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Dear Colleague,

Hydrogen Transportation and Storage Infrastructure

I am writing on behalf of the UK Hydrogen and Fuel Cell Association (UK HFCA) and in response to your current consultation on Hydrogen Transportation and Storage Infrastructure.

The UK HFCA is the leading pan-UK trade body in the hydrogen energy sector, with a Mission to support the growth of our members and the sector, and to ensure that the right policy framework is in place. Our 100 plus member companies 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.

Hydrogen will play a substantial role in all aspects of energy, across all regions of the UK. The UK's hydrogen economy will require a strong Transportation and Storage network at its core to ensure that domestic and commercial users of hydrogen have ready and affordable access to hydrogen and producers can reach these users.

In this response, the UK HFCA highlights the requirement for both pipeline and road transportation in both the short and long term. Storage and pipelines provide a backbone to deliver overall lowest cost and scale. Road transportation is also required, both in the short to medium term as pipelines are developed, and in the long term to ensure hydrogen can reach everywhere, enabling the levelling up of all regions in the UK. Furthermore, road transportation provides the option of high purity hydrogen without the need for clean-up at the point of use.

This response from the UK HFCA covers the following questions:

> ***Question 3.*** *In your view, do you agree we have correctly identified and characterised the market barriers facing the development and operation of hydrogen pipelines and a hydrogen network? Are there any other market barriers we should be considering? Please explain your answer and provide any relevant evidence.*
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> ***Question 13.*** *In your view, is an external funding mechanism needed in a growth phase of network evolution? If so, at what stage of market and network evolution might it no longer be required? Please explain your answer and provide any relevant evidence.*
>
> ***Question 19.*** *In your view, how may vehicular transport for hydrogen develop in the UK? Please do include any other vehicular transport we may have missed. Please explain your answer and provide any relevant evidence.*

Question 20. *In your view, is a business model required for vehicular transport and, if so, how might a business model for onshore pipelines transporting hydrogen as a gas be adapted for this? Please explain your answer and set out the specific market barriers that a business model would be required to address as well as providing any relevant evidence.*

Question 22*. In your view, have we correctly identified and characterised the key market barriers facing larger-scale hydrogen storage infrastructure, and in particular its deployment by the late 2020s? Please explain your answer and provide any relevant evidence.*

Question 24. *Do you agree that Government should develop a dedicated business model for hydrogen storage (subject to value for money and need) and that it should be designed to be technology-neutral? Please explain your answer and provide any relevant evidence.*

Question 36. *In your view, should the build out of hydrogen storage infrastructure evolve through either a) a solely a market-led approach, b) a form of strategic planning, or c) neither? Please explain your answer and provide any relevant evidence.*

Question 37. *In your view, if strategic planning was to be implemented for hydrogen transport infrastructure what form should it take? a) central network planner, b) coordinated approach, c) evolved approach, d) a blend of strategic planning and market-led approaches, or e) none of the above? Please explain your answer and what this approach might look like in a UK context.*

Question 49. *In your view, is the existing regulatory framework for the non-pipeline transportation of hydrogen optimal for supporting the development of a rapidly expanding UK hydrogen economy? Hydrogen transport and storage infrastructure consultation 97*

Question 50. *If you answered 'No' to the previous question, how do you think this might be addressed (regulation/standards/guidance, etc.)? Please explain your answer and provide any relevant evidence. (To be answered collectively)*

Question 3. In your view, do you agree we have correctly identified and characterised the market barriers facing the development and operation of hydrogen pipelines and a hydrogen network? Are there any other market barriers we should be considering? Please explain your answer and provide any relevant evidence.

Whilst the UK HFCA agrees with the market barriers identified by BEIS, there are some which were not addressed. Foremost among these is the lack of storage. Strategic storage, as well as commercial storage, is needed for energy security to accommodate extreme events.

Pipelines are not and will not be the full solution to our transportation needs for several reasons. First, they will not practically be able to reach all producers or users. Secondly, hydrogen of the purity needed for fuel cell applications, in particular, will not be provided via pipelines without clean-up at the point of use. For these reasons, there will be the need for high-purity hydrogen transported via lorry even after a vast network of hydrogen pipelines has been installed.

With regard to a pipeline network, the oversizing of hydrogen pipe can provide additional storage, although this is not an investment that is likely to be made until project owners have guarantees on the supply of hydrogen.

A further barrier is the lack of a strategic direction from Government on the level of national scale hydrogen infrastructure investment and grid reinforcement that is required to achieve our Net Zero

ambitions. One example is the significant uncertainty in pipeline requirement caused by the lack of clarity with regards to hydrogen for heat. While it is generally recognised that both the pipes and cables are required, there isn't a clear vision of what infrastructure is needed where.
Government should be aware of the impact that modular and distributed hydrogen production can have on the overall requirements for transportation and storage, and how the support of modular / distributed production can be beneficial to the whole system.

The UK HFCA recommends that a study is commissioned which considers hydrogen quality, cost and infrastructure at different scales, across different production, storage and usage methods so that the distribution network can be optimised.

Question 13. In your view, is an external funding mechanism needed in a growth phase of network evolution? If so, at what stage of market and network evolution might it no longer be required? Please explain your answer and provide any relevant evidence.

Yes, an external funding mechanism is needed during the growth phase of the UK's network evolution. Prior to hydrogen pipeline infrastructure being implemented, there should be a support mechanism targeted at reducing the cost of the virtual pipeline that is required in the interim. If this is not supported, businesses may have no option other than to wait for more affordable transmission costs, thus delaying hydrogen roll-out. This external funding will also play an important role in ensuring that producers and users in remote regions are not disincentivised from decarbonising through hydrogen both in the short term, and once a pipeline is developed. In industrial clusters, transportation costs will be far lower than in remote regions without some form of balancing, and this could result in hydrogen off takers being centred around production facilities rather than being evenly distributed across the country. There is the opportunity to use price support to level the playing field across the country in relation to the cost of transporting hydrogen.

Price support / external funding mechanisms should cover both pipeline and vehicular transportation of hydrogen. How the need for these will evolve over time will depend on a range of factors including the scale up of both demand and supply, and hydrogen's evolving overall role. Consideration should be given to how remote production and use is accommodated in the medium to long term. The production, distribution, and storage of hydrogen go hand in hand with demand, and the UK HFCA advocates policy mechanisms to support the whole hydrogen ecosystem, including the use of hydrogen and transportation and storage of hydrogen.

Following the initial growth phase, the UK HFCA supports the implementation of a regulated asset base model to enable to roll out of pipeline infrastructure.

Question 19. In your view, how may vehicular transport for hydrogen develop in the UK? Please do include any other vehicular transport we may have missed. Please explain your answer and provide any relevant evidence.

As per our answer to Question 3, vehicle transportation of hydrogen should be developed as a permanent part of the hydrogen distribution solution. Vehicular transportation extends past road alone, and we expect to see rail, marine, and non-road mobile machinery playing a role too. As mentioned above, the UK HFCA anticipates that hydrogen transported through pipelines will not be of suitable quality for some applications, such as transport, requiring purification before use. Vehicular transportation of hydrogen may be most appropriate and cost effective for these applications as it removes the need for purification before use. Renewables based hydrogen is of suitable purity for

these high purity applications, and it will not always make sense to inject this high purity hydrogen into the gas grid where impurities will inevitably be introduced.

Select ports across the country are likely to begin importing and / or exporting hydrogen. If there is a need for imports, these volumes of hydrogen may differ in purity and their final destination. For these reasons, strong vehicular transport will be required to avoid additional costs on imported hydrogen through purification, as well as strong vehicular transportation networks to service every region of the UK. As a wider point, the UK HFCA supports all efforts to meet UK demand via UK supply; this will facilitate the growth of home-grown supply chains, help bring down the cost of UK produced hydrogen and help the industry to flourish.

To reiterate, the requirement for a transportation network which includes vehicular transportation is not only to ensure that high purity hydrogen can be transported, but also that our transportation network can service any and all regions whilst a pipeline system is developed, and those which t hydrogen pipelines will not reach in the future.

Question 20. In your view, is a business model required for vehicular transport and, if so, how might a business model for onshore pipelines transporting hydrogen as a gas be adapted for this? Please explain your answer and set out the specific market barriers that a business model would be required to address as well as providing any relevant evidence.

Whilst some form of support will undoubtedly be needed through the growth phase, it should not be an adaptation of the transport pipeline business model. The strategic framework for movement of gas through pipes is so different to that involving vehicles that it is hard to imagine how it could be developed. Beyond this, if no support is in place, hydrogen production and use may be limited in their geographical coverage, with implications for the levelling up agenda and regional development. This is because the price of hydrogen will increase the further a potential off taker is from the point of production or the pipeline network. The same will apply to remote producers. Any support should reflect the fact that hydrogen transported by vehicle (in the broadest sense) will increase cost for the end user, as will factors such as purity and pressure –and support for vehicular transport should be developed with the aim of creating a level playing field for producers and end users across the country.

Question 22. In your view, have we correctly identified and characterised the key market barriers facing larger-scale hydrogen storage infrastructure, and in particular its deployment by the late 2020s? Please explain your answer and provide any relevant evidence.

Government should ensure the large-scale storage infrastructure that will be required in the future is well matched to receiving inputs of renewable hydrogen, nuclear-enabled hydrogen and CCUS enabled hydrogen because fundamentally there is a temporal mismatch between each of those hydrogen production profiles and hydrogen demand profiles. Underground hydrogen storage will need to be designed as an integral part with high pressure pipelines to / from it.

Question 24. Do you agree that Government should develop a dedicated business model for hydrogen storage (subject to value for money and need) and that it should be designed to be technology-neutral? Please explain your answer and provide any relevant evidence.

The UK HFCA agrees that the Government should provide a dedicated business model for hydrogen storage. Capital support and the provision of initial fill gas will enable low-cost storage - which should

be both connected to hydrogen systems, and aimed at serving UK users. With initial capital expenditure support to build, enable connectivity, and initially fill the storage facility with cushion gas and the minimum strategic gas capacity possible under a Regulated Asset Base (RAB) model. The remaining storage capacity is not operated on a RAB basis, but should enable a marginal cost low enough for efficient arbitrage of commercially traded market gas for short to inter-seasonal time scales. Any business models should be technology neutral, with a focus placed on delivering meaningful storage capacity across all regions of the UK.

Question 36. In your view, should the build out of hydrogen storage infrastructure evolve through either a) a solely a market-led approach, b) a form of strategic planning, or c) neither? Please explain your answer and provide any relevant evidence.

The UK HFCA believes that a solely market-led approach will lead to market failure as the market may underinvest or 'cherry pick' locations – resulting in not enough storage capacity or a suboptimal distribution of storage. However, a business model for every aspect of storage would be impractical, and care needs to be taken to develop a practical solution that allows storage to evolve over time, delivers the required outcomes and does not place an inappropriate burden on the tax payer. For these reasons, the UK HFCA recommends that hydrogen storage infrastructure should be supported through a blend of a market-led approach and strategic planning.

Question 37. In your view, if strategic planning was to be implemented for hydrogen transport infrastructure what form should it take? a) central network planner, b) coordinated approach, c) evolved approach, d) a blend of strategic planning and market-led approaches, or e) none of the above? Please explain your answer and what this approach might look like in a UK context.

Strategic planning should take the form of a central network planner. The implementation of hydrogen transport infrastructure must be considered as part of wider planning for the energy network overall. This will ensure that hydrogen transport infrastructure is considered as an aspect of a whole system approach.

The need for a strategic approach is highlighted by the interplay between hydrogen and other networks. By way of illustration, in the absence of a hydrogen transportation network, electrolysers may be situated close to point of hydrogen use rather than close to the renewable electricity supply. This may require grid connection (with suitable PPAs in place to ensure the low carbon credentials of the hydrogen), thus putting further pressure on our already over-burdened electricity network. A strategic approach, which considers hydrogen alongside other energy vectors and networks, help to deliver the optimal outcome

Question 49. In your view, is the existing regulatory framework for the non-pipeline transportation of hydrogen optimal for supporting the development of a rapidly expanding UK hydrogen economy?

No.

Question 50. If you answered 'No' to the previous question, how do you think this might be addressed (regulation/standards/guidance, etc.)? Please explain your answer and provide any relevant evidence.

The existing regulatory framework for non-pipeline transportation is not optimal for supporting the development of a rapidly expanding hydrogen economy. This regulatory system was not developed with hydrogen in mind, which has led to unnecessary or inappropriate red tape which is impacting businesses' ability to invest and scale up quickly. Regulations and standards applied to the hydrogen sector are often inappropriate - having been adapted from other gases, misinterpreted, misapplied, or simply missing. Some examples of this can be seen in the regulations surrounding transport of pressurised hydrogen by road - where industry is capable of transporting at higher pressures than is currently permitted – or those which prevent hydrogen powered vehicles transporting hydrogen. As illustrated by these examples, there is a need for codes and standards which reflect the particular attributes of hydrogen and its transportation and use.

An appropriately designed regulatory framework will play an important role in assuring the public that the market has been considered and regulated diligently and safely – an important consideration in the early growth of the sector.

In order to address issues surrounding legislation, the UK HFCA recommends the undertaking of an in-depth report by Government to identify bottle necks in current legislation, as well as an office for hydrogen regulations and standards.

The UK HFCA would welcome the opportunity to discuss our recommendations further.
Kind Regards,

Celia Greaves

CEO