Hydrogen to decarbonise industry and commerce

HydroGenus

Delivering the switch to clean green hydrogen

THE DECARBONISATION IMPERATIVE

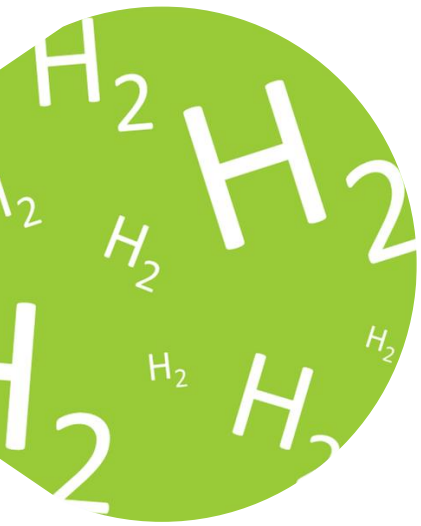
Net Zero for greenhouse gases requires the decarbonisation of industrial heat and chemical processes.

Electrolysis is the method of using electricity to separate water into hydrogen and oxygen. Hydrogen produced by electrolysis from low-carbon electricity delivers significant reductions in carbon dioxide.

Heating processes and some chemical processes which are reliant on natural gas or oil can be readily adapted for hydrogen substitution. The burning of hydrogen does not produce carbon dioxide emissions. When blended with natural gas, hydrogen offers a lower carbon fuel.

Hydrogen also be used to produce synthetic liquid fuels or used in a fuel cell to produce electricity. This electricity can be used to power vehicles. No greenhouse gases or harmful particulates are produced from hydrogen fuel cells.

The UK government has declared that it eventually expects 20-35% of all energy consumption to be served through hydrogen. To accelerate this trend, it has doubled its ambition for hydrogen production to 10GW by 2030, with at least 5GW from electrolytic hydrogen (from almost zero today).



The government is offering an initial £100m electrolyser hydrogen support package until 2025 that enables hydrogen to be supplied at comparable cost to natural gas. More funding is promised via levies.

The switching of industry and commerce to hydrogen is occurring within the wider movement of hydrogen adoption for transport and domestic use.

HydroGenus is ready to help customers make the switch. Our mission is to "*deliver the switch to clean green hydrogen*".

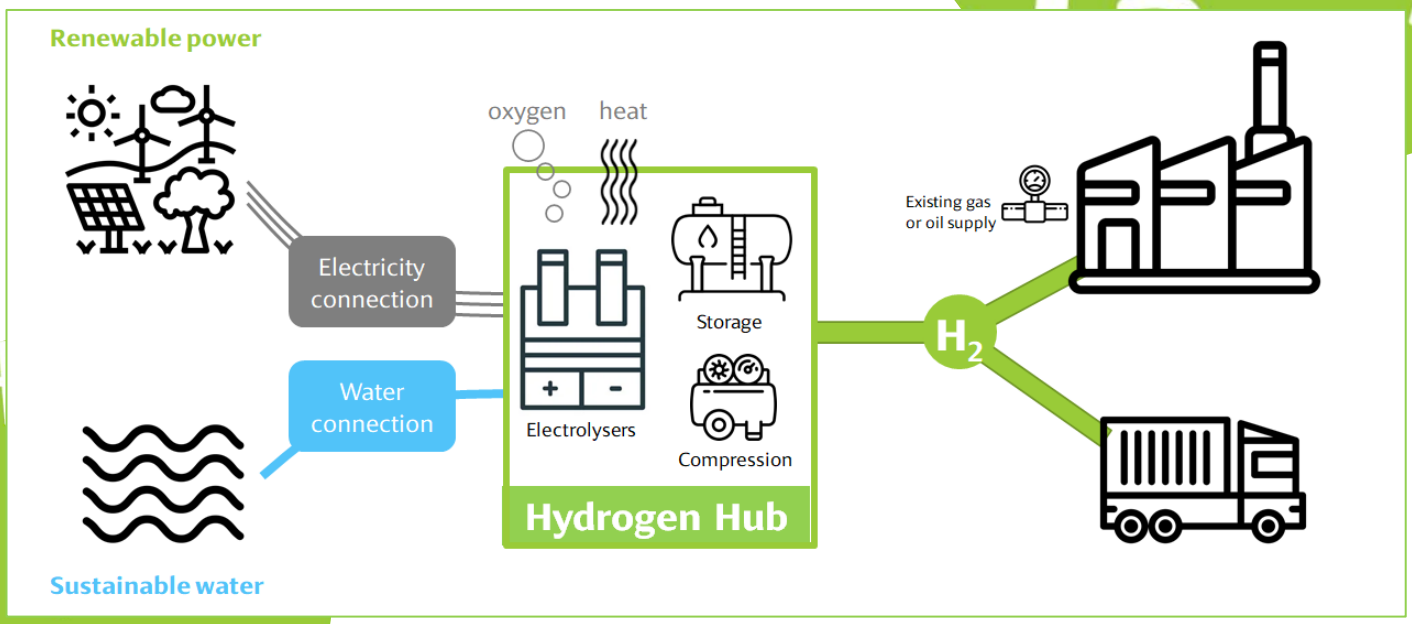
THE HYDROGENUS OFFERING

HydroGenus will enable the safe production of green, low carbon hydrogen from electrolysers through a portfolio of local hydrogen hubs that deliver hydrogen to customers where it's needed, when it's needed.

This can be used to decarbonise many applications such as fuel switching for industry, commerce, and transport.

We are positioned mainly around the development of small to medium size hubs, with electrolyser capacity in the range of 5-10MW producing up to around 5 tonnes of hydrogen a day.

Within these hubs there will be the deployment of state-of-the-art electrolysers and intelligent control systems to flexibly produce hydrogen at times when power is at its cheapest. Our hubs will make the most of renewable electricity and sustainable water sources. They benefit from the resilience of being connected to the local electricity grid or fed directly from wind and solar farms.



These hubs we will efficiently produce at, or near to, communities of hydrogen users. We create the logistics network necessary to deliver the hydrogen through local pipelines or transport via tanks on the back of lorries ('tube trailers'). Users simply receive the hydrogen where it's needed, when it's needed, and at the price they can afford.

We use our expertise to ensure our hubs will benefit from the many government subsidies available in this fast-emerging hydrogen economy.

MAKING THE SWITCH

To meet user needs, hydrogen can either be supplied from an existing hub that HydroGenus has developed, from a hub that is already in development or establish a new hub. These local hubs offer a resilient and cost-effective supply of hydrogen.

We follow a three-step approach in establishing new hubs to serve local needs:

1. Feasibility assessment.
2. Front-end engineering design (FEED) through to Final Investment Decision (FID).
3. Engineering Procurement Construction (EPC),sometimes known as execution.

It may take up to 36 months to complete all steps so that hydrogen production commences. We can fast-track through this process where a hub is already in progress.

FEASIBILITY ASSESSMENT

This step looks at both the technical and financial aspects of a project. We like to build a strong knowledge of our customer needs and requirements so we can tailor the solution. Our initial technical assessment looks at the following:

- Building an understanding of **likely demand** for hydrogen: how much, when, and for what use. This informs the size of electrolysers we need to deploy at the hydrogen hub and the nature of any gas compression and storage required.

- Considering where there is nearby **physical space** to locate the hub and looking at the best way to deliver the hydrogen so that it is available at point of need. This also includes consideration of space for onsite hydrogen storage, vehicle access should hydrogen need to be transported in tube trailers, as well as any constraints with planning permission and permits.

- Electrolysers require **electricity and water**. We use our specialist knowledge to examine the best way to make both available at the hydrogen hub and draw on a considerable experience in both these areas to find a likely solution that can be delivered quickly and cost effectively. For electricity we draw on the resilience of renewable power delivered through a connection to the electricity distribution grid. This can alternatively be fed or supplemented with a direct connection to an existing or new local renewable energy source such as a solar farm which offers a cost advantage. For water we consider the options of drawing from mains supply, from a borehole, or the use of recycled water from any nearby treatment plant.

- We also work with our customers to explore **innovation** opportunities. For example, using the surplus heat or oxygen produced from the hydrogen hub.

The hydrogen market is in its infancy. Consequently, the cost of hydrogen is currently higher than the comparable cost of fossil fuel energy from natural gas, heating oil, petrol, or diesel. This will change over time as levies are placed on fossil fuels and economies of scale build for hydrogen production.

For many customers, the decarbonisation benefits are unlikely to outweigh the cost difference. The adoption of hydrogen will for some years be reliant on access to the various government subsidies that are available. As part of our initial feasibility study, we will use our experience and insight to identify the most applicable **financial support mechanisms** that can be applied to support the financial viability of the project. For example, this includes access to the government's BEIS Electrolytic CfD fund.

The output of this work is a feasibility assessment report which highlights the technical, practical, and economic viability of the project, the indicative costs and benefits, and any risks that need to be addressed.

FROM FEED THROUGH TO FID

Front-end engineering design (FEED) is the basic engineering that follows the feasibility assessment and is used as the basis for the detailed engineering phase (EPC). We keep our customers fully informed throughout.

Our properly executed FEED is essential for helping determine the project investment cost and so setting the price of hydrogen. It is also crucial for detailing the project's technical requirements – such as the control system architecture, equipment lists, process flow diagrams, and civil and electrical specifications. The detailed requirements for planning permission and permits are also developed, as are the outline approaches to dealing with electricity and water connections.

As FEED advances, we also progress the funding arrangements. Upon completion of FEED, we can then move quickly through to Final Investment Decision (FID) whereby we, our customers, and our investors can all commit to moving ahead.

ENGINEERING PROCUREMENT CONSTRUCTION

This is where the detailed engineering design occurs, the necessary equipment and materials are procured, and when installation, commission and start-up of production happens.

We appoint an experienced EPC prime contractor to lead the work. They are responsible for ensuring all safety requirements are met. This will be independently assured. Our EPC contractor will orchestrate the various subcontractors required to deliver the project and liaise as required with the customer's own engineering teams to ensure the hydrogen is connected into the required industrial and commercial process.

FUNDING AND GOVERNANCE

As developers, HydroGenus will earn reward through a mix of fees and project revenues from the stake we hold in the hydrogen hubs that are created.

We start with having a clearly identified customer (off-taker) providing anchor demand under a long-term contract that enables asset financing. Short term off-takers can then be added. We are not attracted to speculatively establishing hubs in the hope that customers appear.

HydroGenus will put together a project specific development fund ('DevEx') to take the opportunity through Feasibility Assessment, FEED, and on to Final Investment Decision. At this point a Special Purpose Vehicle (SPV) will be established to suit the specific needs of the project and parties involved. This SPV will move the project through Engineering, Procurement and Construction and then on to operation and maintenance. The parties to the SPV will include the prime EPC contractor and the necessary investors/lenders.

As HydroGenus we will hold a minority equity stake in the SPV which we will use to fund our business and the development of further hydrogen hubs.

ABOUT HYDROGENUS

We are an experienced team with access to a network of technical and commercial specialists:

- Deep understanding of project financing, electricity connections, renewable power purchasing, and the water sector that are all vital ingredients to the success of projects.
- Involved at the forefront of early development of the green hydrogen market and projects.
- Bringing first-hand experience of how to access the varies funds from government and regulators upon which projects rely for capex and revenue contribution.

We seek to build trusted relationship with our clients. Cultural fit is important to us. We will respond quickly and flexibly.

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