



# What do we need to make Hydrogen a reality?

## Annual Report



All Party Parliamentary Group on  
**Hydrogen**

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# Foreword

In the two years since I led the first ever debate in Parliament on hydrogen, it has become even more clear to me that hydrogen will become an integral part of the UK's energy mix, and I am very pleased that my enthusiasm for UK hydrogen has been echoed by my colleagues in Parliament and Government. Our desire to grow the UK hydrogen economy has been further bolstered over the past year: Putin's war in Ukraine has brought home hydrogen's value in energy security, and the renewed focus on our net zero goals mean Britain has become more open than ever to looking at hydrogen's potential as a universal, zero-carbon energy source.

Proof of this Government's support for hydrogen abounds: the UK's low carbon hydrogen production capacity ambition was doubled to 10GW, the Net Zero Hydrogen Fund amounts to a £240 million investment in UK hydrogen, and the Government underwrote a £400 million loan to help British firms invest in our hydrogen future. This really could be the birth of a new hydrogen revolution, if we make sure the UK takes advantage of this wonder-fuel.

There is no doubt that, as I have mentioned, not only will hydrogen bring energy security to the UK and help us achieve net zero, but there are also huge opportunities presented by the future hydrogen economy. For example, hydrogen will help with decarbonising heavy industry and transport, supporting British technology manufacturers who are already world-leaders in hydrogen technology development, and bringing jobs and wealth to left-behind communities to achieve the Government's levelling-up ambitions.

I truly believe that the UK can become a global leader in the hydrogen economy. The Hydrogen Strategy and the Heat and Buildings Strategy are a strong start down this path. With the Energy Bill set to become law in the spring, and the Government recently launching its long-awaited consultation on mandating hydrogen-ready boilers from 2026, there has never been a more exciting time to be involved in the hydrogen industry.

The All-Party Parliamentary Group on Hydrogen has, over the last year, been a crucial forum for discussing, highlighting, and showcasing these opportunities; this report is a summary of our meetings and provides an overview of the work we have been doing. We have had excellent attendance with a broad range of industry-leading stakeholders. Their insights, along with the case studies of the APPG's sponsors, have formed the basis of this report and the policy recommendations it presents.

I would particularly like to thank all those who have been involved with the APPG over the last two years, particularly my predecessor as chairman, Jacob Young MP, as well as all the officers of the group. I look forward to continuing to support UK hydrogen, and I am excited to continue the excellent work that the APPG has planned for 2023.

If you would like more information on the APPG and its work, please contact the secretariat on [appghydrogen@connectpa.co.uk](mailto:appghydrogen@connectpa.co.uk) and follow us on Twitter @HydrogenAPPG.



**Alexander Stafford MP**

Chairman

All Party Parliamentary Group on Hydrogen



# Executive Summary

Hydrogen will be an inevitable part of the UK's future energy mix. With its potential as a renewable energy source and the UK's geography giving it a key advantage in its production, the gas will be a necessary step towards energy independence and the UK's net zero targets. Whilst the Government have set targets to integrate hydrogen into our future energy mix, the APPG on Hydrogen has spent the last year highlighting key stakeholders and actions that can with the Government's efforts to take hydrogen rollout from words to reality.

All sessions emphasised the need for Government to increase its ambition around hydrogen. Through looking at international comparisons with its peers, it is clear that the UK risks losing its position as a global leader on hydrogen development and rollout. Sectors such as transport and home heating have demonstrated a keen demand across industry for hydrogen, but without a fully fleshed-out implementation framework and timeframe from Government and an official timeframe, the UK risks losing investor confidence.

Whilst industry's support for hydrogen is clear, consumer confidence and education must be improved. Knowledge across the UK of the potential of hydrogen to lower personal carbon emissions remains far too low. The potential of hydrogen's utility across everyday life makes it too good an opportunity to be squandered by poor consumer education.

Hydrogen is by no means a silver-bullet for achieving net zero. However, through work with a range of bodies, such as local governments, industry and communities, the hydrogen economy can become a reality. The APPG on Hydrogen has set out a number of recommendations to reflect this core belief.



## About the APPG

The APPG on Hydrogen is chaired by Alexander Stafford, MP for Rother Valley, and has a total of 18 parliamentary members. It provides a forum for MPs and Peers to engage with leading businesses and organisations that are enabling the UK to meet its decarbonisation targets through the implementation of hydrogen projects, and to discuss policy options to support these.

The APPG's sponsors are Baxi, Bosch, Cadent, EDF, the Energy and Utilities Alliance, Equinor, Howden, Johnson Matthey, National Grid Gas, Northern Gas Networks, Scottish Gas Networks and Shell. Minutes of the APPG's previous sessions can be found on the [APPG website](https://connectpa.co.uk/appg-hydrogen/) (<https://connectpa.co.uk/appg-hydrogen/>).

A large-scale conversion to hydrogen has the potential to:

**Strengthen the UK's energy security:** The horror of the Ukraine war has made it clear that the West cannot afford to be economically dependent on states like Russia and China. Turning back to domestically produced fossil fuels through methods such as fracking cannot be a sustainable long-term solution, but the rapid scaling up of renewable energy sources such as hydrogen can.

**Position the UK as a world leader in the hydrogen rollout:** While the UK has made significant progress in the testing and research it has conducted on the potential of hydrogen, specifically green hydrogen, it is increasingly falling behind the standard set by its international peers. The UK must act quickly to counteract this.

**Drastically cut carbon emissions:** Hydrogen has the potential to slash carbon emissions throughout the economy, from industrial production to the heating of homes to the way we travel, with its ease of application limiting disruption to consumers.

**Lead a green skills revolution:** The APPG is proud to have a cross-UK, cross-party parliamentary membership and to count trades unions among its contributors, who have all testified to the potential of hydrogen to create thousands of new green jobs.

# What is hydrogen?

Hydrogen is a gas that can be combusted in a way that produces no greenhouse gas emissions. It can be produced through electrolysis of water or by reforming methane, where the carbon dioxide generated can be captured and stored.

Many organisations are currently looking at hydrogen as a source of low carbon energy and as a key solution towards supporting the Government's net zero targets. Some businesses assessing hydrogen's potential are exploring the production and delivery of hydrogen through carbon capture, utilisation and storage (CCUS), with others exploring production through nuclear energy and renewable energy such as offshore wind .

The UK has the potential to become a world leader in this sector. It has a long history of leading in developments on gas technology, a large workforce linked to the gas industry and has an excellent safety record. It also has experience in gas conversion, and an integrated gas network already largely adapted to be hydrogen ready.

## Reasons why the UK should become a global leader in hydrogen technology

- **Existing infrastructure for gas storage with an excellent safety record**
- **Demonstrable achievements in scientific and engineering innovations**
- **Skilled professionals, resources, companies and academic/ research facilities**
- **UK financial services and proximity to European markets**

# Recommendations

1. Ofgem must facilitate the development of a liquid hydrogen market which will allow the UK to be attractive for investment and be globally competitive.

2. The Government must set out sector-by-sector roadmaps that highlight how the Hydrogen Strategy could be delivered across the economy.

3. HM Treasury must further consult on offering business rate discounts for companies that implement hydrogen business models.

4. The Government must give early approval for hydrogen blending into the transmission and distribution gas networks at levels of up to 20%, and mandate hydrogen-ready boilers from 2026 to stimulate investment in domestic supply chains.

5. The Department for Business, Energy and Industrial Strategy must develop and implement a long-term Energy Storage Strategy which includes the role of hydrogen.

6. The Government must develop and set out cooperation plans with its international allies for increased information exchange and pooling of research capabilities. This will ensure it is consistently meeting if not setting the international benchmark for hydrogen technology development.

7. Industry must work together, with the visible sponsorship of the Government, to launch a joint public information campaign to ensure consumer education on hydrogen and its potential applications in day-to-day life.

8. The Government must develop a system of tax credits for hydrogen production, with a sliding scale of increased credits the cleaner the hydrogen produced, similar to the US Production Tax Credit (PTC). This would ensure an instant increase in the cost competitiveness of zero carbon hydrogen compared to other forms of hydrogen.

9. Industry stakeholders must create a large-scale implementation strategy of hydrogen refuelling stations for the mutual benefit of the sector and the increased public awareness of hydrogen as a viable fuelling option.

10. Industry must create a public facing investment platform for consumers to invest in hydrogen infrastructure and earn compensation on their energy bills in return, as is currently being done in the wind energy sector.

# Case study Baxi

Baxi's parent company, BDR Thermea Group, launched a world-first pilot in late 2022 using its 100% hydrogen boilers in 12 inhabited homes with hydrogen supplied via an existing natural gas grid.

The pioneering pilot in the eastern Dutch town of Lochem is the first-time hydrogen heating is being tested at this scale anywhere in the world. The detached listed houses, all built around 1900, will each be equipped with one of the boilers, which burn pure hydrogen with zero carbon emissions. The hydrogen is fed into the existing gas grid at a nearby industrial zone.

A collaboration between BDR Thermea's Dutch brand Remeha and grid operator Alliander, the pilot will run for three years, ensuring extensive testing in wintertime, when heat demand peaks. The houses were deliberately chosen as older residential housing stock, with restrictions to the changes that can be made to them due to their heritage status. Decarbonising buildings is an urgent imperative, and hydrogen is one of the key technologies to do this, alongside heat networks, heat pumps and hybrid solutions that combine heat pumps with boilers.

The landmark pilot builds on a raft of exploratory projects involving Baxi and the wider BDR Thermea Group. Baxi participated in the Government-funded Hy4Heat programme, showcasing prototype hydrogen boilers at several 100% hydrogen public demonstrations, building towards a larger deployment in hydrogen neighbourhoods and village trials in coming years.

# BAXI



Baxi's Hydrogen Homes demonstration project at Low Thornley, Gateshead



# Hydrogen and local government

**Our session on hydrogen and local government noted that a critical determining factor in the success of the hydrogen economy will be how efficiently it is rolled out by local governments, and how effectively we make local government a valued and valuable stakeholder in the process.**

The importance of a credible low-carbon hydrogen standard has also become apparent, in order to underpin investment in low-carbon hydrogen production. Scaling up local hydrogen hubs to become central to local economies, such as through the decarbonisation of local transport networks via hydrogen will provide local government with the agency and space to innovate in a way that best suits their communities and our economy. Without a low-carbon hydrogen standard, to support net zero and drive the UK into the future, firms may decide to choose a cheaper, high-carbon alternative.

By better considering workstream development, the UK would have a chance to hugely increase the potential of new, British-developed hydrogen technology rolled out across the UK and

abroad. This includes the development of a hydrogen ecosystem and delivery map, encouraging investment on more mature technologies, as well as living labs to support new projects based on concepts but without a prototype.

Other countries, like the US and Germany, have set high standards for hydrogen, especially in green hydrogen production. The UK must not fail to do the same and more: building out the limited hydrogen facilities in UK, and scaling up new trials via local pilot projects, in order to set out the examples needed for industry and Government to follow on a wider scale.

Local infrastructure development will be key in enabling innovation by local government, rather than a top-down approach from the centre. Contributors expressed concern over the lack of this in the UK, and called for the Government to be investing further to grow the market by stimulating market mechanisms, as the Government did for offshore wind with the Contracts for Difference scheme.



# Case study Bosch

Alongside Bosch's hydrogen boiler activity, the company is partnering with UK based organisations to support the hydrogen transition in other areas – as an example Bosch has partnered with Ceres Power to accelerate the development of the fuel cell and stack technology. These cells are the key elements of the Bosch Solid Oxide Fuel Cells (SOFC) systems which, when operated with green hydrogen, reduce carbon emissions to zero.<sup>1</sup> Research in this area has been defined as an Important Project of Common European Interest (IPCEI) by the European Union.<sup>2</sup>

The establishment of a strong hydrogen economy is very important, that is why Bosch drives the development of technologies to shape the transformation towards it. This is where the Bosch SOFC fuel cell system comes into play because it can already be fueled by natural gas or biomethane and, in the future, by pure hydrogen – all whilst demonstrating significantly greater efficiency than gas or coal-fired power plants. This makes the fuel cell technology an important element for successfully transforming the energy sector today.

In the interest of effective climate action Bosch is also investing in hydrogen production by branching out into the development of components for electrolyzers, the technology needed for electrolysis to split water into hydrogen and oxygen. As in the fuel cell, the key component of an electrolyser is a stack, which comprises several hundred individual cells. Ideally, the electricity for the electrolysis process is generated from renewable sources such as wind or photovoltaic power, in which case it produces green hydrogen.<sup>3</sup>



**BOSCH**



<sup>1</sup> <https://www.bosch.com/stories/sofc-system/>

<sup>2</sup> IPCEI (europa.eu)

<sup>3</sup> <https://www.bosch-presse.de/pressportal/de/en/new-area-of-business-bosch-to-develop-components-for-hydrogen-electrolysis-240065.html>

# Hydrogen and transport

Transport accounts for approximately one-fifth of global carbon emissions. The APPG's session on hydrogen and transport, in which we were delighted to hear from the then-Parliamentary Under-Secretary of State for Transport, Trudy Harrison MP, noted the modal shift that will occur with people shifting from personal transport to clean forms of mass transport, with the rest of the decarbonisation process done for them by mass transport companies.

The importance of hydrogen fuel cells as a key technological development for a clean rail system has become apparent, and it is clear that industry sees them as an absolute necessity going forward, hoping to deploy them globally and see the advanced deployment of fuel cells in the coming years.

Through the expansion of hydrogen technology for the transport sector, the cost of hydrogen fuel cell innovation will come down. This will be crucial for the development of other hydrogen-ready transport solutions and the wider hydrogen economy. Industry sees rail as a starting point for the early adoption of hydrogen. Industry sees rail as an interesting early adoption of hydrogen but needs to be able to build out the necessary infrastructure through private-public partnerships, alongside extra investment in research and technologies to drive down cost.

From below ground to above the clouds, hydrogen has the potential to decarbonise every form of transport. Liquid hydrogen has a particular application potential for aircraft

and has been proven to be effective in smaller aircraft in trials. With large commercial aircraft making up 92% of all aviation CO<sub>2</sub> emissions, industry now requires government support in developing the requisite manufacturing and infrastructure to keep up with its competitors. This would enable, for example, demonstrating hydrogen technology on flight rigs and testing, and expanded production of liquid hydrogen via cryogenic systems.

The aerospace community could demand up to 10% of hydrogen needs by 2030. By 2035 we could have a commercial aircraft flying with a liquid hydrogen solution, with a fuel-cell hydrogen-powered medium-sized aircraft before then, but industry requires further Government support for R&D to make this a reality.

Much as across other sectors, industry and Government must work together to drive down the cost of hydrogen for its rollout across the transport sector, especially commercial vehicles. Through key innovations in larger modes of transport, such as trains and planes, adaptations of technology can be made for smaller, commercial vehicles. But until that initial investment and research is done, hydrogen transport will not be a reality for the everyday consumer. This innovation will take place either in the UK or abroad as countries seek to meet their climate change agreement targets. It is up to the UK Government to decide whether we want to be the pioneer in this space, and if we do, act quickly, and the US hydrogen tax credit system shows us an example of this could work.



# Case study Cadent

Cadent continues to lead the way with the development of a broad range of programmes to make hydrogen a vital technology for use in industry, transport and for heating.

This year, Cadent continued its role as part of the HyNet and East Coast Hydrogen Consortiums, as well as introducing Capital Hydrogen and Hydrogen Valley feasibility studies to create a vision for hydrogen in London, the East of England, and the West Midlands.

Cadent has also worked with industry partners to introduce a public awareness campaign: Hello Hydrogen, which addresses the urgent need to provide consumers with informed choice when it comes to decarbonising their heating.

Cadent's proposal for the development of a Hydrogen Village located in Whitby, Ellesmere Port was successfully progressed to the next stage in Spring 2022. Cadent and British Gas have begun engagement with the 2,000 customers within the proposed 'Village' boundary, who will use 100% hydrogen for heating and cooking, rather than the natural gas they use now. A Hydrogen Experience Centre has recently opened in Ellesmere Port which allows local people to come and find out more about the Hydrogen Village trial and try 100% hydrogen gas appliances for themselves.

The Hydrogen Village programme will demonstrate the benefits of hydrogen for heating in a large domestic area, helping Cadent to understand how best to convert future areas of the gas grid to hydrogen as efficiently as possible, enable the Government to assess the feasibility, costs, and benefits of a transition to hydrogen.

Ofgem will confirm the location of the village in 2023 and properties in the confirmed 'Hydrogen Village' will be provided with a free 'hydrogen-ready' gas boiler upgrade, and hydrogen will then be supplied from 2025 for the duration of the programme – currently expected to last around two years.

**Cadent**  
Your Gas Network



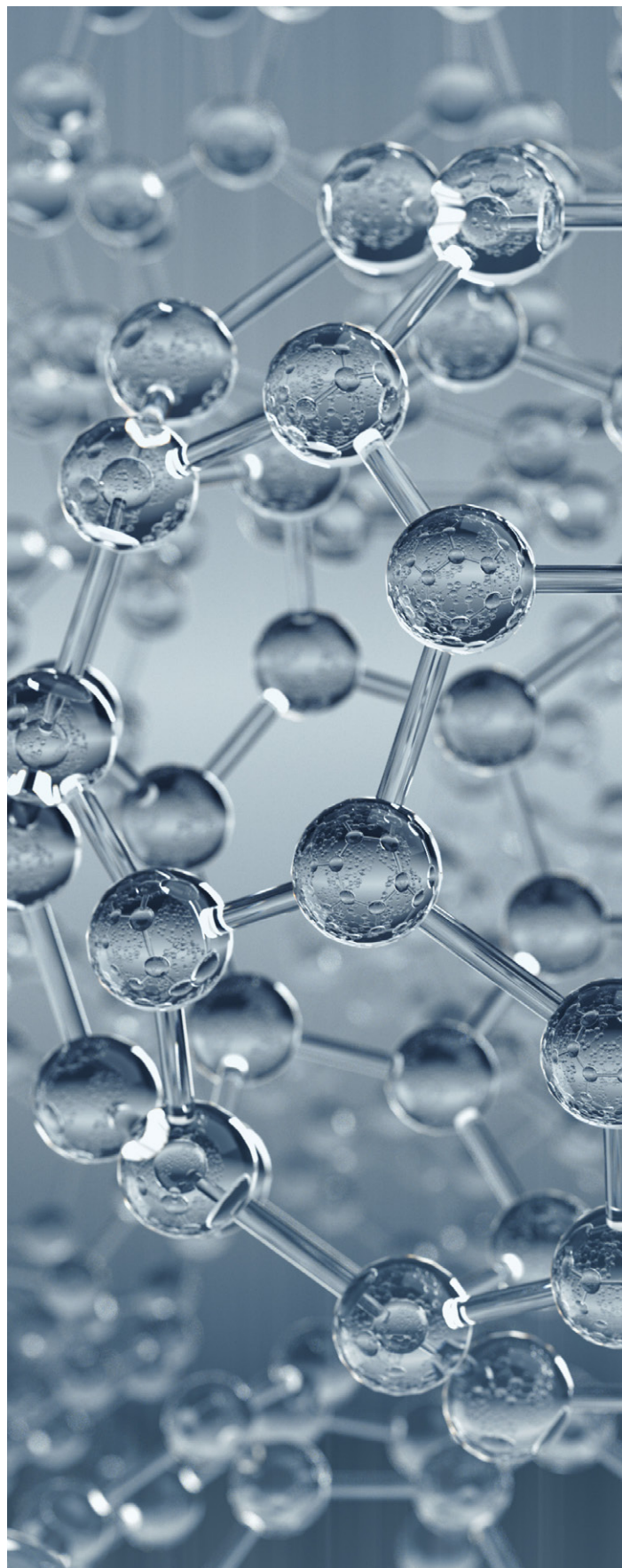
# Hydrogen production and energy security

Our session of the APPG on hydrogen production and energy security was the first session held after the beginning of the war in Ukraine and the release of the Government's British Energy Security Strategy.

The Strategy took the landmark step of doubling the ambitions set out in the Hydrogen Strategy for hydrogen production, setting out the target of producing to up to 10GW of low carbon hydrogen production capacity by 2030, with at least half of this coming from electrolytic hydrogen.

The expansion of hydrogen targets in the Strategy, as called for in our 2019 APPG's annual report, will form a key plank of securing the UK's energy independence from hostile states like Putin's Russia. Industry welcomed its ambition and cited it as critical to providing energy security, with the new 10GW ambition far more in line with what industry wants to be able to deliver, and further welcomed the green/blue hydrogen split within it as well as the new Low Carbon Hydrogen Standard.

When using green hydrogen, industrial sectors such as steel should be prioritised, and due to its scarcity, green hydrogen should be prioritised for the decarbonisation of the essential parts of the economy. However, we need some flexibility, such as when blending hydrogen into the gas grid. Industry agreed that while hydrogen is not a silver bullet to achieving net zero, it has excellent applications in certain areas, with both blue and green hydrogen playing a crucial role. We must also emphasise the importance of a political framework and momentum, on the scale of that seen somewhere like South Korea or Germany, in order to accelerate the decision-making process on hydrogen rollout.



# Case study Equinor

Equinor is leading a project to develop one of the UK's – and the world's – first at-scale facilities to produce hydrogen from natural gas, in combination with carbon capture and storage (CCS). The project, called Hydrogen to Humber Saltend (H2H Saltend), provides the beginnings of decarbonising the Humber, the most carbon intensive industrial region in the UK.

H2H Saltend, a 600-megawatt low carbon hydrogen production plant, will be located at the Saltend Chemicals Park (SCP), to the east of Hull. The project could enable a variety of critical industries at SCP and the wider East Yorkshire area to reduce CO2 emissions by nearly one million tonnes annually.

Equinor is also planning a second 1.2-gigawatt low carbon hydrogen production facility in the Humber which combined with H2H Saltend could deliver 18% of the UK Government's target of 10GW hydrogen production capacity by 2030.





# Hydrogen mass rollout for consumers

The prospect of a more accessible hydrogen economy for consumers has been welcomed by all, but the current high cost makes it unaffordable for most consumers. A particular problem is the current cost of the electrolysis process for producing green hydrogen. However, we must consider the ongoing race between national governments to drive down the price of hydrogen, especially zero-carbon green hydrogen. Current trajectories show that market forces are driving the price down over time as supply of green hydrogen and electrolysers increases.

Government, industry and suppliers also need to have honest conversations with consumers about the costs of moving to a net zero economy and the likely high costs of hydrogen systems.

Hydrogen suppliers should be more deeply integrated into the hydrogen roadmap, especially for hydrogen in homes, where hydrogen-ready boilers need to be considered as an interim step in the rollout. While research conducted using data from

the two hydrogen village projects has found that 70-80% of trial consumers were opting for hydrogen heating when given the choice, until we go ahead and roll out hydrogen heating, it is difficult to be certain exactly how such a huge change will affect consumers. Some customers will always find change difficult, but the village trials present an excellent opportunity to understand how we support customers in difficult spaces to undergo change. Furthermore, they demonstrate consumer attitudes towards hydrogen boilers and are key ambassadors to improving consumer education around this new technology, boosting perceptions of an otherwise unknown appliance.

There is an ongoing debate about the future of blue and green hydrogen. Low-carbon hydrogen produced via CCUS will help the UK achieve our ambition net zero goals and the APPG agrees with the Climate Change Committee's recommendation that CCUS remains part of our energy mix. However, it should be stressed that ultimate goal should always be zero-carbon, green hydrogen.

# Case study

# Johnson Matthey

As a global leader in sustainable technologies, Johnson Matthey (JM) applies its cutting-edge science to develop solutions that make a real difference to the world around us. The company's decades of experience in hydrogen cuts across numerous parts of the hydrogen value chain, including market leading production catalysts and processes, high-performance components for fuel cells and electrolyzers, and award-winning technologies for low carbon hydrogen production. JM also provides a suite of catalysts and process technologies to support the transformation of hydrogen into sustainable fuels and chemicals.

Johnson Matthey's technology will be playing a leading role in projects for low carbon hydrogen and sustainable fuels. Its LCHTM technology has also been selected for the HyNet project to deliver hydrogen in the northwest of England. In Bilbao, Spain, JM's Fischer Tropsch (FT) CANSTM technology, co-developed with bp, and HyCOgen™ technology has been selected for use by Aramco and Repsol at a new synthetic fuels plant.

Earlier this year, JM expanded its presence in electrolytic hydrogen by forming a strategic partnership with Enapter, a leading provider of next generation anion exchange membrane (AEM) technology. In fuel cells, the company announced that it is investing £80 million in a new manufacturing facility at Royston, capable of producing 3GW of components annually.

In support of creating a circular hydrogen economy, JM has begun fuel cell recycling at its Zhangjiagang facility in China, refining the platinum group metal content from membrane electrode assemblies for Unilia, one of the world's leading providers of fuel cell stack technology.

**JM** Johnson Matthey  
Inspiring science, enhancing life





# The Hydrogen Strategy: One year on

In our session celebrating one year since the Hydrogen Strategy, panellists and contributors looked at the impact of the strategy, the developments that have taken place in the hydrogen industry since then and what comes next. While the Hydrogen Strategy has had a profound impact on industry, more collaboration between Government and the sector is needed. To scale up hydrogen, we need new markets linked together by infrastructure, and we need early investment and building to start now in order to be ready for ten years' time, as well as a transmission storage model that transfers hydrogen to users in the same way as methane.

There are three key points to decarbonising the energy sector via hydrogen:

Firstly, on finance and international investment, there is a lot of enthusiasm for hydrogen internationally. This means we must have the market and infrastructure in place to make the most of this. An example of a quick win is the blending of hydrogen with the existing gas network, which a number of heating appliance manufacturers are already trialling.

Secondly, on upscaling targets, while industry welcomed the Government upgrading its hydrogen production targets to 10GW by 2030 in the ESS, it noted that we need to further scale this up dramatically. In a privatised world, we must coordinate across both the private and public sector to meet these challenges.

Finally, on delivery, industry and Government must consider the best end-use applications of hydrogen and how to choose them, as well as where we can convert and build that demand early on.

To take hydrogen to the next stage, we also need a solution around long term energy storage. Batteries are a sufficient solution for now, but long term we need solutions that will get energy to end users. The Government must consider bringing forward the hydrogen business models, to give industry the certainty it needs from next year to start planning relevant projects. A regulatory framework for hydrogen would also be welcome, to build feasibility and give projects more structure.





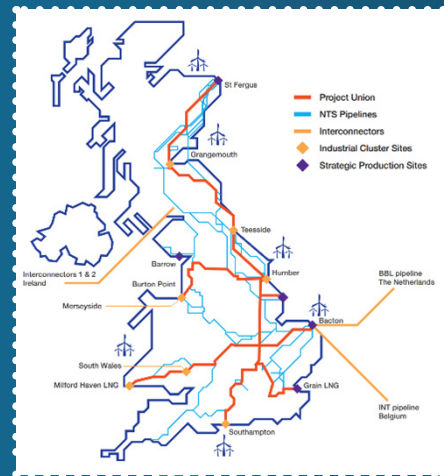
# Case study

## National Grid Gas

FutureGrid has developed a hydrogen test facility using real-world decommissioned transmission assets, which will demonstrate in real time the ability of our National Transmission System (NTS) to transport hydrogen safely and reliably. This test facility is representative of the current network and will be used to test a range of different hydrogen concentrations (including 2, 5, 20 and 100%). To date, we have conducted 15,000 cycles of testing on our standalone fatigue rig in order to prove that our pipeline can safely operate with hydrogen at a range of pressures. Located in Cumbria, the project started in April 2021 with funding from Ofgem's Network Innovation Competition (NIC), and is expected to be complete by the end of 2023. Project partners are DNV, the Health and Safety Executive, Northern Gas Networks (NGN), Fluxys (the equivalent Gas Transmission Operator in Belgium), Durham University and Edinburgh University.



Project Union will deliver a “first of a kind” hydrogen transmission backbone for the UK – and be a key enabler for developing a hydrogen economy to realise 10GW of low carbon hydrogen by 2030. Through the phased repurposing of existing assets, alongside new ones, a hydrogen backbone of around 2,000km will be created, which represents around 25% of the UK's current natural gas transmission pipelines. This approach of primarily repurposing assets is up to five times more cost effective compared to new build and minimises any additional environmental impact. The backbone will initially link strategic hydrogen production sites, including the industrial clusters, across the UK by the early 2030s and provide the option to expand beyond this initial hydrogen transmission network to connect additional consumers. Project Union is crucial to unlocking a hydrogen economy for the UK.



nationalgrid

# Hydrogen and heavy industry

In our session on hydrogen and heavy industry, contributors stressed the need to move quickly on the use of hydrogen in industry. We need more of the basic materials used in industry, such as steel, with the world economy set to create as much infrastructure in next 50 years as it has already. With this in mind, we will need to decarbonise industry to ensure this can be done sustainably.

There remain concerns that the UK is in danger of being left behind by international competitors on the use of hydrogen in heavy industry, noting the examples of projects across Europe and especially in Germany where investment is higher and there is more developed strategic direction. The Government should be investing in facilities to make the process more efficient and competitive, but it needs to be a multi-sector approach, not just steel.

An important catalyst for this will be ramping up the production of green hydrogen in order to efficiently decarbonise industry. While the Government's signalling to industry on issues such as this has got better, it still needs to improve to catch up with the countries setting the standard in the hydrogen industry like Germany and France. For example, the Government has yet to give a green light or even set out provision for a pilot manufacturing facility fuelled by hydrogen, which would mean a significant step towards parity.



# Case study NGN

Northern Gas Networks' (NGN) Hydrogen Homes near Gateshead are the UK's first houses to demonstrate 100% hydrogen appliances to the public.

Built in partnership with Cadent and the Government's Department for Business, Energy and Industrial Strategy (BEIS), the homes showcase the appliances developed, predominantly by UK manufacturers, through the Hy4Heat programme. The appliances look and feel very similar to today's gas appliances and operate in the same way, demonstrating that a transition to hydrogen would lead to little disruption, or changes to cooking and heating homes in the future. Some of the appliances, including meters and boilers are hydrogen-ready meaning they could be installed, use natural gas and be switched to run on hydrogen by an engineer within an hour. This would minimise expense, inconvenience and waste for consumers.

Since opening in summer 2021, the unique homes have welcomed over 2,000 visitors with guests travelling from as far afield as Japan, Australia and the USA. The homes have also attracted national broadcast and print media, even featuring in the New York Times, making millions of people aware of the opportunity of a hydrogen transition for homes.

The homes are providing a valuable education to the public by breaking down any barriers or concerns they may have about a future change in their gas supply. Dedicated days for gas engineers, which also offer the opportunity to meet the manufacturers, are very popular and, in addition to the public, the homes welcome visitors from schools, universities and from across industry.



Northern  
Gas Networks

# How to make hydrogen a reality

During our events at party conference, which focused on the theme of how to make hydrogen a reality, 4 key areas were cited as key to focus on to get the hydrogen economy moving, in order to 'make hydrogen a reality':

1. **Marketplace regulation changes**
2. **Continuation of hydrogen trials from the existing proposals from Cadent and Northern Gas Networks**
3. **Infrastructure preparation for hydrogen-ready status**
4. **Consumer engagement**

Concern has also been expressed over the current lack of consumer awareness on net-zero, for example with heat pumps, emphasising that we need a greater consumer focus and be conscious that we can't force decisions on people.

There are unfortunately no silver bullets anywhere, and we will need a mix of technologies to achieve net zero, which for heating will include heat pumps and hydrogen. The examples of the US, Germany and Australia were cited as examples of pushing ahead with a blend of technologies, in addition to encouraging the development of the hydrogen economy. Concern was expressed that the UK needs to up its pace to keep level with the field, or else risk being left behind. We know what the next steps forward should look like, but institutional change is needed to enact it. To begin to ameliorate this, the Government should consider moving ahead with blending as a route to developing the hydrogen economy.

Furthermore, we cannot afford any further delay on the milestones that have been set out, for example the aforementioned 2026 decision on hydrogen heating, with hydrogen heating the policy area that the next policy decisions should centre on. The village trials will provide the key evidence that Government needs to make a decision, and keeping up the momentum and programs, for example via the recently-returned Energy Bill, is key.

While there was broad agreement with the Government's twin-track approach of balancing short to medium-term investment in both blue and green hydrogen, concerns were also raised that the Government was not yet delivering on what was a broadly correct strategy, with greater private sector investment and a strong regulatory framework to give investors' confidence badly needed. Further work should be done to understand the demand side, rather than just supply, and Government should consider more hydrogen village trials to showcase its feasibility and increased ambition on hydrogen export.



# Case study SGN

## LTS Futures

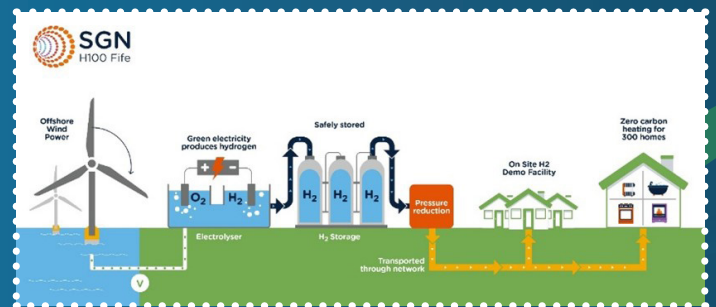
The LTS Futures project will research, develop, test and evidence the compatibility of Local Transmission System assets, pipelines, associated plant and ancillary fittings with hydrogen. The project will end with a first-of-its-kind repurposing trial and demonstration. The pipeline being used in this live trial is statistically representative, which will help us develop a blueprint methodology for repurposing the LTS in Great Britain's network for hydrogen. In April 2022, SGN secured £29.9m in funding from energy regulator Ofgem and gas distribution companies to deliver the project. The LTS Futures project will be based in Grangemouth, Scotland, and delivered with support from global chemical company, INEOS. It will enable wide-scale system transformation of the UK gas network to hydrogen, driving decarbonisation.

## H100 Fife

H100 Fife is a world-first project happening in Levenmouth, Fife. It has a crucial role in helping us move away from natural gas to hydrogen. The project will provide evidence to help inform future low-carbon policy decisions and a clear path towards net zero heating for Scotland and the UK.

Renewable electricity produced by a 7MW wind turbine will be used to produce green hydrogen in an electrolyser. This renewable hydrogen gas will be delivered through a new 100% hydrogen gas network, which SGN will install underground alongside their existing gas network.

In the first phase, up to 300 participants will be able to sign up to receive a hydrogen gas supply. They'll all get a new hydrogen boiler and new hydrogen appliances to replace their existing natural gas appliances. These will be supplied, installed, and maintained for the entire project duration free of charge. They will also receive £1,000 for taking part. Participants will pay the same for hydrogen gas as they would for natural gas and can opt out at any time during the project.





# Hydrogen in homes

The Energy Bill will be a key catalyst for the development of hydrogen in homes. Its return to Parliament for scrutiny and amendment is welcome, if overdue, and its passage into law (expected to be in the spring) will make future projects for hydrogen in homes far easier to carry out and bring the UK a step further to having a world-leading energy sector.

The UK's heating sector accounts for a third of the UK's carbon emissions, as noted by the Business, Energy and Industrial Strategy Committee in their February 2022 report on decarbonising heat in homes. Hydrogen and hydrogen-ready, boilers can, therefore, play a large role in the decarbonisation of home heating. However, this has to be the proactive choice and policy of government in order to give providers the certainty necessary and consumers competitive prices. Retrofit solutions show that hydrogen has a part to play, but this requires increased Government action and engagement with consumers.

Industry has little in the way of clarity and transparency from Government on what their plan is, with much of industry working as pan-European businesses, they currently work with significant R&D budgets in hydrogen development and are working to a timescale based on 2026, yet they can only do this due to certainty provided by governments in Europe, not the UK.

Industry welcomed the variety of ways the Government has outlined to decarbonise heating in homes, particularly since these are not competing technologies but complimentary; they will work together to reduce the UK's heating emissions. Industry and Government are aware that decarbonising heating in homes is going to require both heat pumps and hydrogen boilers, given some applications are better suited to one or the other. It is, however, imperative that the Government's timetable for testing hydrogen-ready boilers is met, adding that we need blending from 2023 to create demand. The Government should also be receptive to clear signals from industry showing demand for hydrogen heating solution to grow, and invest accordingly.

# Case study Shell

Hydrogen could play a vital role in helping society achieve its net-zero emissions ambitions, particularly for hard-to-abate sectors such as heavy-duty transport and heavy industries.

The Humber region is one of the UK's largest industrial clusters, presenting a significant decarbonisation opportunity. Not only is 80% of the country's licensed CO<sub>2</sub> storage capacity accessible from Humber, but the sum of all of the proposed projects in the cluster have the potential to meet 30% of the Government's H<sub>2</sub> production targets. Shell and Uniper are progressing plans for one such project - to produce blue hydrogen at Uniper's Killingholme site, through the Humber Hub Blue project announced in April 2022. The project includes a proposed blue hydrogen production facility with a capacity of up to 720 MW, using gas reformation technology with CCS. It is expected to capture approximately 1.6 MT CO<sub>2</sub> per year.

The captured carbon would be fed through the proposed Zero Carbon Humber onshore pipeline. The hydrogen produced could be used to decarbonise heavy industry, transport, heating and power throughout the Humber region. The project is expected to be operational later this decade.

The UK government have introduced a welcome ambition for hydrogen production and a clear Hydrogen Strategy. Following this with sector-by-sector hydrogen demand policies that set out how the strategy could be delivered will help generate the demand for hydrogen, with companies like Shell ready to play their part in the supply.

Shell could invest up to £25 billion in the UK energy system over the next decade, subject to Board approval, of which more than 75% could be on low- and zero-carbon energy products and services such as this.<sup>1</sup> UK infrastructure investment to support a transition to networked hydrogen as an industrial, transport and eventually domestic or commercial fuel represents a major over-arching jobs and growth opportunity for the UK.



<sup>1</sup> Subject to Board approval

# Hydrogen and the workforce



As previously outlined, the development of the hydrogen industry is essential for the UK's net-zero targets and the decarbonisation of the energy sector. However, without an adequately trained and re-skilled workforce, the hydrogen industry cannot progress at the pace, scale, and efficiency required. Representation, innovation, and the centrality of workers in industry will be key to progress.

The hydrogen industry must be futureproofed from the ground up. A key step for achieving this will be through increased representation and diversity of gender, age, background, and experience. This will ensure that companies have a vast range of experiences and ideas to draw upon, whilst also ensuring that the skills base is broad and varied.

Through increasing representation, further innovation can take place, and new ideas from a vast range of workers will allow for new ideas. This is particularly the case for the pool of employees that firms hire from with regards to their educational background. Through having a variety of apprentices, university graduates and reskilled workers, further innovation and change can take place more rapidly. This is particularly the case in the maritime industry, where a great deal of innovation is needed to decarbonise shipping.

Finally, workers need to be placed at the centre of industry's progress. There are currently a great deal of trained and skilled men and women in industry. However, focussing too much on innovation and change may result in leaving behind the current workers along with their potential to contribute to the industry. Firms must work with their current employees to create adequate reskilling programmes so that any change is sustainable.





# Case study

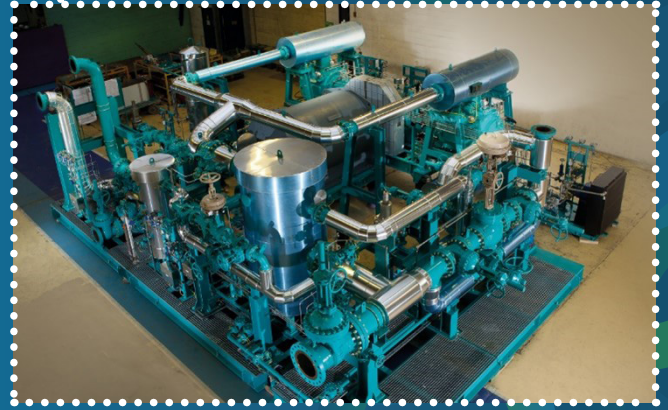
# Howden

Howden is recognised as a global leader in hydrogen compression solutions, headquartered in Glasgow. We are well established in the global hydrogen market, with over a century of compression experience and our technology can handle and optimise hydrogen across the value chain from production, to storage, distribution and end use such as refuelling stations, Power-to-X applications and heavy industrial purposes.

Howden's hydrogen compression solutions have enabled some of the world's most unique and innovative renewable hydrogen projects that are accelerating the energy transition. In the US, Howden's compression technologies play a critical role in supporting Raven SR to convert household waste into hydrogen, a technology that will see demand around the world. In France, Howden is supporting a project to demonstrate the feasibility of industrial scale underground storage of green hydrogen, which is an important step in establishing the development of the hydrogen economy in Europe.

Within the UK, Howden will support Inovyn's hydrogen production plant in Runcorn, UK. With our piston and diaphragm compression technologies, Inovyn will be able to supply compressed fuel-cell quality hydrogen to the transport and industrial sectors. Howden's technology will support Inovyn's ambition to tap into the emerging hydrogen fuel-cell market in the UK and boost its revenue from co-produced hydrogen, realising the business' mission to lead the UK to net-zero carbon emissions.

Howden is an active member in a number of the world's most important global and regional hydrogen associations and our experts collaborate and raise awareness of the importance of the energy transition and the company's role navigating and de-risking the pathway to the clean hydrogen energy transition.



# Carbon intensity in hydrogen production

The UK must ensure it provides a welcoming regulatory environment for hydrogen production, especially for green hydrogen. Governments across the EU have embraced green hydrogen, while the Inflation Reduction Act has produced a competitive environment for investment in the United States. Both the EU and the US appear to have sophisticated and joined-up strategies for hydrogen, especially in its storage and end use, which the UK would do well to emulate.

Any forthcoming low-carbon hydrogen scheme should be focussed around a zero-carbon hydrogen standard to reflect net zero goals, with a transparent communication stream to consumers implemented to allow for further consumer education on the zero-carbon potential of hydrogen. The current low carbon hydrogen standard should be the baseline for all hydrogen standards in the UK rather than an optional premium. The UK has the potential to produce high-quality, zero-carbon hydrogen and we must reach this standard to retain our position as a global hydrogen pioneer.

There is also a need for greater direction from Government, for both electricity power systems and our hydrogen design systems, if there is to be proper investment to produce both zero-carbon and low-carbon hydrogen at the scale required. The Energy Bill's provisions would unlock primary legislation that would support hydrogen and the 10GW for hydrogen by 2030, so it is imperative that this passed into law as soon as possible.



# Thank you

We would like to thank all the parliamentarians and speakers who have contributed to such a rich programme this year, as well as the APPG's Vice Chairs and Officers:

- Andy Carter MP
- Bill Esterson MP
- Baroness Hooper
- Christine Jardine MP
- Clive Betts MP
- David Duguid MP
- Ed Davey MP
- John Spellar MP
- Jessica Morden MP
- Liz Savile-Roberts MP
- Lord Oates
- Lord McNicol
- Lord Moynihan
- Lord Wigley
- Richard Thomson MP
- Roger Gale MP

A special thank you also goes to the sponsors of the group, without whom this work would not be possible:

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