrogen projects through the Hydrogen Allocation Rounds (HAR). The 11 winners of the first HAR (HAR1)[6] are scheduled to provide 125MW production capacity. Each will receive HPBM revenue funding via a bespoke front-end agreement in line with the conditions detailed in the Low Carbon Hydrogen Agreement (LCHA), which itself includes a requirement for multi-year contracts with users. In early April 2025, government announced 27 shortlisted green hydrogen (electrolytic hydrogen plus other specified technologies) production projects under HAR2,[7] amounting to 765 MW. A further 1.5GW is planned across HAR 3 and 4.[8] We recommend that a wide range of low carbon hydrogen production options are allowed in the LCHS and the HAR application.

CCUS (Carbon Capture, Use and Storage) enabled hydrogen is being supported via the decarbonisation of key UK industrial clusters, with two announced for the mid-2020s and an aim for four by 2030. In October 2024, government announced £21.7 billion of funding available, over 25 years, to support the first two clusters. See below for more details.

As shown in the diagram, the HEA's UK Hydrogen Project Map,[9] there has been promising early progress in the hydrogen sector. However, of the total 100+ projects, less than 30 cover hydrogen use.

As described in the following sections, there remain challenges to the use of hydrogen.

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



Action plan structure

The purpose of this action plan is to identify key areas limiting demand for 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 three key areas of importance relating to the development of hydrogen demand:

01

Overarching measures to build demand

02

Hydrogen demand in industry and power generation

03

Hydrogen demand in transport

Overarching measures to build demand

As noted above, whilst government support is helping to bring down the price of hydrogen, users are often faced with the need to change processes and technologies to adapt them for hydrogen use.

They are also required to sign-up to multi-decade contracts in a period when the market pathway for hydrogen is still evolving. Furthermore, pipeline networks to bring together producers and users will not be available for a number of years. The combination of these factors creates barriers to attracting private investment into projects.

Carbon pricing

Delivering UK decarbonisation goals requires that the full range of policy levers are aligned. At just under £37 per metric ton,[10] the UK carbon price is failing to stimulate zero carbon solutions, including hydrogen. Stakeholders across the hydrogen value chain are thus unable to make long-term business decisions with the confidence they need for the scale of financial investment required to adapt existing business models and infrastructure networks to hydrogen.

Mandates

Mandates can play an important role in stimulating the uptake of low carbon technologies. Examples include the Sustainable Aviation Fuels Mandate[11] and the EU Renewable Energy Directive.

Risk Taking Intermediaries

Whilst the hydrogen sector remains in its infancy, allowing sufficient flexibility for the initial wave producers and users to work together will be crucial, and limiting risk is a key element of this. At present, and due to the many uncertainties linked to multi-decade contracts, it is challenging for producers and users to find terms with acceptable levels of risk. There is a temporal misalignment between the length of contractual commitment developers need from end users to finance a hydrogen project, and the relatively short-term basis on which end users, particularly in the transport sector, normally procure their fuel. Amending the boundaries of the contractual framework is one way of managing this risk.

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Our members consider that the controlled eligibility of risk-taking intermediaries (RTIs) within the LCHA would improve the financial security required by both producers and users to ensure a bankable project. An RTI could link a number of users and producers at various scales, 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.

RTIs are considered 'Non-Qualifying Offtakers' in the LCHA heads of terms,[12] 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.[13] 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 subsidised hydrogen. The HEA believes that Great British Energy (GBE) is well placed to act as an RTI and recommends that the practicalities of this be explored as a matter of urgency.

Inland hubs

A sizeable proportion of industrial activity occurs outside of the main industrial clusters and should not be overlooked. One solution to this would be for government (potentially via Great British Energy) to invest in inland hydrogen hubs alongside core industrial clusters and ports to allow hydrogen trade. These hubs, which can combine different user types and sizes, would bring together demand with local production, mitigating the reliance on long-distance transportation and national pipelines. By aggregating users, it is possible to decouple production from demand and deliver a smoother overall demand profile, thus reducing risk and allowing producers to operate more economically. Hub elements to be invested in include low carbon hydrogen production, local pipelines,[14] users and hydrogen refuelling infrastructure.

> **Building industrial demand for hydrogen beyond the major clusters can be achieved via government investment (potentially via Great British Energy) in inland hydrogen hubs alongside core industrial clusters and ports to allow hydrogen trade.**

Inland hydrogen hubs could be connected to national hydrogen infrastructure in the future to become prosumers, supplying demand further afield. This approach would also help to accelerate hydrogen roll-out across the UK, thus aligning with the Modern Industrial Strategy's objective to maximise regional growth outside of London and the Southeast.[15]

Blending into the gas grid

In December 2023, government announced a strategic policy decision to support blending of up to 20% hydrogen by volume into the GB gas distribution networks. The intent is for blending to act as an offtaker of last resort to support hydrogen economy growth, whilst ensuring it does not 'crowd out' the supply of hydrogen to alternative end users who require it to decarbonise – essentially, to deliver market building benefits. Work to develop the safety case continues and the HEA is keen to see this completed so that blending becomes a realistic option. In parallel, development of a system of PPAs between hydrogen producers and the gas grid must be prioritised, including consideration of factors such as the need for new metering and how costs will be shared. Whilst it would be ideal if a single standardised contract form could be agreed, we recognise that this may be difficult to achieve in practice.

As blending into the distribution network moves forward, it will be good to see more progress to facilitate blending at the transmission level. This will both open up the opportunity for hard-to-decarbonise industries connected to the transmission grid to start using hydrogen and ensure that the UK network remains interoperable with Europe. We are encouraged to see the planned consultation on transmission level blending that is scheduled for 2025.[16] With work progressing in Europe to introduce blended gas over the next couple of years, it will be important to maintain pace in this area.

Hydrogen demand in industry and power generation

The role for hydrogen

Industry cannot decarbonise without hydrogen and up to 50TWh of demand in industry could be met by low carbon fuels, primarily hydrogen, in 2035. Sectors for which hydrogen is particularly relevant include those which are notoriously hard-to-abate, such as asphalt, steel, glass, cement, and petrochemicals. In these and others, hydrogen is decarbonising via:

- Fuel switching for boilers, burners and other high temperature processes used in industrial and manufacturing operations; and
- process gas feedstock.

The National Energy System Operator (NESO) estimates that the GB electricity system could need around 40-45GW of long duration flexible capacity by 2030. Hydrogen to Power (H2P) is one of the first-of-a-kind technologies that the NESO considers an important requirement for a clean power system in 2030.[17] Having Hydrogen available in the power system could achieve lower emissions at a lower cost than a system without hydrogen. Hydrogen delivers significant system benefits in a future based heavily on intermittent renewables, particularly around system balancing. Long duration energy storage, supplied primarily by hydrogen and linked with hydrogen for power and other applications, could provide between £13 billion and £24 billion in savings to the electricity system between 2030 and 2050. There are multiple roles for hydrogen for power, including as a fuel for low carbon flexible generation and as a decarbonisation pathway for existing unabated gas power plants.

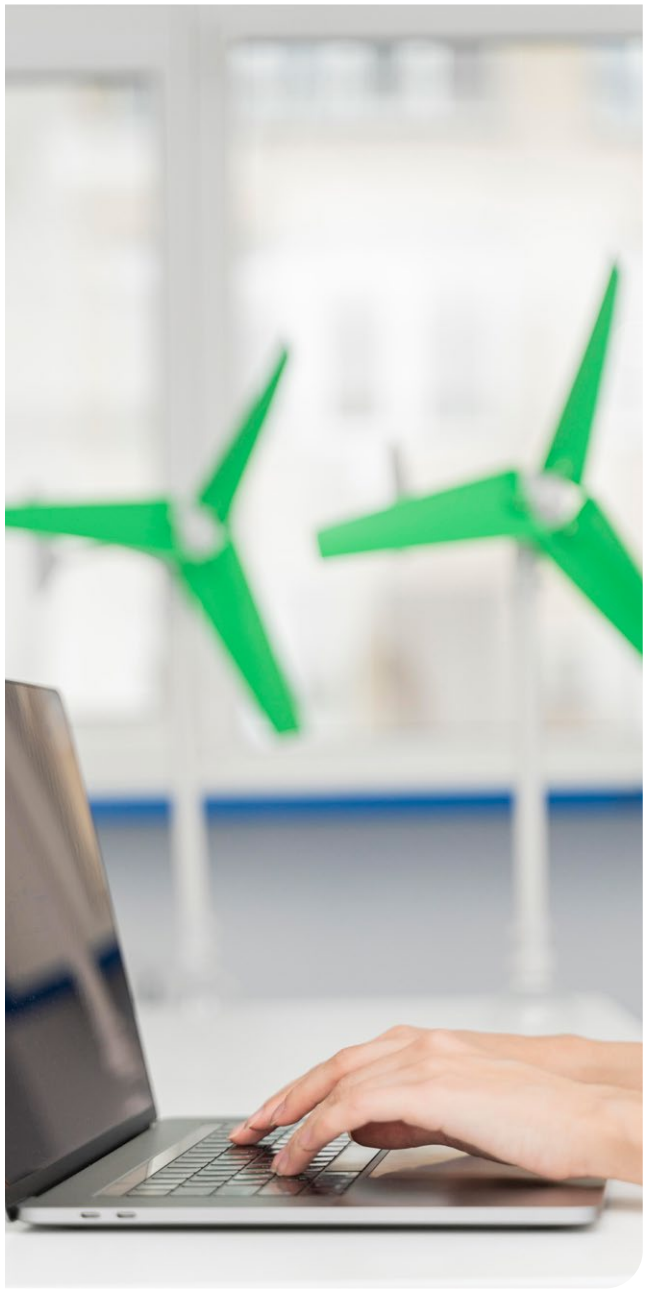
Status

Work to date to decarbonise industry has been focused on the largest UK clusters and typically involves Carbon Capture and Storage (CCS). Precombustion capture removes CO_2 from natural gas to provide hydrogen fuel. As noted above, in October 2024, government announced a £22 billion investment in CCS projects, focusing on developing two carbon capture clusters in Merseyside and Teesside. This 25-year initiative aims to stimulate private investment and generate jobs in these industry-heavy areas. The first two clusters are expected to be followed by two more – the Scottish Cluster and the Viking cluster in the Humber.

In parallel with this, The Industrial Energy Transformation Fund (IETF) supports the development and deployment of technologies that enable businesses with high energy use to transition to a low carbon future. Since its launch in 2020, the IETF has provided £500 million of funding across a range of decarbonisation options.

Whilst these initiatives have been welcomed in helping companies decarbonise through hydrogen, the overall reach and impact is limited both in geographical and business terms.

Government is currently considering the potential design of a market intervention to support the deployment of H2P. Following earlier consultation,[18] there are plans to engage with stakeholders on the design principles for a H2P business model in Spring 2025 (based on a Dispatchable Power Agreement (DPA) model) and to enable H2P to participate in the current Capacity Market as soon as practical.



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, is £7.75/MWh.[19] 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 use green hydrogen, will face an additional charge. The scale at which these facilities operate means that CCL charges become a significant OPEX cost, making hydrogen a less feasible solution.

As of March 2025, following input from stakeholders including the Hydrogen Energy Association, government has committed to remove CCL costs from electricity in electrolysis to produce hydrogen and to conduct a wider review. A consultation on the mechanism for doing this is underway at the time of writing of this report and is due to close on 7th May 2025.[20]

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Stimulating demand for hydrogen in industry

Deployment targets

Under the Renewable Energy Directive II (REDII) the European Union has set targets for increasing the use of renewable hydrogen in industry and transport (See page 17). These require that up to 42% of all hydrogen used in industry by 2030 be constituted of Renewable Fuels of Biological Origin (RFNBOs),[21] expanding to 60% by 2035. This is a clear incentive to increase the share of renewable hydrogen in heavy industry in order to avoid penalties and, thus far it has triggered a surge in hydrogen demand.

The HEA recommends that a similar approach be adopted in the UK. Targets not only clearly demonstrate government's intent and commitment but also provide a cost neutral route to stimulating demand. In practical terms, a credit-based system for low carbon hydrogen uptake would allow the sector to achieve targets on an equitable basis. For example, end users located close to production facilities could use a larger share of hydrogen and sell credits to stakeholders who will take longer to transition.

Asset investment and management

Displacing fossil fuel infrastructure with hydrogen alternatives requires industrial end users to make a significant CAPEX investment. For businesses with typically small margins, this can be difficult to justify. The HEA recommends that any government policy supporting industrial users switching to hydrogen should include an affordable loans mechanism to make the CAPEX investment more manageable for companies of all sizes, including smaller companies with less credit credentials.

The impact on existing assets due to a switch to hydrogen must also be recognised. Those based on high carbon operations may have a long asset life remaining, with associated financial implications. For industrial users looking to switch to hydrogen now, the government should offer compensation for the value of existing assets which would otherwise have been reclaimed over the full operational term of the asset.

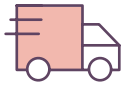
Hydrogen within refineries

In Europe, RFNBOs[22] used in refineries to produce industrial products consumed in the industry sector can be counted towards the industry target. The HEA would like this to be explored as a policy driver for the RTFO in the UK, as this would encourage further participation from refineries in clean hydrogen projects.

Hydrogen demand in transport

The role for hydrogen

The transport sector accounts for ~40% of final energy consumption, with 80% of that being road transport. The Zero Emission Vehicle (ZEV) Mandate requires that 80% of new cars and 70% of vans sold in UK be zero emission by 2030, increasing to 100% by 2035.[23] Similarly, there are national targets specifying that all new HGVs under 26 tonnes must be zero emission by 2035, with all new HGVs sold to be fully zero emission at the exhaust by 2040.[24]

~40% 

of final energy consumption comes from the transport sector

As of April 2025, government announced revisions to the Zero Emission Vehicle (ZEV) Mandate, introducing several key changes aimed at supporting the automotive industry's transition to electric vehicles (EVs) while responding to recent international trade developments. The main change is an adjustment in the deadline for selling new hybrid and plug-in hybrid vehicles from 2030 to 2035.[25]

Decarbonisation of road transport cannot be achieved by electrification alone and up to 45TWh of demand in transport could be met by hydrogen in 2035. Applications include light duty vehicles, vans, buses and trucks, and both fuel cells and combustion are options.

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Hydrogen-fuelled buses provide a similar user experience to the petrol and diesel buses used today. Refuelling at the depot allows current routes to be serviced across the UK without inter-day refuelling (which might not be the case for electric buses). Added to this, fleets benefit from shorter refuelling times compared with other clean alternatives. Hydrogen offers particular benefits in rural areas with long distance routes, hilly terrain or colder temperatures which are unlikely to be serviceable by battery technology in the foreseeable future. Grid infrastructure constraints in some regions are also a consideration.

In HGVs, hydrogen fuel provides un-paralleled range compared with other clean alternatives. Fewer, faster refuels mean that hydrogen fuelled HGVs can remain on the road for longer periods, while being capable of carrying large payloads. These benefits make hydrogen HGVs a strong option to decarbonise without altering day to day operations.

Light duty hydrogen transport, including cars and vans, offers a preferable direct user experience than EVs –fast refuelling, greater range - particularly for those without access to dedicated off-street parking. Electrification of all road transport is already proving challenging and including Fuel Cell Electric Vehicles (FCEVs) will reduce the burden on the electricity network, take advantage of the growing hydrogen infrastructure and offer choice for consumers. By way of example, Wales and West Utilities (WWU) estimates that less then <50% of journeys across its fleet could be completed by a Battery Electric Vehicle (BEV) (assuming overnight recharging). In contrast, >95% of journeys could be completed by a Hydrogen FCEV (assuming daily refuelling). Furthermore, hydrogen powered Light Commercial Vehicles (LCVs) would see no unladen weight increase, whereas BE technology could lead to an increase of up to 25%. Hydrogen LCVs allow WWU staff on call-out standby the flexibility to use vehicles at any moment, as opposed to waiting for sufficient charge before

attending the call-out. In addition, few industrial staff can accommodate a home charger for BEVs.[26]

With other countries setting targets for FCEVs, the UK risks passing up a viable avenue for decarbonising this sector.

Beyond road transport, hydrogen is increasingly recognised as an important part of the decarbonisation transition for a range of modes. These primarily comprise shipping / maritime, rail, aviation / aerospace, and Non-Road Mobile Machinery (NRMM) applications:

Earlier modelling has estimated that the domestic demand for maritime hydrogen alone could reach 15-20TWh annually by 2035;[27] government acknowledges that this may now be an underestimate. Maritime propulsion options based on hydrogen include fuel cells, internal combustion engines and turbines, and across boats and ships at various scales. In addition, both hydrogen and hydrogen carrying fuels, such as ammonia and synthetic methanol, are under consideration, with considerations around energy density, storage, ease of use, safety, cost and practicality all having a role in shaping the future mix. Initial work has focused on the use of hydrogen for short journeys where energy storage requirements are low.

15-20TWh

estimated annual demand for maritime hydrogen by 2035

Hydrogen is emerging as a transformative solution for decarbonising trains. Fuel cells offer smoother, quieter and more efficient travel, and are anticipated to be easier and cheaper to maintain than diesel equivalents. While the train itself is more expensive than diesel or electric models, hydrogen fuelled rail travel is a cheaper alternative than electrifying lines. Hydrogen combustion is also an option for both trains (particularly freight) and for larger vehicles at terminals and stations.

Hydrogen is at the heart of the transition from fossil fuels in aviation and aerospace. It has been safely used in aerospace for decades, and, for aviation, has the potential to drastically reduce carbon emissions. It enables multiple options for aircraft propulsion, including direct combustion, fuel cells or a combination of both, and also provides a low-carbon energy source for synthetic fuels.[28]

NRMM comprises mobile machines and transportable industrial equipment or vehicles, excluding those made to transport goods or passengers on roads. Examples of NRMM include construction and farming equipment. Due to NRMM's typically high energy output and flexibility demands, it is increasingly likely that hydrogen will play a substantial role in decarbonisation. Hydrogen ICEs offer reduced initial investment for manufacturers looking to switch from fossil fuels, and the NO_x emissions of hydrogen ICEs are minimal, to the extent that an increasing number of countries consider it a zero-emissions technology. Hydrogen ICE maintains engine familiarity for operation, performance and maintenance, allowing for a high-power output and fast refuelling times. Fuel cells have the advantage of low operational costs and reliability; they have been proven to maintain operation in challenging and rough working environments. The technology releases zero emissions and the lack of harmful substances in its composition, such as battery acid, present upcycling opportunities. The modular technology of the fuel cell also makes it easily scalable, which is an important asset for the range of NRMM applications. NRMM contributes as much as 2.7% of total UK GHG emissions.[29]

Status

To date, the Renewable Transport Fuel Obligation (RTFO) has the main been mechanism to support the growth of hydrogen as a transport fuel, particularly in road transport. However, it has not been effective for hydrogen and there has been very little progress to date. Even for other fuels, it has had a trimming effect on CO_2 emissions when what is needed is a step change. A further failing is that the RTFO addresses only parts of the hydrogen transport ecosystem with no current support for aspects such refuelling infrastructure.

While initiatives such as the £23 million investment to establish the UK's first multi-modal hydrogen transport hub in Teesside, the £200m zero carbon freight trials and the £270 million Zero Emission Bus Regional Areas (ZEBRA) trials have all supported a small number hydrogen vehicle and infrastructure projects as part of a wider portfolio, this has been on a miniscule scale relative to what is needed.

The use of hydrogen for light vehicles such as cars and light vans has been written off by DfT, with the focus being put on electrification and biofuel for this category. This is in contrast with many other countries (see below) and fails to recognise hydrogen's potential for cars and light vans.

The maritime sector is international in approach, reflecting the movement of shipping across the globe. In 2023, the International Maritime Organisation set at target of reaching net-zero GHG emissions by or around 2050. In the UK, a report from the UK House of Commons Environmental Audit Committee in 2024,[30] recommended a refresh of government's Clean Maritime Plan which should include a strategy for developing hydrogen-based zero-emission maritime fuel production in the UK and the associated transmission and storage facilities. The use of hydrogen in maritime applications is supported via the RTFO. While hydrogen combustion engines up to around 2MW are available commercially, multiples of 10MW of power will be required to power transoceanic vessels.[31] Forty of the projects funded under the first three rounds of the Clean Maritime Demonstration Competition since 2021 have related to hydrogen or to hydrogen-derived fuels.

The HydroFLEX, developed jointly by Porterbrook and the University of Birmingham, and with funding from Innovate UK, is the UK's first hydrogen powered passenger train. Elsewhere, Siemens has just received authorisation to introduce hydrogen fuelled trains on the German rail network.[32] In its 2024 report on rail decarbonisation, the Rail Industry Association concluded that hydrogen powered trains could be 'a permanent solution for long routes without electrification if cost can be reduced and hydrogen supply improved'.[33]

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Work to determine the role of hydrogen in aviation has been focused via the FlyZero project, which considered design challenges, manufacturing demands, operational requirements and market opportunity of potential zero-carbon emission aircraft concepts.[34] The project concluded that "green liquid hydrogen is the most viable low-carbon emission fuel with the potential to scale to larger aircraft…"

Relative to other mobility sectors such as HGVs, Light Commercial Vehicles (LCVs) and passenger vehicles, NRMM has made slow progress in the transition to Net Zero. In March 2024, the HEA responded to a DfT and DESNZ consultation on 'Non-road mobile machinery: decarbonisation options'.[35] [36] The Summary of Responses to the consultation highlighted the need to develop detailed policy interventions to stimulate progress. The HEA looks forward to progress on this.

Following a consultation that closed in April 2024, the Department for Transport is developing an amendment to The Road Vehicles (Construction and Use) Regulations 1986 to allow hydrogen-powered off-road machinery to be used on the road.

Stimulating demand for hydrogen in transport

A Hydrogen for Road Transport Strategy

In considering the future for low carbon transport as a whole, the HEA recognises that a combined approach that considers both hydrogen and electrification is the way forward for the UK to reach its goals. However, with respect to hydrogen, policies that target fuels alone will not work, and any strategy must address infrastructure, vehicles, and the range of energy vectors that carry hydrogen, such as ammonia. Furthermore, the development of hydrogen for transport will proceed in parallel with a system-wide suite of developments as hydrogen scales up to take its role across transport, power, heat and overall system resilience. Different components of this journey must not be considered in isolation.

To date, hydrogen for transport has had to rely on a patchwork of grants and policy levers that share no clear strategy to link and progress all aspects of a hydrogen transport network over the medium term. Hydrogen needs additional attention to achieve a point of critical mass where the industry becomes self-sustaining. A long-term vision is the key to progress and will aid in removing risk for those contemplating investment in the sector. This in turn will help to bring down system wide costs and help to accelerate scale-up in line with targets. Action now will not only ensure we reach critical mass more quickly but also ensure that it is a UK supply chain servicing the industry.

For hydrogen to flourish, it will require fuel production, refuelling infrastructure and vehicle funding support to be connected. Earlier vehicle trials were made possible through CAPEX funding of local hubs which included refuelling and maintenance of the fleets. To ensure fuel is available for future fleets, a combination of CAPEX and OPEX funding should be offered by DfT to a level that delivers growth, brings down costs and enables the sector to operate commercially, bringing a range of benefits for the UK.

Future proofing – for example, with respect to states and pressures of hydrogen fuel - should be a key consideration with the roll-out of hydrogen transport to ensure public funds bring value for money.

In line with the above, the HEA calls on government to develop a 'Hydrogen for Transport Strategy' which covers the full role for hydrogen in transport and sets out a clear roadmap with appropriate and linked policy levers to guarantee scale up and growth at the rate the UK needs to meet its net zero goals. These policy levers should be designed to complement and align with wider hydrogen developments so that demand and supply can develop in tandem, reducing risk for all involved. A key priority should be delivering choice and optionality so that our transport system evolves to meet user needs both in the short and long term.

Emissions targets

Mandated emissions targets are arguably the most powerful tool in driving change in the uptake of hydrogen and other zero emission technologies in the transport sector. The most obvious and relevant example is the UK's 2050 net zero target, which is driving huge change in our energy sector. The Committee on Climate Change expects that upfront investment costs will be balanced by net savings in the period out to 2042.[37]

Incremental regulatory change such as this stimulates the transition to net zero alternatives as a matter of necessity, whilst allowing users an adjustment period. We welcome the recent publication of the Maritime Decarbonisation Strategy, and the inclusion of the goal for the UK domestic maritime sector of zero fuel lifecycle GHG emissions by 2050, alongside intermediate 2030 and 2040 targets of a 30% and 80% reduction respectively. NRMM and rail applications must be similarly mandated with zero emissions targets to ensure consistency with the wider transport sector.[38]

Incremental regulatory change such as this stimulates the transition to net zero alternatives as a matter of necessity, whilst allowing users an adjustment period

Deployment targets

Under the Renewable Energy Directive II (REDII), the European Union has set targets for increasing the use of renewable hydrogen in transport and industry (See also page 12). For transport, the target is a 1% share of RFNBO by 2030. This is augmented by a mandate that hydrogen refuelling stations be installed every 200km on the main EU roads and in all major cities by 2030. These two targets provide clear incentives to increase the share of renewable hydrogen in transport to avoid penalties, and thus far, it has triggered a surge in hydrogen demand.

The HEA recommends that a similar approach be adopted in the UK.

RTFO

Government has recently consulted on the future of the RTFO,[39] recognising that it needs to adapt to ensure it continues to achieve cost effective carbon savings, aligns with the UK's overall progress towards future carbon budgets and interacts effectively with other low carbon fuel support mechanisms.

The RTFO classifies hydrogen as a development fuel, a classification which ensures that the RTFO supports the production of certain fuels in sufficient amount to bridge the expected gap relating to limited availability of biofuels. Our response to the consultation can be found on our website.[40] The summary is produced here in full as it relates specifically to how hydrogen demand in transport can be developed.

'The HEA is supportive of the classification of hydrogen as a development fuel. However, as noted in the Call for Evidence, the current operating parameters of the RTFO are insufficient to deliver on its objectives. We recommend that hydrogen be considered in a separate category to the other development fuels, with a broader definition of eligible low carbon production pathways.

Against the backdrop of wider efforts to reach net zero, which will see a significant shortfall in the overall availability of low carbon fuels, the current definition of hydrogen under the development fuel category is restrictive. It does not fully take advantage of all the possible sustainable pathways towards hydrogen production and delivery as a fuel. Furthermore, the incentives that are in place for development fuels do not fully cover the total costs of effectively delivering hydrogen as a sustainable fuel at scale – including capital costs associated with both vehicles and infrastructure.

To address these issues, we propose two adaptations that will incentivise and allow the delivery of sustainable hydrogen fuel at scale. These are as follows:

- Widen the definition of allowable hydrogen within the RTFO – i.e. beyond electrolytic to include a wider range of low carbon options,
- Develop a separate subcategory for hydrogen as a development fuel, with greater incentives that take into account the investment costs of hydrogen production and delivery as a fuel.

More broadly, we recommend a more strategic approach to the decarbonisation of transport in the round that recognises the trajectories for the range of modes and, particularly for hydrogen, links across to the full value chain. This will ensure that future mechanisms are fit for purpose not only for the short term, but also in line with longer term trends and developments.'

Price parity and overseas competition

As a result of various design features, there is a lack of alignment between the HPBM and the RTFO. Consequently, there is limited incentive for producers to supply hydrogen as a fuel or the capacity for customers to use it. This is exacerbated by the need for compression, high-pressure storage, tube trailer technology and other elements of hydrogen refuelling infrastructure, and associated costs. As a consequence, the hydrogen projects coming through the HAR pipeline are not producing hydrogen fuel at a large enough scale to be price competitive with diesel.

As new hydrogen markets (e.g. aviation) and associated policy frameworks develop, it is critical that there is alignment and consistency between approaches. The HEA recommends that government review the operation of the RTFO, HPBM and SAF (Sustainable Aviation Fuel) mandate to ensure complementarity of purpose and impact.

The EU Hydrogen Strategy predicts a price of between €2.5 and €5.5/kg for renewable hydrogen at the pump by 2050,[41] and it is already possible to buy hydrogen in Belgium and Northern France for €8/€8.5/kg. Based on calorific value, the HEA estimates hydrogen parity with diesel to be ≈ £8/kg. If the UK does not aim to reach this price parity soon, there is a substantial risk to the development of the UK hydrogen market.

Hydrogen internal combustion engines

Reaping the benefits that hydrogen offers requires the full set of low and zero carbon options to be brought forward. This includes supporting the use of hydrogen ICE as a legitimate zero emissions technology. Hydrogen ICE it can operationally match a diesel ICE equivalent for a price that is feasible for those using hydrogen in their fleets. Incentivising the modification of existing ICEs, as well as supporting the roll out of purpose-built ICEs, would be a fast way of stimulating demand in the road transport sector, whilst bringing a substantial amount of hydrogen fuel into circulation. There are also significant clean growth opportunities associated with enabling a transition for globally exporting companies such as Cummins.

Scale

The overall approach to hydrogen production on the UK is essentially based on large scale projects supplying large scale users. Whilst this is well suited to major industrial clusters, it is more challenging for the typically much small and more dispersed pattern of demand in transport. Measures are needed to collectively support smaller fleets and demonstration projects to the point where there is sufficient hydrogen fuel in circulation to be cost competitive. It is thus imperative that government leverages growth by either supporting the adoption of hydrogen in smaller scale fleets or revising the HPBM and / or RTFO to incentivise the development of large-scale hydrogen fuel projects. Three of the recommendations outlined above can contribute to this:

- A hydrogen for transport strategy which recognises and addresses considerations of scale,
- The development of smaller scale hydrogen hubs, which bring together users of various types and scales,
- Having a Risk-Taking Intermediary functioning between producers and users.

Type approval processes

A fragmented regulatory landscape means that securing Type Approvals for transport applications is challenging and time consuming, as safety cases for different hydrogen applications require approval from different regulators. Improving the approval process will reduce the associated cost of certification for hydrogen technology developers and increase the speed at which it becomes commercially available to end users. Pilot projects are invaluable for demonstrating the safety case via the operational data they produce (see below).

Pilot projects

Pilot projects are essential to help bring down the costs of hydrogen, iron out practical hurdles and highlight the value that hydrogen brings. Change can be driven from a grassroots level in a strategically targeted way whilst demonstrating the government's long-term commitment to hydrogen as a viable technology for the transport sector. Projects aimed at upgrading, retrofitting, and converting existing assets are a cost-effective way to begin this process. Pilot projects can form part of inland hubs (see page 9) and could be supported via Great British Energy.

Summary of recommendations

Our recommendations to accelerate the growth in hydrogen demand are summarised below. A number of these are connected; for example, the development of inland hubs, support for pilot projects and streamlining of type approval processes can be aligned to scale up hydrogen use in transport at pace.

01 Review carbon price with a view to a more impactful level.

02 Allow risk-taking intermediaries (RTIs) under the Hydrogen Business Model – potentially with GB Energy taking on the role of RTI.

03 Introduce mandates to stimulate change.

04 Invest in inland hydrogen hubs, where different user types and sizes are bought together with local production, to complement industrial clusters.

05 Accelerate work on hydrogen blending so that it can act as an offtaker of last resort to support hydrogen economy growth in the short term.

06 Develop deployment targets for the industrial use of hydrogen.

07 Introduce an affordable loans mechanism to make the CAPEX investment in fuel switching more manageable for companies of all sizes, including smaller companies with less credit credentials.

08 Consider the role and status of hydrogen used in refineries.

09 Develop a Hydrogen for Road Transport Strategy

10 Mandate emissions targets to drive change in the uptake of hydrogen and other zero emission technologies across all relevant transport modes.

11 Increase support for hydrogen and widen the definition of allowable hydrogen under the RTFO and the Low Carbon Hydrogen Standard (LCHS).

12 Review how the operations of the RTFO, HPBM and SAF mandate interact to ensure complementarity of purpose and impact.

13 Support the roll out of purpose-built hydrogen ICEs across all relevant transport modes and incentivise the modification of existing ICEs.

14 Support the adoption of hydrogen in fleets.

15 Improve type approval processes to minimise delays and complexity.

16 Develop pilot projects for hydrogen for transport.

Next steps

Addressing these key areas of hydrogen demand will help the UK hydrogen economy to accelerate at the pace needed not only to deliver our net zero objectives, but also to allow the UK to capitalise on the long-term economic benefits of supporting this industry and align with the target of up to 10GW of low carbon hydrogen production by 2030.

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, 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 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 would be happy to discuss strategies for implementing our recommendations.

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