



Hydrogen Advisory Council Member and Company Profiles

BOC Limited (Linde Group)

John Panikar, President UK, Ireland and Africa:

BOC has a long history of supplying hydrogen for industrial uses and is the UK's largest producer of merchant hydrogen.

We are committed to the use of hydrogen for transport. BOC opened the UK's first publicly accessible hydrogen fuelling station in Swindon, operates Europe's largest bus refuelling station in Aberdeen and is working to expand the network of hydrogen refuelling stations, particularly to support heavy duty transport applications.

BOC works to support industrial decarbonisation and will be supplying hydrogen as part of the BEIS funded Industrial Fuel Switching competition.

Through our parent company, The Linde Group, we have invested in green hydrogen production technology with a stake in ITM Power, a British manufacturer of polymer electrolyte membrane (PEM) electrolysers. We have also formed a joint venture with ITM Power to implement projects combining ITM Power's expertise in PEM electrolysis and Linde's leading engineering procurement and construction experience.

As a global leader in large scale hydrogen production and carbon capture, we are also providing technical assistance and input to several 'blue hydrogen' projects in development in the UK – ensuring that these projects select the best available and lowest cost technology. As a specific example, BOC is working with the Net Zero Teesside team, led by BP, to evaluate the retrofit of a carbon capture plant on our existing Steam Methane Reformer (SMR) hydrogen plant.

BOC continues to support UK policy development through our involvement in the BEIS Hydrogen Expert Group that is currently evaluating business models for hydrogen use in industry.



BP

Peter Mather, Senior Vice President, Regions, Cities & Solutions & Head of Country, UK:

BP believes that hydrogen has a critical role to play in achieving the goals of the Paris Agreement.

We are involved in blue and green hydrogen projects in Germany, Netherlands and Australia and are actively assessing options to participate in both blue and green Hydrogen production in the UK across different demand sectors, to position for rapid scale up of the industry.

BP is the lead technical partner of the Net Zero Teesside project, which has the potential to be the UK's first commercial full-chain CCUS project – capturing CO₂ from gas-fired power generation and local heavy industry, transporting it and storing it under the North Sea and in turn enabling the production of blue hydrogen in the north east of the UK.

Committee on Climate Change (CCC)

Baroness Brown, Deputy Chair:

The CCC produced a detailed report on the role of hydrogen in decarbonising the UK economy in 2018: Hydrogen in a Low Carbon Economy, November 2018.

In the CCC's report on Net Zero in March 2019 we modelled various hydrogen scenarios with hydrogen potentially providing up to one third of the UK's energy needs in 2050.

In our annual Progress Reports to Parliament in July 2019 and June 2020 we have stressed the need to make progress with developing the hydrogen economy in the UK.

Offshore Wind Sector Deal

As part of the OSW Sector Deal, Baroness Brown has been chairing a cross industry working party looking at OSW and grid integration and OSW and hydrogen. The collective is about to publish two reports on this work developed by the Offshore Renewable Energy Catapult and the Energy Systems Catapult. The OSW and hydrogen report should come out later in July.



Energy Systems Catapult

Richard Halsey, Director, Innovation:

The Energy Systems Catapult is part of a network of leading technology centres helping to transform the UK's capability and drive innovation to promote both productivity and economic growth. The Catapult is involved in a wide variety of projects looking at the role of hydrogen as part of a future net zero energy system and the opportunities for innovation in integrating hydrogen in smart local energy systems.

Equinor

Al Cook, Executive Vice President of Global Strategy and Business Development & UK Country Manager:

Equinor, the Norwegian energy company, has been a major gas supplier to the UK for many decades. It is a global leader in Carbon Capture and Storage, for example via the Northern Lights CO₂ storage project with Shell and Total in Norway, and with its partner, SSE, is presently developing the world's largest offshore wind farm in Dogger Bank.

Equinor is active in continental Europe on hydrogen, working with Vattenfall to convert Vattenfall's Magnum gas-fired power plant in the Netherlands to run on hydrogen, and is a partner in the H-vision project, a large-scale blue hydrogen project in Rotterdam.

Equinor has high ambitions in the UK; it is a co-founder of the Zero Carbon Humber project, together with National Grid and Drax, and within that wider project launched the key blue hydrogen component, Hydrogen to Humber Saltend, at the Saltend Chemicals plant, in June 2020. It is also a partner in the Net Zero Teesside project.

Imperial College London

Professor Nilay Shah FEng, Director of the Centre for Process Systems Engineering & Head of Chemical Engineering:

Our institution undertakes a wide range of research and development activities associated with hydrogen. This includes technologies for production, storage and use of hydrogen, techno-economic and environmental analyses, process and product design, industrial decarbonisation, CCUS, systems engineering and integration and energy policy and road-mapping.

We have created relevant spin-outs in fuel cells, energy storage and process modelling and design, and collaborate with a wide range of industries in the UK and internationally. We host the H₂FC Supergen Hub, the UK's academic network of researchers in the field of hydrogen and fuel cells.



ITM Power Plc

Graham Cooley, CEO:

ITM Power Plc designs and manufactures products which generate hydrogen gas, based on Proton Exchange Membrane (PEM) technology. This technology only uses electricity and tap water to generate hydrogen gas on-site and the company has a product offering capable of being scaled to 100MW+ in size. The company's new factory, Bessemer Park in Sheffield, has a 1GW per annum capacity and is the world's largest electrolyser manufacturing facility. ITM Power was the first hydrogen related company to be listed on the London Stock Market and has been developing electrolysis for over 20 years.

Johnson Matthey

Jane Toogood, Sector Chief Executive, Efficient Natural Resources:

Johnson Matthey is a global leader in science that enables a cleaner, healthier world. We continually invest in R&D to find new and better ways to produce clean, sustainable technologies for a wide range of markets globally and have expertise in scale up to commercialisation of world scale facilities. JM has a leading global position in the supply of catalysts and technologies into today's 'grey' hydrogen market.

Building on our scientific applications expertise we have developed a process to produce 'blue' Low Carbon Hydrogen (LCH) in which over 95% of the CO₂ produced is in a form that can be efficiently and cost effectively captured and stored or used in other processes. This state of the art LCH technology forms the core of several collaborative projects in the UK, supported by BEIS, to demonstrate and scale up the production and application of hydrogen.

In addition, JM has decades of experience in innovation and large-scale manufacture of fuel cell technology with components being used today in commercial applications within the transportation and stationary power markets. The scientific principles of electrochemistry which are used in fuel cells are also the core for 'green' hydrogen from electrolysis and JM is investing in programmes to bring a similar critical component, a coated catalyst membrane, to market as quickly as possible, leveraging our science and state of the art manufacturing technologies.

JM is a member of the inaugural Board of the Hydrogen Council and through this and other international links will be able to support the Hydrogen Advisory Council with insight on global advances in hydrogen. We believe there is a genuine opportunity for the UK to become a world leader in the development of clean energy technologies that will drive forward the shift to net zero. Big challenges like this need people to work together and JM is excited to share its scientific, applications and market knowledge to unlock the potential of hydrogen.



Mitsubishi UFJ Financial Group

Andrew Doyle, Director, Power and Renewables:

MUFG has identified low carbon hydrogen as an extremely interesting new development to help achieve decarbonisation targets both in the UK and globally. While we still see some challenges to the bankability of low carbon hydrogen projects, we believe there will be significant opportunities in the near to medium term and we are keen to drive our understanding of the technology, regulation and markets to ensure we can support future developments.

MUFG co-hosted an IPFA event centred on Hydrogen in a Net Zero Economy in October 2019 and also produced an article titled 'The Future of Hydrogen' (May 2020). We have been actively involved in the BEIS Hydrogen Experts group sessions as well.

We look forward to participating in the Hydrogen Advisory Council and helping aid the future development of this sector.

Ørsted

Duncan Clark, Head of UK Region:

Accelerating the uptake of renewable hydrogen is fundamental both to Ørsted's vision for a world which runs entirely on green energy and the UK's ambition to deliver a net zero economy by 2050.

Ørsted has led the UK offshore wind sector in its industrialisation and cost reduction journey and intends to be at the heart of renewable hydrogen as it follows that path in the UK.

Renewable hydrogen is at a similar tipping point where, with the right government support and industrial resolve, the UK's capabilities can be rapidly scaled up to reduce cost and deliver decarbonisation targets. One of the unique advantages of offshore wind is that it can be developed very quickly at scale: 5+ years from initial concept to multi-GW projects installed and operational coupled with similarly rapid electrolyser development the UK can truly lead the world in the development of a hydrogen economy, delivering jobs, investment and export opportunities before 2030.

Ørsted intent is to leverage its UK offshore wind development portfolio to provide low cost green power and establish a similarly market leading green hydrogen business. The first step in the delivery of that ambition within the UK is Ørsted's partnership with ITM Power, Element Energy and Philipps66 on the Gigastack project in the Humber, supported by BEIS; the first phase of this project connects the offshore wind from Hornsea 2 with ITM's next generation stack to establish a 100MW electrolyser and deliver renewable hydrogen to the Philipps66 refinery meeting up to

30% of its current demand. This project will act as proof of concept to enable all partners to accelerate their ambitions to decarbonise the Humber region.

Delivery of green hydrogen at scale will need an integrated approach which engages supply chains, sponsors and (most importantly) industry as offtakers: Ørsted has established a consortium in Denmark committed to the creation of a sustainable fuel hub in Copenhagen. Partners include shipping and logistics companies (including Moller-Maersk), an airline (SAS), and Copenhagen Airport; the project aims to be operating electrolyzers with a capacity of 250MW by 2027 and 1.3GW by 2030.

Pale Blue Dot

Alan James, Managing Director:

Pale Blue Dot Energy is currently working on the Acorn Hydrogen Project in North East Scotland. It is designed to be an early customer of the Acorn CCS Project. It will be a 250MW auto thermal reformer unit which will produce hydrogen for a range of markets including mobility, domestic heat and also blending into the gas grid. Working alongside our Acorn partners Shell, Chrysaor, and Total, we are aiming for first hydrogen production in 2025.

Progressive Energy

David Parkin, Director:

Progressive Energy is a clean energy project development company, focused on delivering projects that make material contributions to decarbonising the 'hard to reach' sectors of the economy. We are the lead developers for the HyNet integrated Hydrogen / CCUS project in the North West, which delivers at scale low carbon hydrogen for region-wide, cross-sectoral decarbonisation. We also lead the delivery of a number of underpinning science and engineering demonstration projects, including HyDeploy / HyDeploy 2 and HyNet Industrial Fuel Switching.

Ryse Hydrogen

Buta Atwal, Chief Executive Officer:

Both Ryse and Wright Bus have a clear Hydrogen strategy. We believe that transport is an important starting point for hydrogen, as normally a bus / train will return to base, therefore the infrastructure required can be better and cost effectively organised. We also have our first hydrogen production site under development which gives us an insight of the development and cost of producing hydrogen at scale.

Shell

Paul Bogers, Vice President for Hydrogen:

Shell sees hydrogen as a clean and versatile energy carrier that can be used as an energy-dense, molecular fuel for power, transport, and in industry as feedstock.



These qualities suggest hydrogen may be integral to addressing greenhouse gas emissions, in particular from hard-to-decarbonise sectors of the global energy system.

Shell is actively involved in a number of projects to produce both blue and green hydrogen.

- In Scotland, Shell is part of the Acorn CCUS project which will include industrial decarbonisation but will also use existing oil and gas infrastructure at the St Fergus gas processing terminal to reform North Sea gas into blue hydrogen, capturing the CO₂ and storing it offshore. The hydrogen produced would then be used in transport, in the gas grid to decarbonise heating in homes, and in industry.
- Shell is also involved in the UK in the Net Zero Teesside Cluster and projects and consortia in the Netherlands which see blue hydrogen and CCUS as a means to decarbonise heavy industry.
- In Germany, at the Shell Rhineland Refinery, work is underway to install one of the largest hydrogen proton exchange membrane (PEM) electrolyser in the world with a peak capacity of 10MW and production volume of 1,300 tonnes of hydrogen a year.
- In the Netherlands, together with consortium partners Gasunie and Groningen Seaports, Shell has announced one of the largest green hydrogen projects in Europe, the NorthH2 project which project envisages the construction of very large wind farms in the North Sea, growing gradually to a capacity of about 10GW. The first turbines could be ready in 2027 and will be used for green hydrogen production, mainly to supply industry. NorthH2 expects to produce around 800,000 tonnes per year by 2040 and would avoid about seven mega-tonnes of CO₂ per year.
- Also in the Netherlands, Shell intends to create a green hydrogen hub in the port of Rotterdam, using green electricity generated by wind power. Expected to go into operation by 2023, the green hydrogen plant will produce about 50,000-60,000kg of hydrogen per day and have a capacity of around 200MW.

Shell is also part of several initiatives to encourage the adoption of hydrogen in transport.

- In Germany, we are working with private-sector partners, including Linde, and the German government in the H2 Mobility joint-venture to develop a nationwide network of hydrogen refuelling stations for passenger cars. Thus far, 80 stations have been made operational, growing to 90 in 2020.
- We also have hydrogen refuelling stations in California, USA and, in partnership with ITM Power, in the UK. More are under construction. In 2018, Shell opened its first hydrogen station in Canada, in Vancouver; and announced plans to open three new stations in the Netherlands.
- For the heavy-duty segment, Shell is part of a consortium in California which is developing three new large-capacity refuelling stations for heavy-duty hydrogen fuel-cell trucks, in partnership with Toyota and Kenworth Truck Company. These stations will form the first hydrogen truck refuelling network in California.

Siemens Energy Ltd, UK and Ireland



Steve Scrimshaw, Vice President:

At Siemens Energy Limited, hydrogen is an important cornerstone of our strategy. The decarbonisation of the global economy is one of the most important challenges facing us today. The key to this is the steady expansion of renewable energies and their integration into mature industrial, energy and mobility infrastructures. Our interest spans a wide spectrum of activities internationally but specifically in the UK:

- Renewable energy through our shareholding in Siemens Gamesa Renewable Energy (SGRE). SGRE are supporting the integration study being led by Dame Julia King on behalf of the Offshore Wind Industry Council
- Connecting offshore wind farms to the National Grid
- Grid Stability Projects
- Energy storage and conversion
- Gas Transmission compression and distribution
- Small and Large Power Generation equipment – in both an on and offshore environment coupled with associated decarbonisation technologies such as carbon capture and storage and burning alternative low/zero carbon fuels
- Converting power to alternative fuels such as ammonia, methanol and "green" hydrogen via Electrolysis for multiple use cases in the transport, industrial and domestic environment.

University of South Wales

Jon Maddy, Senior Lecturer and Hydrogen Centre Manager:

Through its Hydrogen R&D Centre at Baglan and laboratories at Glyntaf, the University of South Wales (USW) has a substantial experience and expertise in the research and development of electrolytic, thermo-chemical and biological hydrogen production, hydrogen energy storage, hydrogen purification, and the application of hydrogen for the decarbonisation of industry, transport and heating.

With a portfolio ranging from fundamental research to commercial development, the University engages with a wide range of industrial, academic and government partners to make advances in hydrogen technology. A range of current projects support these activities, notably the ERDF Flexible Energy Systems (FLEXIS) and Reduced Industrial Carbon Emissions (RICE) projects. With industrial partners, USW has created the South Wales Industrial Cluster and leads the R&D aspects of the Cluster's activities as part of the Industrial Strategy Challenge Fund, Industrial Decarbonisation Deployment and Roadmap projects.