Decarbonised Gas Alliance: Hydrogen in a Green Recovery:

Submission to the Hydrogen APPG inquiry, June 2020

1. Hydrogen can help tackle the hard-to-decarbonise sectors

The hard-to-decarbonise sectors – industry, heavy transport and domestic heating – can all make extensive use of hydrogen to hep reach net zero. Combined, these sectors account for around 180 million tonnes of CO2 equivalent – 40% of the UK's emissions:

Industry – 76.5 million tonnes of CO2 equivalent (17% of UK total):[1]

- Hydrogen is needed to provide high-temperature heat for industrial processes, and is also vital where the process requires a flame to come into contact with the product being made, for example glass and ceramics. There is existing industrial hydrogen demand, although the hydrogen is not low-carbon.
- The first trial of hydrogen in the steelmaking process has just been completed in Sweden,[2] and a UK trial has been funded to evaluate the use of hydrogen in glass manufacture.[3]
- All of the UK's main industrial clusters, located in less affluent areas of the country, have ambitious decarbonisation plans that include hydrogen production.[4]

Heavy transport – 35.3 million tonnes of CO2 equivalent (8% of UK total):[5]

- Hydrogen can be used in cars trucks, buses, trains and ships as a zero emission fuel. It is particularly suited to heavy transport where it's harder for vehicles to carry big enough batteries, and where hydrogen refuelling times are faster.
- Hydrogen buses are being used successfully in Aberdeen, and HGV manufacturers are starting to roll out hydrogen models. In Germany, hydrogen trains are in operation, and the SWIFTH2 project is evaluating the potential for hydrogen ferries for Scottish islands.

Domestic heating – 67.5 million tonnes of CO2 equivalent (15% of UK total):[6]

- The UK has around 28 million homes, and therefore needs to decarbonise heating in 1 million homes a year between now and 2050. 85% of homes are connected to the gas grid, and many of these are not suited to electrification, as they do not have hot water tanks or large radiators. Hydrogen offers a cheaper and less disruptive option, with only the boiler needing to be replaced.
- Hydrogen safety trials – for blended and 100% hydrogen – are taking place across the country, and a hydrogen-ready boiler has already been developed.

In addition, hydrogen can help accommodate the growth of renewable **electricity**, with stranded wind and solar power being used to produce hydrogen, and then the hydrogen being used in a power station to produce electricity when wind and solar generation are low. Equally, natural gas reforming could also play an important role in providing the hydrogen for reliable back-up power capacity.[7]

2. Hydrogen and associated infrastructure development can be a significant job creator

Hydrogen development, and associated infrastructure, including CCS and domestic conversion, can be a significant job creator in its own right:

- **Green hydrogen production:** A recent report by the Offshore Wind Innovation Hub found that the transition to green hydrogen (100% H2 gas network) will result in an estimated investment level of between £4 billion and £12 billion per year over an extended period (up to 50 years) between 2040 and 2090.[8]
- **Domestic hydrogen conversion:** The H21 North of England report showed that a widespread conversion of homes to hydrogen would require over 3,000 gas engineers for a number of years, with additional management staff.[9]
- **CCS (needed for blue hydrogen):** Hydrogen and CCS development for broad-based decarbonisation could be a significant job creator, leading to 43,000 jobs for industrial decarbonisation alone, 195,000 jobs if hydrogen plays a full role in economy-wide decarbonisation, 221,000 jobs if the UK also becomes a major hydrogen exporter.[10] A recent Summit Power report also found that developing a network of CCUS projects along the East Coast of the UK, capturing 75 million tonnes of CO_2 per year, would provide £163 billion of economic benefits and 225,000 jobs, cumulatively, through to 2060.[11]

3. Hydrogen enables low carbon industrial exports

In many parts of the country, energy intensive industries –iron and steel, cement, chemicals, oil refining, food and drink, pulp and paper and ceramics – are the largest employers in the area and offer high quality jobs that pay above the median wage. Overall, energy intensive industry accounts for £140 billion in economic value added and employs over 1.1 million people.[12] But the UK has seen too much emissions reduction through offshoring of heavy industry, and is now the largest per-capita importer of CO2 emissions in the world.[13] To give one example, the closure of Redcar steelworks in late 2015 led to 2,000 job losses, but caused nearly half the fall in industrial emissions in 2016.[14]

Hydrogen provides an opportunity to turn this around, and develop UK exports of decarbonised industrial products, together with exports of hydrogen technology and services. Overall, the global hydrogen market could reach £1.9 trillion a year by 2050,[15] with the global fuel cell market reaching over £140 billion, while the European electrolyser market (dependent on the Brexit trade outcome) could be £3.7 billion in 2017-2025, which could represent around £0.8 billion to the UK by 2025.[16] International cooperation to ensure consistency on, for example, low carbon hydrogen standards, will be essential if the UK is to capture the full export potential.

But these opportunities will only be realised if the UK produces hydrogen at home – if we wait for other countries to take the lead, the opportunity will be lost.

4. There are different ways of producing low carbon hydrogen – all are needed

All forms of low carbon hydrogen production are needed if we are to reach net zero:

- **Blue hydrogen,** produced from natural gas with CCS, is currently the cheapest and largest scale production method, and could meet the hydrogen demand of the UK's major industrial clusters.
- **Green hydrogen,** produced using electrolysis powered by low carbon electricity, is being developed for distributed uses such as transport, as it satisfies the high-purity requirements of fuel cells. Green hydrogen will also be developed to make best use of onshore wind and solar power, and offshore hydrogen production at offshore wind farms is also being piloted.[17]
- **Hydrogen production from gasification of plastics or bioenergy** can reduce the problem of plastic waste and produce a zero emissions or negative emissions fuel at the same time. The UK's first waste plastic to hydrogen plant has recently been given planning permission.[18]

5. Hydrogen development needs focused support to happen in practice

Five elements are key to scaling-up hydrogen:

1. **Hydrogen production business models**, for all forms of low carbon hydrogen and associated storage. We support a variant on a CfD model as one viable option.
2. **Hydrogen storage** options for underground, grid-scale storage of hydrogen need to be evaluated, especially in areas located away from traditional salt cavern storage complexes, including Wales, Scotland and parts of southern England.
3. **Associated CCS infrastructure** to decarbonise industry directly and for blue hydrogen production, should be supported through a combination of CfDs and regulated financing.
4. **Gas networks** should continue to be supported to blend hydrogen, and then to convert to 100% hydrogen. Blending is an interim step which is important to increase the hydrogen market. At the same time, hydrogen ready boilers should be mandated to ease the transition for consumers.
5. **The Renewable Transport Fuel Obligation (RTFO)** needs to be amended to support all forms of low carbon hydrogen, including green hydrogen with an electricity grid connection, and should also be extended to cover fuel for rail and marine, as well as road.

Overall, what government has done to support renewable electricity, with great success, needs to be replicated for hydrogen to tackle the hard-to-decarbonise sectors and create jobs in key industries. Cost reductions for renewables have been driven by economies of scale, technological improvement, and lower financing costs as investments become less risky. The same would be true of hydrogen – major investment could see hydrogen costs fall by half by 2030.[19]

[1] NB: Includes: All industrial processes, Iron and steel combustion and electricity, Industrial combustion and electricity (excluding iron and steel), Commercial and miscellaneous combustion and electricity. BEIS, Final UK greenhouse gas emissions national statistics 1990-2018, Table 3 https://data.gov.uk/dataset/9568363e-57e5-4c33-9e00-31dc528fcc5a/final-uk-greenhouse-gas-emissions-national-statistics
[2] See https://www.ovako.com/en/newsroom/news--press-releases/ovako-press-release-detail/?releaseId=389A46FDB96CDB2F
[3] See https://www.gov.uk/government/publications/industrial-fuel-switching-to-low-carbon-alternatives/industrial-fuel-switching-demonstration-successful-projects-phase-3
[4] These projects are: HyNet (North West), NECCUS (Scotland), Net Zero Teesside, South Wales Industrial Cluster, Zero Carbon Humber
[5] NB: Includes: Domestic civil aviation, Buses, HGVs, Railways – mobile combustion, Shipping – national navigation, Shipping – fishing vessels, Military aircraft and shipping, Aircraft support vehicles. BEIS, Final UK greenhouse gas emissions national statistics 1990-2018, Table 3 https://data.gov.uk/dataset/9568363e-57e5-4c33-9e00-31dc528fcc5a/final-uk-greenhouse-gas-emissions-national-statistics
[6] NB: Includes: Residential combustion. BEIS, Final UK greenhouse gas emissions national statistics 1990-2018, Table 3 https://data.gov.uk/dataset/9568363e-57e5-4c33-9e00-31dc528fcc5a/final-uk-greenhouse-gas-emissions-national-statistics
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[9] H21 North of England, 2018, pp.284-285 https://northerngasnetworks.co.uk/h21-noe/H21-NoE-23Nov18-v1.0.pdf
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[12] BEIS analysis using the ONS Annual Business Survey
[13] Office for National Statistics, The decoupling of economic growth from carbon emissions: UK evidence, October 2019, Figure 11 https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/compendium/economicreview/october2019/thedecouplingofeconomicgrowthfromcarbonemissionsukevidence
[14] Cooper SJG and Hammond GP, Decarbonising UK industry: towards a cleaner economy, Institution of Civil Engineers paper 1800007, May 2018, p.3; See https://www.gazettelive.co.uk/news/teesside-news/redcar-steelworks-closure-contributes-sharp-12696855
[15] Hydrogen Council, Hydrogen scaling up, November 2017, p.8 http://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-Scaling-up_Hydrogen-Council_2017.compressed.pdf
[16] Tractebel and Hinicio, Study on early business cases for h2 in energy storage and more broadly power to h2 applications, June 2017, p.2 https://www.fch.europa.eu/sites/default/files/P2H_Full_Study_FCHJU.pdf
[17] See https://www.imeche.org/news/news-article/dolphyn-project-gets-3.1m-for-offshore-wind-powered-hydrogen-production
[18] See https://www.constructionenquirer.com/2020/03/04/first-waste-plastic-to-hydrogen-plant-approved/
[19] Hydrogen Council, Path to Hydrogen Competitiveness, January 2020 https://hydrogencouncil.com/en/path-to-hydrogen-competitiveness-a-cost-perspective/