HOUSE OF COMMONS SCIENCE AND TECHNOLOGY COMMITTEE: THE ROLE OF HYDROGEN IN ACHIEVING NET ZERO

WRITTEN EVIDENCE FROM THE HYDROGEN TASKFORCE
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HYDROGEN TASKFORCE

House of Commons Science and Technology Committee: The role of hydrogen in achieving Net Zero

Written evidence from The Hydrogen Taskforce

Executive Summary

The Hydrogen Taskforce welcomes the opportunity to submit evidence to the Science and Technology Committee's inquiry into the role of hydrogen in achieving Net Zero. It is the Taskforce's view that:

- The *10-Point Plan's* 5GW production target represents a conservative view of what is possible in the UK and that the UK must look to be more ambitious, if it is to compete internationally;
- The Taskforce's analysis demonstrates that hydrogen demand is estimated to range from 40 TWh to 161 TWh by 2030, requiring installed production capacity of 5.8 and 20.7 GW;
- A twin track approach to the scaling up of blue and green hydrogen, with associated infrastructure investment, must be employed, as this will prove less costly, reduce risks and ensure UK leadership in production and expertise;
- The UK holds world-class advantages in hydrogen production, distribution, application and related technologies, such as Carbon Capture, Usage and Storage (CCUS) and offshore wind;
- Other economies are moving ahead in the development of hydrogen and the UK must respond.

In March 2020, the Taskforce 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 for use 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.

Please note, the above policy recommendations are currently in the process of being revised to take into account recent commitments from the Government and the Taskforce's analysis on how hydrogen can support the UK to decarbonise and reach the stated ambition of Net Zero by 2050.

The Taskforce would welcome the opportunity to brief the Committee on its enhanced policy recommendations to the Government, once these have been established.

The Hydrogen Taskforce

1. The Taskforce is a coalition of the hydrogen industry's largest organisations that operate and innovate in and across this sector, including Arup, Baker McKenzie, Baxi Heating, BOC, BNP Paribas and Arval, BP, Cadent, Centrica, DBD, Equinor, ITM Power, Johnson Matthey, Northern Gas Networks, Ørsted, SGN, Shell, SSE Thermal and Uniper.[1]

2. The Taskforce aims to enable the UK to become a world leader in the 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 development of the hydrogen sector in the UK.

Responses to the questions asked by the Committee

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

The focus, scale and timescales of the proposed measures:

3. In late 2020, the Government's *10-Point Plan* and *Energy White Paper* made a series of significant commitments to scale up low-carbon hydrogen production and its use in the UK. These documents noted the range of applications for this resource in heating, transport and industry, alongside UK expertise in the production of green and blue hydrogen (through CCUS).[2]

4. *The 10 Point Plan* notes that the Government aims to develop 5GW of low-carbon hydrogen production capacity to fulfil 42TWh of annual low-carbon hydrogen demand by 2030. The Government hopes to see 1 GW of installed capacity by 2023. It has made £240m available (Net Zero Hydrogen Fund) to support this target, up to 2024/25.

5. It also notes that the Government will work with industry to pilot the blending of 20% hydrogen in the home heating gas grid. The Government will support industry to begin a large village hydrogen heating trial in 2025 and set out plans for a possible hydrogen town pilot by 2030.

6. On CCUS, a key component of blue hydrogen production, the Government will invest £1bn up to 2025 to support the deployment of two industrial clusters or "SuperPlaces" in the 2020s, and a further two clusters by 2030. This will support the UK's ambition to capture 10MtCO_2 annually by 2030.

7. According to this plan, these measures will support the creation of 8,000 jobs across the UK's hydrogen value chain by 2030, potentially reaching 100,000 by 2050. CCUS will support 50,000 jobs by 2030.

8. The Taskforce welcomed the inclusion of a 5GW production target within the *10 Point Plan*. This marked the first major target announcement on hydrogen by the UK and it is an important first step. It is the view of the Taskforce that this 5GW target represents a very conservative view of

[1] Please note, some of the companies listed were not members of the Hydrogen Taskforce when the March 2020 paper was published and, therefore, do not necessarily share all the views therein.
[2] HM Government, *The Ten Point Plan for a Green Industrial Revolution* (2020), 10-11, 22-23.
HM Government, *The Energy White Paper: Powering our Net Zero Future* (2020), 94-95, 112, 125-128.

what is possible in the UK and that the UK must look to be more ambitious if it is to compete internationally.

9. The Taskforce, in consultation with industry, has undertaken its own analysis to estimate a range of hydrogen production and demand across the value chain in 2030. This range reflects the impact and depth of policy measures as well as the uncertainty in forecasting.

10. By 2030, the Taskforce's central or baseline estimate of hydrogen demand is 76 TWh, of which 53 TWh (70%) would likely be met by large-scale production of blue hydrogen.

11. In the central estimate, we anticipate that the remaining 30% of overall hydrogen demand (23 TWh) would be met by green hydrogen and this demand would require an installed capacity of 4.6 GW.

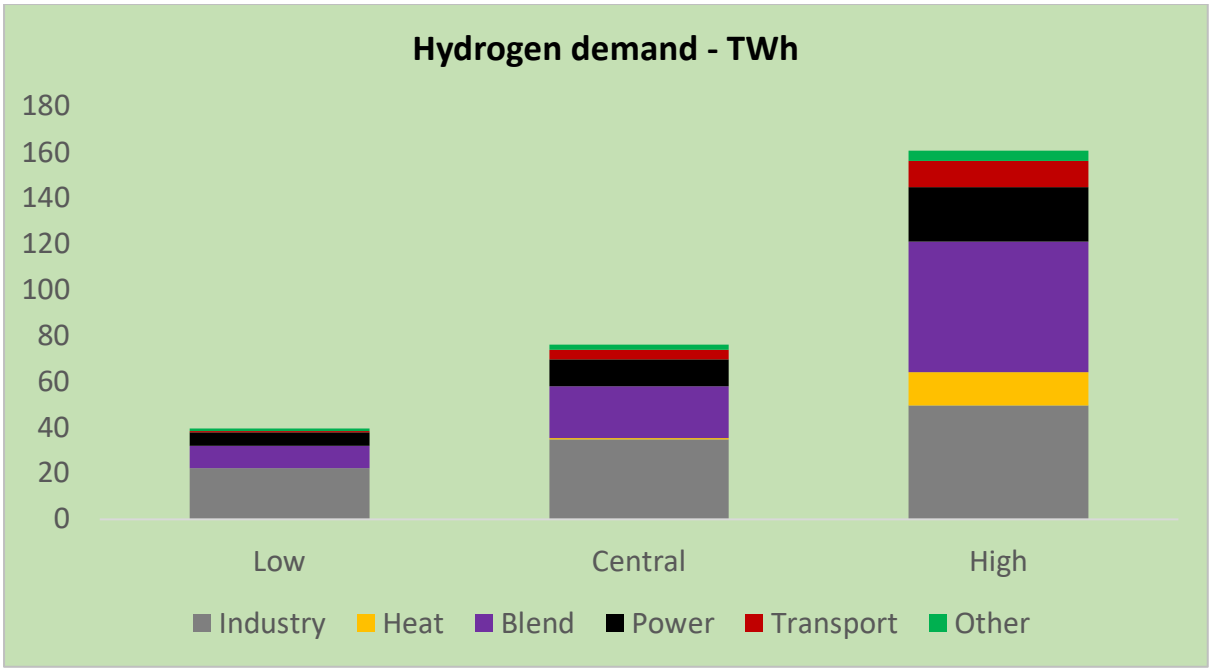
Table 1: Hydrogen Taskforce Estimates of UK Hydrogen Demand and Production Capacity in 2030

	10pt Plan	Low	Central	High
Production – installed capacity (GW)	**5**	**5.8**	**10.9**	**20.7**
Blue		4.0	6.2	12.0
Green		1.9	4.6	8.6
Demand - TWh		**40**	**76**	**161**
Industry		22.2	34.8	49.7
Blending		9.9	22.4	56.9
Power		6.0	11.9	23.8
Transport		0.6	4.1	11.2
100% domestic heat		0.0	0.7	14.5
Other (i.e. CHP, ammonia)		1.1	2.3	4.5
Impact				
Carbon abatement ($MtCO_2$)	41	17.2	34.7	73.4
GVA - £bn		5.8	11.1	23.4
Jobs	8,000	23,900	45,400	96,200

Note: The Taskforce's 'low' estimate has been formed by assuming a 50% reduction in hydrogen demand (and capacity) against the 'central scenario'. Similarly, the 'high' estimate has been assumed to be a 50% increase on the 'central' estimate.

12. In its analysis, the Taskforce also provided a further breakdown of hydrogen demand by end-use sectors. Buildings are estimated to account for most of the hydrogen demand across all scenarios. Transport is projected to account for the lowest share of overall hydrogen demand.

Table 2: Hydrogen Taskforce Estimates of End-use demand profiles, TWh



13. The Taskforce's estimated hydrogen production capacity, informed by industry, differs markedly from *10 Point Plan's* figure of 5GW of installed capacity by 2030.

14. While the Taskforce agrees that the Government must remain technology agnostic, we believe that further detail on the anticipated blue and green hydrogen production, considering economic drivers, must be outlined in the forthcoming UK Hydrogen Strategy.

15. The Taskforce is also eager to see further information on the anticipated demand from end-use sectors and potential growth levers in this strategy. The Taskforce's analysis illustrates significant demand for hydrogen across industry, heat, blending, power and other sectors.

16. The Taskforce, as outlined in its recent Economic Impact Assessment (EIA) and further analysis, believes that hydrogen offers a significant opportunity for UK industry, manufacturers and innovators.[3] This opportunity has the potential to support the decarbonisation of the UK and provide substantial economic value to our country through GVA, direct and indirect employment and the export of hydrogen, skills and expertise to Europe and elsewhere.

How the proposed measures—and any other recommended measures—could best be coordinated:

17. The *10 Point Plan* provides no indication on how the Government plans to coordinate the implementation of these measures. However, the Taskforce works closely with the Department for Business, Energy and Industrial Strategy's (BEIS) Hydrogen Economy Team, BEIS Hydrogen Business Models team and the newly established Hydrogen Advisory Council. These units and organisations will likely inform and drive these measures, as well as the forthcoming UK Hydrogen Strategy.

[3] Hydrogen Taskforce, *Economic Impact Assessment* (2020).

18. It should be noted, however, that the application of hydrogen currently sits across sectors whose remit lies with multiple different Government departments including 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.

19. Given hydrogen's cross-sector application, there is value in a more joined up approach across government and other government bodies and regulators, 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 comprehensive Hydrogen Strategy or Roadmap.

20. The Taskforce looks forward to the forthcoming UK Hydrogen Strategy and hopes that this document will include a roadmap with clear sequencing of production and demand, across a variety of end-use sectors. This roadmap must be developed in partnership with industry to ensure that it aligns with their ambitions and provides industry and investors with further confidence in the ambition and commitment of the UK to hydrogen and enable them to invest.

The dependency of the Government's proposed plans on carbon capture and storage, any risks associated with this and how any risks should be mitigated:

21. The Government has not decided on the proportions of blue and green hydrogen within its 5GW target. The greater the reliance on blue, the greater the dependency on CCUS. The production of blue hydrogen at volume and in its low-carbon form requires Carbon Capture Usage and Storage (CCUS).

22. The UK has advantages for blue hydrogen, which is produced through steam-methane reforming (SMR) or autothermal reforming (ATR) coupled with CCUS. SMR is more carbon intensive than ATR. Expertise in the oil and gas sector can aid the transition to the production of blue hydrogen via CCUS.

23. UK CO_2 storage potential is significant, estimated to be around 78GT. No major technical hurdles to storing industrial scale CO_2 offshore exist. CCUS is widely regarded as being a scalable and efficient method to decarbonise heavy industry, while producing hydrogen.

24. On CCUS, the Taskforce believes that the Government must prioritise its plans to deploy business models to support this pathway to produce low-carbon hydrogen, but it notes that these models need to be correctly sequenced with current and forthcoming hydrogen projects, as well as existing and future policy mechanisms.

25. The Taskforce would welcome further guidance on which industries the Government intends to target for CCUS as a decarbonisation technology, and which industries will be targeted for hydrogen.

26. The Taskforce recommends a twin track approach to the scaling up of blue and green hydrogen, as this will prove less costly in the long-run and ensure UK leadership in both blue and green production and the associated and exportable expertise in this sector. It also reduces risk with multiple sources of hydrogen to meet scaling demand.

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

27. Members of the Taskforce are leading and 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, H2H Saltend, Project Cavendish and the Aberdeen Bus Project. Feasibility studies have demonstrated the applicability of hydrogen in the sectors that these projects focus upon and the potential reductions in the costs of producing hydrogen.

28. The Taskforce welcomes Ofgem's recently awarding £18 million, alongside £6.9 million from the Scottish Government, to SGN's H100 Fife project. SGN shareholders and Cadent, Northern Gas Networks and Wales & West Utilities are also providing funding for this project. This demonstrates the collaborative relationship that this sector is building with Government and regulators.

29. To ensure that existing and future projects demonstrate the viability of hydrogen across the value chain, the Taskforce recommends that the UK Hydrogen Strategy includes a roadmap with clear sequencing of production and demand, across a variety of end-use sectors. Additionally, the Taskforce welcomes the forthcoming consultation on 'hydrogen-ready' appliances, noted in the *10-Point Plan*.

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

30. The Taskforce believes that the UK Hydrogen Strategy could address some of engineering and commercial barriers for the entire value chain, such as the high-cost of the production of low-carbon hydrogen and regulations that inhibit the blending of hydrogen in the gas grid. For example, the Taskforce recommends that the Gas Safety Management Regulations (GSMR) are amended to enable blending and, eventually, 100% hydrogen heating.

31. The ongoing hydrogen trials led by the gas grid operators have sought to overcome and provide solutions to engineering challenges associated with hydrogen for heat. These trials include H21, H100 and HyNet, as well as projects that been developed through the Green Recovery.

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

32. Over 80 per cent of UK homes and businesses are connected to the gas network, giving the UK a world-leading level of gas grid coverage. This high-performing industry has delivered 99.9 per cent reliability across its assets. The regulatory framework has already been developed for the network. The gas grid represents not only a high value asset that consumers have already paid for, but also a highly valuable industry that develops and maintains it. It is important that we leverage the gas grid and the industry that supports it as the UK decarbonises.

33. Hydrogen offers the UK a pathway to cost effectively decarbonise the gas grid, protecting and creating jobs while delivering clean energy to homes and businesses across the country. In the 1960s, the UK gas industry converted the local gas distribution network from towns gas to North Sea gas and constructed a national transmission distribution network. The conversion of the gas grid to hydrogen would represent a similar challenge.

34. In addition, the use of hydrogen in the gas grid delivers many energy system benefits. Hydrogen, produced from electrolysers, can provide a link between the electricity system and the gas system allowing energy to be stored in times of surplus, as well as offer long term storage solutions.

35. The gas grid can provide an initial reliable market for hydrogen, which will allow production to scale. The grid, in conjunction with industrial uses and power generation, will create the required demand volume that will enable producers to deliver cost down. This approach is particularly important for blue hydrogen production that can only be delivered at scale and needs a large initial offtaker but would also enable green hydrogen to be injected into the grid. This would enable consumers to buy "green gas" in the same way that they currently buy green electricity.

36. The UK also has much of the existing infrastructure required to support the rapid scale-up of hydrogen in power generation. Power generation can provide a key early off-taker for hydrogen in addition to industrial and domestic heat. The UK has many existing CCGT generation plants which can be repurposed to run on hydrogen blends. In addition, if hydrogen production is sufficient, there is substantial potential for the development of new CCGT plants designed to run on 100% hydrogen. This additional power generation from hydrogen will be vital in meeting increased power demand resulting from widespread decarbonisation.

37. There are few technological constraints to the introducing blending into the gas grid and to starting to develop 100% hydrogen distribution networks. However, a regulatory framework must be established that allows networks to invest. This could be delivered under a Regulated Asset Base (RAB) model.

38. The early mandating of 'hydrogen-ready' boilers will support the streamlining of the process of conversation and stimulate jobs and economic growth. It should be noted that this pathway will be dependent on a government decision regarding hydrogen. Further trials are required to consider customer perceptions of hydrogen in the home.

39. All networks and clusters must have a network plan in FEED stage by 2025. This will require intervention from Ofgem and ensuring that the mechanisms outlined for RIIO2 are delivered in an agile and flexible way. By 2022, a system operator and shipper must be appointed to manage storage and settlement and licensing conditions need to be established. Hydrogen meters are being developed under the Hy4Heat programme, but these will need to be in place in any homes that are converted.

40. Blending will help provide early markets to scale production and provide storage whilst salt caverns are being developed. The GSMR must be amended to enable blending. In order to stimulate demand for blending, a green gas programme could be introduced, like that of renewable electricity whereby consumers can purchase "green gas" through their energy provider. This system has been implemented for biomethane and could be built upon for hydrogen.

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

41. According to the Taskforce's analysis outlined in Table 1, hydrogen could potentially unlock £11.1bn in economic growth and support 45,400 jobs by 2035.

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

42. Hydrogen has a key role to play across the energy system, offering a complementary decarbonisation route alongside electrification. The application of hydrogen looks different across various sectors.

43. In industry, the need to upgrade equipment and local grid connections is likely to make this more expensive than clean hydrogen for industrial users, with the Committee on Climate Change (CCC) concluding that: "hydrogen options may be cheaper than electrification" for most industrial sites, excepting the use of electrical heat pumps used to heat buildings.

44. Hydrogen will have a key role to play in transport, particularly in larger vehicles which are less suited to electrification and where consumers demand rapid refuelling. Hydrogen is expected to be the dominant choice for HGVs and shipping and is also likely to see deployment in buses, rail, cars and vans, particularly those that travel large distances or have high utilisation. Hydrogen's use in aviation is also being explored.

45. The CCC, in its review of HGV options, found that the most cost-effective option for decarbonisation in terms of infrastructure costs is a hydrogen-lead scenario, which has a cumulative CAPEX cost of £3.4bn in 2060. This is compared to £21.3bn for the BEV scenario.

46. Decarbonising shipping with hydrogen and ammonia (produced from green hydrogen) is a promising avenue and the CCC's Net Zero Report noting that shipping requires a 75% or 100% uptake of ammonia, in order to meet net zero.[4] The global nature of shipping will require international cooperation on decarbonisation routes, and this is being widely discussed.

47. In domestic heating, a balance between electrification and hydrogen will be needed. In its recent analysis, the CCC indicated that further research, and in particular the results of trial use of hydrogen in gas networks will be key for understanding the most appropriate balance between the two.

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[4] Climate Change Committee, *Net Zero: The UK's Contribution to Stopping Global Warming* (2019), 154.

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