capital hydrogen

Reaching net zero: the role of hydrogen

Hydrogen is increasingly being brought to the table as a serious contender for decarbonisation. This was especially apparent at this year's Futurebuild conference, where hydrogen's potential consistently featured in key discussions surrounding decarbonisation.

This momentum is being matched by policy. The UK Government recently announced that it is progressing towards signing contracts for 11 green hydrogen projects under the first Hydrogen Allocation Round (HAR1). Additionally, 27 projects were shortlisted for funding in the second round (HAR2), including several of our Capital Hydrogen members, such as Hygen Energy, Uniper, RWE, and Carlton Power.

As an energy carrier, hydrogen has the potential to play a crucial role in helping us reach net zero – particularly in sectors where electrification is challenging. It is a viable option for many key industries, from transportation to manufacturing and heavy industry.

Government and industry professionals alike need to adopt a forward-looking approach if we're going to effectively tackle the climate crisis. Investment in hydrogen infrastructure will be crucial to reduce the UK's reliance on fossil fuels and future proof our industries, and long-term certainty will help to attract investors to the sector.

Why hydrogen?

Industries such as steel, cement, chemicals, and food production all use high-temperature manufacturing processes that can be difficult and expensive to power with electricity alone.

That's where hydrogen comes in.

In the industrial landscape, hydrogen offers a practical solution due to its high energy density. Hydrogen delivers more energy per unit of weight than many alternatives, which means that it is particularly useful for sectors such as heavy industry and transport.

Hydrogen can be used in a multitude of ways, including in direct combustion, to power hydrogen fuel cells and as a feedstock in industrial processes. Additionally, hydrogen doesn't always require completely new infrastructure as other alternatives do. In many

cases, there is no need to start from scratch when switching to hydrogen from natural gas, and existing gas networks and assets can be repurposed.

In fact, several pilot projects across the UK are already testing hydrogen-ready infrastructure. For example, National Gas's FutureGrid project has enabled extensive testing of hydrogen in repurposed pipelines, in a secure offline environment. The project has tested the transportation of hydrogen in pipelines from all over the gas network that were previously used for natural gas.

The UK government has also recognised the strategic value of blending up to 20% hydrogen into gas networks, which is a major step toward integrating hydrogen into the country's energy mix[1]. Blending can help de-risk the first hydrogen production projects, acting as a last-resort offtake – with the added bonus of carbon savings from blending hydrogen into the gas network at low percentages.

Looking further afield at a dedicated 100% hydrogen network, both the Climate Change Committee (CCC)'s 7th carbon budget and the most recent National Infrastructure Assessment highlight the value of a dedicated hydrogen pipeline network as a requirement for the UK to reach its net zero targets.

This means that while transitioning to hydrogen will still require significant work, infrastructure won't need to be built entirely from scratch. Existing gas networks and certain industrial equipment, such as kilns, can be adapted rather than entirely replaced - making the shift more cost-effective. By leveraging existing assets, businesses can make progress in their individual decarbonisation journeys less disruptive.

Decarbonising Heavy Industry

Heavy industries contribute significantly to carbon emissions, with sectors like steelmaking and cement production being some of the biggest emitters. In fact, the 2 billion tons of steel produced worldwide each year accounts for about 7% of human greenhouse gas emissions[2].

But hydrogen presents a clear path to cleaner industry.

- For steelmaking, hydrogen can replace coal in direct reduced iron (DRI) processes, which in turn dramatically cuts emissions.
- In cement production, hydrogen-powered kilns can act as an alternative to fossil fuel powered kilns. This could make a huge difference in one of the

[1] Department for Energy Security and Net Zero (2023), Hydrogen blending into GB gas distribution networks
[2] The International Energy Agency (2020), Iron and Steel Technology Roadmap
[3] The International Energy Agency (2018), Technology Roadmap - Low-Carbon Transition in the Cement Industry

most energy-intensive industries, with cement ranking as the third-largest industrial energy consumer worldwide[3].

- In the chemical industry, hydrogen plays a key role in producing ammonia and methanol – which are both essential for agriculture and industrial use.

Initiatives like the Made with Hydrogen campaign are already highlighting the role of hydrogen in creating sustainable supply chains across these sectors.

Low-heat industries

Hydrogen isn't just limited to high-heat industries. Often when we think of hydrogen, industries such as steel and cement making come to mind – but hydrogen has an essential role to play for lower-temperature processes too.

For example, hydrogen can replace natural gas in beer brewing, offering a sustainable alternative for major producers. Some industrial bakeries and food manufacturers are also testing hydrogen for cleaner heating and cooking processes – even in applications that don't require high heat. Take Toyota and Rinnai's exploration into hydrogen-powered cooking methods[4], for instance, which could have a huge impact on everyday culinary practice.

Further, AMF Bakery Systems have introduced the world's first emission-free hydrogen tunnel oven[5], which means that industrial bakers can reduce carbon dioxide emissions by 99.9% within the baking process.

Transport and Manufacturing

Everyday manufacturing processes and transport are also key industries for hydrogen.

While battery electric vehicles (BEVs) will likely dominate passenger transport, hydrogen could be better suited for long-range and heavy-duty applications. Hydrogen-powered trains such as Germany's Alstom Coradia iLint are already operational in Europe, providing a zero-emission solution for non-electrified routes. Hydrogen trucks can reduce diesel dependency whilst still offering brief refuelling times, and in shipping, hydrogen and ammonia-based fuels offer promising solutions for reducing emissions in maritime transport.

However, there are drawbacks to be considered, and no route to net zero is without its challenges. For example, to scale hydrogen adoption in transport, investment in refuelling infrastructure will also be crucial, which will require both support and collaboration from industry stakeholders.

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[4] Toyota Times (2024), Toyota showcases technology developments towards a sustainable future
[5] AMF Bakery Systems (2020), AMF BAKERY SYSTEMS INTRODUCES THE WORLD'S FIRST EMISSION-FREE HYDROGEN TUNNEL OVEN

Hydrogen is not a silver bullet – but it can play a critical role in the net zero puzzle. As production scales up and costs fall, its role in heavy industry, transport, and manufacturing is only going to grow, and we need to make sure it is at the top of the agenda.

The UK must continue to support hydrogen innovation, infrastructure investment, and industry collaboration if we are going to unlock its full potential in helping us decarbonise our industries. Initiatives like the Capital Hydrogen programme play a key role in driving this transition, ultimately bringing us one step closer to reaching net zero.

Learn more about the Capital Hydrogen programme on our website.