HOUSE OF COMMONS ENVIRONMENTAL AUDIT COMMITTEE INQUIRY TECHNOLOGICAL INNOVATIONS AND CLIMATE CHANGE - HYDROGEN

WRITTEN EVIDENCE FROM THE HYDROGEN TASKFORCE JUNE 2020

HYDROGEN TASKFORCE

Executive Summary

The Hydrogen Taskforce welcomes the opportunity to submit evidence to the Environmental Audit Committee's inquiry into Hydrogen. It is the Taskforce's view that:

- Due to its various applications, hydrogen is critical for the UK to reach net zero by 2050;
- The UK holds world-class advantages in hydrogen production, distribution and application; and
- Other economies are moving ahead in the development of this sector and the UK must respond.

The Taskforce has defined a set of policy recommendations for Government, which are designed to ensure that hydrogen can scale to meet the future demands of a net zero energy system:

- Development of a cross departmental UK Hydrogen Strategy within UK Government;
- Commit £1bn of capex funding over the next spending review period to hydrogen production, storage and distribution projects;
- Develop a financial support scheme for the production of hydrogen in blending, industry, power and transport;
- Amend Gas Safety Management Regulations (GSMR) to enable hydrogen blending and take the next steps towards 100% hydrogen heating through supporting public trials and mandating 100% hydrogen-ready boilers by 2025; and
- Commit to the support of 100 Hydrogen Refuelling Stations (HRS) by 2025 to support the roll-out of hydrogen transport.

The Hydrogen Taskforce

1. The Hydrogen Taskforce is a coalition of UK-based firms that operate and innovate in the hydrogen sector. Members include Arup, Baxi, BNP Paribas and Arval, BOC, BP, Cadent, DBD International, ITM Power, Northern Gas Networks, SGN, Shell and Storengy.

2. The Taskforce aims to enable the UK to become a world leader in the international application and service of hydrogen, to deliver excellence throughout the supply chain and create a globally attractive export. It has elected to submit evidence to this inquiry as it has a significant interest in the UK realising its full potential in the hydrogen market.

Responses to the questions asked by the Committee

How effective has the Government's investment in hydrogen projects such as the Low Carbon Hydrogen Supply competition, the UK Hydrogen Mobility Programme and Hy4Heat been in moving the sector towards becoming an integral part of a low-cost, low-carbon economy and boosting the productivity and competitiveness of the UK energy sector?

3. The UK Government has invested over £90m in hydrogen projects which has, in conjunction with EU funding, enabled industry to develop and deploy hydrogen technologies. In addition, the Government has announced £70m of investment in new hydrogen supply and industrial fuel switching projects.

4. The Hydrogen Supply Programme, which commits £33 million to exploring the feasibility of producing low-cost clean hydrogen at scale, has been successful in developing technologies to further blue and green hydrogen production, as well as storage and distribution solutions. The supply of low-cost clean hydrogen is critical to the feasibility of hydrogen for large scale decarbonisation and this investment must be scaled over the next five years.

5. The UK Hydrogen Mobility Programme is an effective collaboration between Government and industry, resulting in the deployment of 15 hydrogen refuelling stations and over 200 vehicles. Significant learnings from this programme include deployment models, user experiences and maximising infrastructure reliability. Government support has enabled the industry to move through the early demonstration phase and focus must now be placed upon mass deployment.

6. The Hy4Heat, HyDeploy, H21 and H100 projects have demonstrated the technical and economic viability of hydrogen as a pathway to decarbonise domestic and commercial heat by decarbonising the gas grid, as well as the development of appliances that use 100% hydrogen. Due to the success of these projects, the UK is now considered a leader in the development of hydrogen for heating.

7. The Hydrogen Taskforce believes that these investments by Government and industry, alongside enhanced collaboration, have created unique expertise within UK industry. It is critical that the UK builds on this foundation, in order to enable decarbonisation at scale and create exportable products and expertise.

What level of output can the sector deliver in the UK, and what Government support would be needed to achieve this? How does the potential for hydrogen differ by end-use?

8. The UK is well placed to take advantage of hydrogen to create high-value jobs, export benefits and cost-effective decarbonisation in key sectors of its economy. UK firms currently lead in hydrogen sector niches; R&D and university expertise; transferable skills from the oil and gas sectors and developing services for hydrogen.

9. The Hydrogen Taskforce is currently completing an Economic Impact Assessment (EIA) to identify the contribution that the sector could deliver in the UK by 2035, including estimated output. This will examine the value chain and different end uses. This report will be available in July 2020. The Taskforce would like to share the results with the Committee.

10. To achieve high levels of output from the hydrogen sector, the Hydrogen Taskforce's believes that Government and industry should now invest and collaborate to ensure that technology development and commercialisation takes place at pace. The Taskforce's policy recommendations

outline steps the UK Government can take to drive hydrogen output, unlock investment from industry and lead in technology development.

11. Industry is ready to invest in large scale hydrogen production, storage and distribution projects to decarbonise critical areas of the UK energy system with Government support.

How realistic is industry's claim of widespread applicability of hydrogen technology in transport, heating and other sectors? Is hydrogen a cost-effective, feasible solution towards a low-carbon economy?

12. For applications without other viable decarbonisation pathways, meeting net zero is not possible without hydrogen. The Hydrogen Taskforce argues that investment in the development and demonstration of hydrogen solutions must be an immediate priority.

13. The scale and demand profile of domestic, commercial and industrial heat means that, although other technologies such as heat pumps and district heating have a key role to play, decarbonisation at the scale required to meet net zero targets will require hydrogen to make a significant contribution.

14. Various schemes, such as HyNet, H21, H100 and the HyDeploy programmes, are clearly demonstrating the applicability of hydrogen in the gas grid. Heating technologies can be deployed now, providing early markets for hydrogen, developing infrastructure and allowing the upstream supply chain to mature.

15. For transport applications, the timeline for hydrogen becoming cost effective in these end-use applications is dependent on several factors, including industry investment in R&D, the development of supportive policy frameworks and the cost and availability of clean hydrogen. For technologies that have reached higher levels of maturity, such as haulage and buses, there is an opportunity to ramp up deployment over the next decade as costs decrease and technology is more readily available.

What are the different implications of hydrogen produced from fossil fuels versus from renewables in terms of cost, scale, and emissions, and in terms of meeting the UK's net zero targets?

16. There are differing views on the cost and emissions implications of green and blue hydrogen production. The Taskforce views these costs as an emerging picture and would point the Committee to recent studies produced by the Energy Networks Association, the European Commission and the World Hydrogen Council on the associated cost implications of hydrogen production.

17. Through the production of hydrogen via electrolysers, which are powered by wind and other renewables, the UK is in a strong position for the production and eventual export of green hydrogen. In terms of scale, the UK has more offshore wind capacity than anywhere else in the world, currently over 8GW, which can support this demand. For example, the Gigastack project, based in Humberside, aims to produce green hydrogen cost-effectively through wind power. This project's Phase 1 feasibility study showed that it could reduce the cost of green hydrogen by more than 50% compared to today's costs.

18. The UK has advantages for blue hydrogen, which is produced through steam-methane reforming or autothermal reforming coupled with Carbon Capture Usage and Storage (CCUS). Expertise in

the oil and gas sector can aid the transition to the production of blue hydrogen via CCUS. UK CO2 storage potential is significant, estimated to be around 78GT. No major technical hurdles to storing industrial scale CO2 offshore exist. CCUS is widely regarded as being a scalable and efficient method to decarbonise heavy industry, while producing hydrogen.

19. Investment in both technologies would allow the UK to develop and scale world-leading green and blue hydrogen production sectors that are both needed to meet potential future demand, creating and protecting high value jobs in the process.

How feasibly can hydrogen technology be applied in various sectors, from transportation, to energy generation and industrial processes, whilst maintaining the highest safety standards?

20. Members of the Hydrogen Taskforce are participating in projects that aim to ascertain and further the feasibility of hydrogen in various sectors. These include Centurion, Gigastack, HyDeploy, Hy4Heat, HyNet, HySecure, H100, H21 and the Aberdeen Bus Project. Feasibility studies have demonstrated the applicability of hydrogen in the sectors that these projects focus on and the potential reductions in the costs of producing hydrogen.

21. As with any chemical carrier, hydrogen is low risk under the right safety management regulations and protocols. Hydrogen has been safely used for industrial applications over many decades.

How might the UK take advantage of further advances in hydrogen technology, such as hydrogen boilers and innovative storage and distribution solutions?

22. The UK is home to firms that are in the vanguard of hydrogen technology, with a strong R&D base and highly skilled workforce.

23. UK firms are at the forefront of developing domestic hydrogen appliances that demonstrate the safe use of hydrogen as a fuel in producing domestic heating, hot water and cooking. Baxi Heating UK has developed a 'hydrogen ready boiler,' which can be initially installed to operate on natural gas then converted to hydrogen with a simple intervention. Once hydrogen is available on the gas network, these boilers can be easily converted without the need for a new heating system.

24. Storengy and Cadent, as part of the Hydrogen Supply Programme, are working to store hydrogen safely in salt caverns in the Centurion project. Building or repurposing existing salt caverns is a relatively quick, practical and cost-effective method of providing bulk storage of hydrogen. Capital costs of hydrogen storage in caverns are expected to fall by 50% to £600/MWh. This is very competitive with the cost of battery storage, currently £160,000/MWh. The large storage volumes provided by salt caverns could be key in providing the intra-seasonal storage required to meet winter energy demand.

25. ITM Power, Cadent and Northern Gas Networks are working on the HyDeploy project, in collaboration with Keele University, which aims to establish the potential for blending and distributing hydrogen into the normal gas supply. This project will help determine the level of hydrogen which can be safely used by customers' existing domestic appliances.

26. The H21 project, which is being undertaken by several Taskforce members, will demonstrate the suitability of existing assets to transport 100% hydrogen. This project will provide key safety evidence that will support gas networks' future conversion to hydrogen.

27. SGN's H100 project is looking to demonstrate the UK's first network to carry 100% hydrogen. This project will examine the regulatory, technical, physical and commercial feasibility of distributing 100% hydrogen to approximately 300 homes and businesses.

28. The Taskforce believes that a strong, government-backed and well-regulated domestic market for hydrogen would drive growth and investment, providing valuable support for the UK's hydrogen innovators and helping them to compete on the world stage.

What support does the sector require to keep pace with the most cutting-edge innovations, such as in hydrogen fuel cells; using Small Modular Reactors for hydrogen production; and in end use applications?

29. To keep pace with innovations in hydrogen technology, cross-sector coordination with Government support to efficiently develop solutions, new business models and value chains is required.

30. Hydrogen technologies are still in the early stages of deployment and face operational cost challenges, particularly when competing with low cost high carbon alternatives, such as natural gas. The development of a financial support scheme will enable investment across the supply chain, including those areas which are less mature, enabling hydrogen technologies to achieve cost down and mass market deployment.

31. The Hydrogen Taskforce has defined policy recommendations for Government (see executive summary). These recommendations are designed to ensure that hydrogen can scale to meet the future demands of a net zero energy system and that the UK leads this sector.

What is the UK industry doing to scale up green and blue hydrogen production by using its offshore wind capability and developing feasible, cost-effective Carbon Capture and Storage technologies?

32. The ability of UK industry to scale up activities in both green and blue hydrogen production is currently limited by the lack of supportive policy frameworks and corresponding lack of secure market for hydrogen. The feasibility studies and demonstration projects mentioned elsewhere in this submission have demonstrated that these technologies are ready to be scaled but that industry awaits the right market and policy frameworks to allow this.

Given hydrogen's potential cross-sector application, how co-ordinated is the Government's approach to policy and regulatory development of hydrogen?

33. The application of hydrogen currently sits across sectors whose remit lies with multiple different Government departments including the Department for Business, Energy and Industrial Strategy (BEIS), Department for Transport (DfT), Ministry for Housing, Communities and Local Government (MHCLG), Department for Environment, Food and Rural Affairs (DEFRA) and HM Treasury. This has contributed to a fragmented approach to policy and regulatory development for hydrogen.

34. Given hydrogen's cross sector application, there is value in a more joined up approach, which would ensure that hydrogen's role in the future energy system emerges in a strategically coordinated manner. Many other economies have realised the benefit of cross department coordination through the development of a Hydrogen Strategy or Roadmap. These strategies give industry and investors confidence in the ambition and commitment of these countries to hydrogen and allows them to invest.

35. The Taskforce is committed to supporting Government to develop a strategy that addresses the role of hydrogen across the energy system and the steps that unlock the benefits of this energy carrier.

How well has the Government raised awareness amongst industry, public officials and the general public of the potential for hydrogen to support a low-carbon economy?

36. Hydrogen's role has been recognised in key papers such as the Committee on Climate Change's Net Zero report, National Grid's Future Energy Scenarios and BEIS' Clean Growth Strategy. However, there is still a low level of awareness across wider government stakeholders, politicians and industry players of the role of hydrogen in meeting net zero.

37. The case for hydrogen is most compelling when considered at an energy system-wide level, and therefore requires communications to emphasise the benefits of hydrogen at this level, with a focus on the economic and environmental benefits.

38. According to a 2019 study conducted by UKRI and Newcastle University, public understanding of hydrogen is low. Once informed, willingness to use blended hydrogen in household appliances was moderately high. 70.6% of respondents believed that blended hydrogen would result in positive environmental impacts. However, both the perceived cost of hydrogen and the safety concerns surrounding its use remain.

39. As part of the H21 project, Leeds Beckett University and Northern Gas Networks have produced a study that shows that consumers trust the gas industry to ensure the safe use of hydrogen and it provides key recommendations for educating and informing the public.

40. These studies show that there is a need to communicate the cost-effective and safe benefits of hydrogen production, distribution and use.

41. The Taskforce believes that the UK Government already recognises the role of hydrogen as a pathway to decarbonisation but urges it to join with industry to communicate the value of this resource to the public.

To what extent has the UK established, or can establish, any early adopter advantage in the use of hydrogen in research, applied science or industrial processes? Which countries are at a similar or more advanced stage than the UK in exploring applications for hydrogen in helping deliver net-zero targets?

42. The UK benefits from widespread R&D and university expertise, transferable skills from the oil and gas sectors, and the presence of UK-based firms leading in important hydrogen sector niches. The UK can build on this to achieve a competitive advantage in the production and use of hydrogen.

43. For example, the UK's offshore wind capacity, interest in expanding nuclear capacity and continued investment in electrolyser technology allows the UK to maximise the value from its world-leading offshore capability to produce green hydrogen.

44. UK CO2 storage potential is significant, with no major technical hurdles to storing industrial scale CO2 offshore. Investment in Carbon Capture Use and Storage (CCUS) technologies would allow the UK to exploit this natural asset and develop a world-leading blue hydrogen production sector.

45. The UK should seek to leverage its world-leading level of gas grid coverage and oilfield infrastructure, decarbonise heat and support the decarbonisation of transport and industrial processes through the delivery of clean hydrogen.

What can the UK hydrogen sector learn from other countries' hydrogen strategies?

46. While the UK has led development of many hydrogen applications, it is now in danger of being left behind by other countries who have more ambitious and joined up approaches to hydrogen. For example, Germany's COVID-19 stimulus package earmarked €9bn for the expansion of hydrogen capacity, targeting 5GW by 2030 and a further 5GW by 2040. Portugal recently announced a new €5bn 1GW green hydrogen production plant to come online by 2023. Investment committed by the UK Government to date is an order of magnitude lower, at less than £200m.

47. Other nations have hydrogen strategies that inform their activities, and which give industry confidence to invest. Japan's hydrogen strategy (established 2017) focuses on enabling hydrogen to reach cost parity with competing fossil fuels and sets the foundation for investment in R&D and infrastructure.

48. The UK lacks a hydrogen strategy and the Taskforce is fully committed to supporting the Government to develop a strategy that addresses the role of hydrogen across the energy system and takes the steps required to unlock its benefits.

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