Response to All Parliamentary Group on Hydrogen Inquiry into how the UK's Hydrogen sector can help support the UK's economic recovery

12 June 2020

This response to the All Parliamentary Group on Hydrogen Inquiry into how the UK's Hydrogen sector can help support the UK's economic recovery is submitted by The Energy Systems Catapult, The Offshore Renewable Energy Catapult, The High Value Manufacturing Catapult, The Oil and Gas Technology Centre, The Aerospace Technology Institute and the Advanced Propulsion Centre. These organisations represent world-leading technology centres designed to transform the UK's capability for innovation in areas of strength.

Collectively our centres represent extensive expertise and experience working with government, industry and academia in energy innovation including the potential role of low carbon hydrogen across production, infrastructure and end-use, in supporting the UKs commitment to net zero, improved productivity and economic growth.

Key Points

1. Hydrogen is expected to play a significant role in our future net zero energy system. To deliver on our net zero commitments, significant hydrogen switching could be required across industry, heavy transport, shipping and aviation, with annual volumes in the range of 200-300TWh by 2050[1]. This means creating an entire new energy sector within 30 years to deliver energy volumes equivalent to that of the power sector today.

2. The development of a networked system of supply, transport and end-use for hydrogen in the UK at this scale would require significant R&D investment in the 2020s. This has the potential to support both economic recovery, clean growth and job creation.

3. As an energy carrier the degree to which hydrogen is decarbonised depends on how it is produced. There are low, zero and negative emission options for producing hydrogen and the optimal future mix of hydrogen production technologies is highly uncertain. Biomass gasification with carbon capture and storage and steam methane reforming (at 99% capture rate) looks appealing for hydrogen production to support net zero. Such facilities would produce hydrogen constantly throughout the year, with surplus during summer being placed into geological storage for use in winter. Without innovation, steam methane reforming at a 95% capture rate is likely too high carbon to meet Net Zero. Innovating to make this more efficient and achieve high carbon capture rates is critical to allowing a longer-term role for steam methane reforming whilst remaining consistent with the achievement of net zero.

4. Whilst electrolysis currently appears a less cost-effective option, innovation (including learning by doing) is expected to bring down costs and improve performance. Demonstrating green hydrogen production from electrolysis at scale in the 2020s should be a priority given implementation risks with steam methane reforming and CCS, which, if proven successfully, may then compete to deliver lower cost hydrogen to consumers. Nuclear energy is a possible route to the production of hydrogen with evidence that thermochemical processes driven by heat directly from nuclear energy and electrolysis from electricity generated by nuclear energy could produce cost effective hydrogen.

5. There are multiple possible end-uses for hydrogen across industry, transport (including shipping and aviation), electricity generation and heating. Some industrial processes are not well suited to electricity as a low-carbon energy source; and hydrogen could also provide a very valuable resource for managing peak electricity demand in an energy system with significant amounts of installed renewable generation capacity. Transport and heating are potentially important end-uses for hydrogen in delivering net zero but within each there are applications and locations where it is likely to be more suited. A blanket approach for these sectors is unlikely to be effective in achieving a net zero economy.

6. There are many non-technical barriers, including public acceptance and consumer appeal, to low carbon heating technologies including hydrogen for heating. There is a need for innovation to drive the development of compelling customer propositions and cost effective low and zero carbon heating products and services that deliver people the comfort

[1] https://es.catapult.org.uk/reports/innovating-to-net-zero/

they want at home. Programmes such as BEIS Hy4Heat are contributing critical evidence to the potential use of hydrogen for heating in the UK. Early demonstration of 100% hydrogen networks and boilers is essential to prove the safety case and maintain this as an option for decarbonising heat. Better evidence is also need on the feasibility of technical integration and large-scale conversion of existing gas heated homes to electric heat pumps through programmes such as BEIS Electrification of Heat Demonstration Project. There is a potentially significant role for hydrogen in shipping, which appears attractive from a carbon abatement perspective. Hydrogen is also being explored for aviation applications, including directly for short-haul flights and as an intermediary in the production of e-fuels for other types of flights.

7. Effective planning and coordination of hydrogen production, storage and distribution as part of our wider energy system is essential to ensure cost effective, low carbon supply; and ensuring synergies between end-uses are realised and conflicts avoided. There is a need to strengthen network price controls to support decarbonisation by incentivising and taking forward whole systems local area energy planning and develop a much better understanding of options for decarbonising local energy systems across the UK to inform national decisions related to hydrogen production, infrastructure and use (including repurposing of the gas grid) that supports net zero objectives. This has the potential to link to local industry strategies including consideration of regional hydrogen production and use.

8. Demonstration of the safety of hydrogen switching for industrial processes is essential. There is the need to consider the integration of decarbonisation roadmaps for industrial clusters with the development of local area energy plans to enable investment in hydrogen infrastructure in the right places at the right time. Industry also requires stronger policy incentives to invest in emissions reduction through improving industrial processes, fuel switching, and technology innovation.

9. There is a clear need to improve the alignment of existing policies related to decarbonisation including the role of hydrogen and to strengthen policy where there are clear gaps. There is the potential to create an economy wide carbon policy framework to deliver Net Zero efficiently. Improved market price signals are needed that incentivise efficient use of the system in time and space. This includes reforms to ensure more accurate time-of-use and locational signals to strengthen incentives for supply and demand to match user needs and local system circumstances. The creation of technology neutral support mechanisms is most likely to encourage innovation and drive cost competitiveness in all forms of hydrogen production (blue and green) and its use.

10. There is the potential for the UK to play a leading role in the development of hydrogen technology given the significant renewable energy potential for green hydrogen production and domestic gas reserves for blue hydrogen production. To realise this potential the UK needs to increase and accelerate R&D or risk being overtaken with major technology development and demonstration happening overseas.

11. Whilst no fundamental breakthrough technological innovations are required for hydrogen to play a major role in our future energy system continued innovation is critical if hydrogen technologies are to be cost competitive. The development of the necessary infrastructure and a functioning market for low carbon hydrogen will be needed to enable investment in both supply and demand technologies. At this time and given the scale of the net zero challenge and potential significant role of hydrogen this means there is need to support innovation through a balanced R&D portfolio.

12. The sector requires a joined-up strategy that drives innovation and enables effective coordination across sectors along the hydrogen value chain from production to storage and distribution and ultimately end use of both blue and green hydrogen. Recognising the potential importance of hydrogen to supporting economic recovery and delivering net zero our technology centres are working together to inform a roadmap for a UK hydrogen economy and enable coordinated focus and government support for hydrogen innovation in the UK.