
# Hydrogen

## Its role in energy transition and investment portfolios

**Natasha Thomas**

Hydrogen is increasingly seen as a crucial element to achieving net zero carbon emissions. However, there are different types of hydrogen and to take advantage of market trends, it is important to know the difference.

Today, the top four uses for hydrogen are in oil refining, ammonia production, methanol production and steel production, though it can be used in many more applications.

For example, in transportation, it can be used either as hydrogen-based fuels for shipping and aviation or as hydrogen fuel cells. Fuel cell electric vehicles (FCEVs) tend to have a longer driving range, faster refuelling time and lower weight than battery electric vehicles (BEVs), making them prime for medium to heavy-duty fleets.

The International Energy Agency's (IEA) *Tracking Transport 2020* report found that global transportation generates 24% of direct CO2 emissions from gasoline and diesel combustion. Thus, the use of clean hydrogen would significantly reduce emissions.

In powering the grid, hydrogen can be used as feed gas for gas-fired power stations, as it can be stored and then quickly 're-electrified' in periods of low renewable energy supply or high demand, effectively providing a zero-carbon storage alternative to batteries and pumped hydro [water] to support intermittent renewables.

Hydrogen can also fuel residential heating and cooking systems, either as a replacement for natural gas or blended into the existing natural gas grid. Moreover, hydrogen can support back-up power solutions for high-power applications like data centres that require alternatives to the grid to protect against shutdowns.

Increasingly, hydrogen is being used in the production of steel. Typically, there are two main paths steel producers can take to do this. The first is using an integrated blast furnace and basic oxygen furnace combination, which produces steel from iron ore using coking coal as a reductant [that is, to reduce the iron ore]. The second is through an electric arc furnace (EAF) which uses direct reduced iron (DRI) or steel scrap to produce steel.

EAF use of electricity as a source can be combined with hydrogen and renewables, and offers the biggest potential reduction to emissions in steelmaking. EAFs can use multi-source renewable electricity (wind, solar, pumped hydro) alongside clean hydrogen as a reductant to produce the DRI.

### Various types, various costs

There are two main ways to make hydrogen—via the electrolysis of water which uses electricity to split water into hydrogen and oxygen, or by using steam to reform natural gas (methane) into hydrogen and CO2.

The process of producing 'clean' hydrogen needs to result in little to no carbon emissions and can comprise both 'blue' and 'green' hydrogen.

Blue hydrogen is hydrogen derived from fossil fuels followed by capturing, utilising and storing the CO2 by-product, known as carbon capture usage and storage (CCUS), which makes the production carbon neutral.

Green hydrogen is created with electricity from renewable energy, produced from the electrolysis of water, with effectively zero carbon emissions. According to Infinite Blue Energy's *Capital raise: Advancing green hydrogen projects in Western Australia and abroad* report of 2021, today, only 3–4% of hydrogen produced globally is green hydrogen.

In most markets today, clean hydrogen is more expensive than conventional fuels, which benefit from significant incumbent infrastructure. We have seen a large range of costs across the different types of hydrogen. While costs for green hydrogen are currently in the range of US$5.00–$8.00/kgH2, we see estimated costs in 2030 of US$1.25–$2.70/kgH2.

This compares to estimated costs of US$1.00–$1.75/kgH2 for 'grey' hydrogen [made from fossil fuels, and which uncaptured CO2 is released in the process], and US$1.40–$2.45/kgH2 for blue hydrogen.

In Australia, the *National Hydrogen Roadmap* established by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) puts forward A$2–$3/kgH2 (excluding storage) for clean hydrogen as cost-competitive by 2030 across different applications. This assumes a combination of natural gas with CCUS and electrolysis with renewables.

In our view, the key factor for the competitiveness of green hydrogen is power pricing. This will increasingly be the case as the cost of electrolysers comes down over time due to economies of scale and other technological advancements.

## Market growth

The IEA's *Global Hydrogen Review 2021* reported that the global hydrogen market was around 90 million metric tons [or tonnes, that is, 1,000kg] p.a., the bulk of which is used in the refining process for oil, and to produce ammonia, methanol and steel (via the direct reduction of iron ore).

In its *Hydrogen Conference Takeaways* report of 2020, U.S. Capital Advisors found that approximately 75% of global hydrogen production currently comes from natural gas, with the remainder largely from coal. As mentioned earlier, today only 3–4% of hydrogen produced globally is green hydrogen.

By 2030, the IEA forecasts that [annual] global hydrogen demand will reach more than 200 million metric tons, with that number more than doubling to over 500 million metric tons by 2050. To put this number into context, 25,000 terawatt hours (TWh) of electricity are required to produce 500 million metric tons of green hydrogen. [According to a World Economic Forum article titled 'Hydrogen isn't the fuel of the future. It's already here', "this is more than 2.5 times as much as the total electricity produced from nuclear and renewables combined in 2018".]

According to the Hydrogen Council ["a global CEO-led initiative that brings together leading companies with a united vision and long-term ambition for hydrogen to foster the clean energy transition"], more than US$30 billion needs to be invested through 2030 globally to reach government production targets. The largest share of investments is projected in Europe (about 45%), followed by Asia, where China is leading with around half of total investments.

## Investment opportunities

If one believes that green hydrogen will be successful, on the infrastructure side we see the biggest opportunities in the renewable energy sector (wind and solar).

Hydrogen is only 'green' when it is created with electricity from renewable energy. Investing in renewable energy generation is a way for investors to benefit from the hydrogen thematic without underwriting a specific technology or speculative start-up risk.

We see the need for over US$5 trillion in capex globally between now and 2050 in order to add the required wind and solar capacity that can support the level of green hydrogen envisioned by the Hydrogen Council by 2050. This equates to five times the current wind and solar market, representing up to 20–30% of total clean energy capacity to 2050.

In terms of exposure to hydrogen, our most favoured renewable energy companies are NextEra (US onshore wind and solar) and Ørsted (global offshore wind), both global leaders in renewables in their fields and both set to benefit from the green hydrogen thematic.

Energy infrastructure companies, primarily those with large natural gas pipeline networks such as US-based pipeline company, Williams, may also stand to benefit, as the industry can partially reuse existing gas infrastructure along with newly constructed pipelines and storage.

Many of these companies are also actively studying CCUS technology to lower emissions from blue hydrogen production.

Further, as green hydrogen is produced via the electrolysis of water, production via this process will require secure, long-term access to water. Regulated water utilities such as Severn Trent in the UK could benefit from this demand.

## Risks

Despite the momentum in hydrogen around the world, we think that hydrogen and its place in the global energy mix still has many unknowns. There have been strong decarbonisation commitments by governments globally, and we think now is the time for governments to develop

**The quote**

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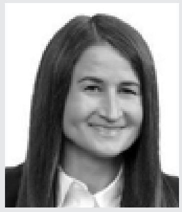

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policies and regulations to encourage the build-out of required infrastructure to support hydrogen, as well as the uptake of clean hydrogen across supply chains.

Government policy will play a key role in the growth trajectory of clean hydrogen. However, there are a number of obstacles to the widescale adoption of hydrogen, including storage, pipelines for distribution, and competition with battery power, both in power generation and transportation.

A further consideration is the intensive water usage that is required to produce green hydrogen via the electrolysis of water. Production via this process will require secure, long-term access to water which needs to be considered by governments globally when setting targets around hydrogen production.

We believe the will and the momentum exists among leading nations to develop green hydrogen as part of the renewable energy complex. We think the risks are minimal compared to the opportunity for investors focused on the key beneficiaries of hydrogen development, such as essential infrastructure and utilities, rather than trying to find the type of hydrogen project that becomes the preferred source. **FS**

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