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Research and Insights

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Hydrogen, ‘it’s a gas, gas, gas…’ for the energy transition

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Hydrogen has surfaced as a hot topic in energy transition, though the technology is in somewhat of a transition itself. Hydrogen is relatively untested in live infrastructure, and is still an unknown with respect to its place amongst other gas energy sources. With renewed focus on net zero what does hydrogen have to offer? Natasha Thomas, Portfolio Manager, Energy & Communications, discusses the benefits of hydrogen, and where it fits in the transition to net zero.

Key points

- The world has unquestioningly entered the major stages of the multi-decade energy transition.
- COP26 saw 197 countries agree to the Glasgow Climate Pact, underscoring the need for renewables.
- Hydrogen, though an evolving technology, offers a crucial bridge to renewables in the energy complex.
- Over US$5 trillion in capex is needed globally by 2050 to add the required wind and solar capacity for net zero, with hydrogen key to supporting base-load power.
- Investors should focus on the key beneficiaries of hydrogen development such as essential infrastructure and utilities, rather than trying to find the type of hydrogen project that prevails over all others.

Q: In summary, what came out of the COP 26 summit?

A: COP 26 (UN Climate Change Conference 2021) closed mid-November with 197 countries agreeing to what has been called the Glasgow Climate Pact, one which supports the goals of the Paris Agreement, but sees countries pull forward the starting line to next year from 2025 (as originally planned) in order to achieve their 2030 net-zero targets. The 2030 targets that world governments are implementing offer actionable and accountable steps on the longer journey to 2050. The Glasgow Climate Pact agreed at COP 26 is a step along the path towards the net zero by 2050 targets. These goals were ratified by 196 countries at COP 21 in Paris on 12 December 2015. This is known as the Paris Agreement. We believe hydrogen will play an important role in achieving 2030 and 2050 targets.

Q: We’re increasingly hearing about blue, green and clean hydrogen. What are these and how do they differ from the hydrogen we all know?

A: 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 most common hydrogen today is known as ’grey hydrogen’ and is typically derived from fossil fuels, involving the combustion of gas or coal in the steam methane reforming process.

Hydrogen is considered a crucial bridge to achieving net zero carbon emissions. In order to achieve this, the process of producing hydrogen needs to result in little to no carbon emissions. This is referred to as ’clean hydrogen’ 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 ‘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.

If hydrogen is produced using low or zero carbon emission sources, it has the potential to help companies, industries and countries around the world reduce emissions to meet agreed emissions targets.

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Q: How can hydrogen be used for energy?

A: Hydrogen is increasingly seen as a crucial element to achieving net zero carbon emissions. Today, the top-4 uses for hydrogen are in oil refining, ammonia production, methanol production and steel production, however 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. As global transportation currently generates 24% of direct CO2 emissions from gasoline and diesel combustion, 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 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 shutdown.

Increasingly, hydrogen is being used in the production of steel. Typically, there are two main paths steel producers can take to produce steel. 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. The second is through an electric arc furnace (EAF) which uses direct reduced iron (DRI) or steel scrap to produce steel. The EAF's 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.

Q: How does the cost of hydrogen compare to other energy sources?

A: In most markets today, clean hydrogen is more expensive than conventional fuels, which benefit from significant incumbent infrastructure. We have seen a big 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 have seen 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 and US$1.40-2.45/kgH2 for blue hydrogen.

In Australia, the National Hydrogen Roadmap established by the 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, and this will increasingly be the case as the cost of electrolysers comes down over time due to economies of scale and other technological advancements. Today, electrolyser costs represent 30% of a typical green hydrogen project, compared to the cost of electricity from renewables representing 55% of the cost. With today's technology, green hydrogen would need zero cost electricity and ~A$9.80/Gj gas to be cost-competitive with blue hydrogen. BloombergNEF released data in October 2021 that concluded that by 2030, green hydrogen can be cheaper, globally, than blue hydrogen and, in some regions, cheaper than natural gas by 2050.

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Q: What is the potential scale of hydrogen as an energy source?

A: The global hydrogen market is currently around 90Mt pa, 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). Approximately 75% of global hydrogen production currently comes from natural gas, with the remainder largely from coal. Today, only 3-4% of hydrogen produced globally is green hydrogen.

By 2030, the International Energy Agency (IEA) forecasts that global hydrogen demand will reach more than 200 Mt, with that number more than doubling to over 500 Mt by 2050. To put this number into context, 25,000 terawatt hours (TWh) of electricity are required to produce 500Mt of green hydrogen.

According to the Hydrogen Council, 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.

Q: What are the investment opportunities?

A: When we look across the hydrogen value chain there are still many unknowns regarding the competing technologies, but if you believe 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. Also, 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.

We think that economies of scale and technological advancements will be required in order for green hydrogen to compete with alternative sources. This is similar to the path that the renewable power industry has taken where technological advancements in battery storage have brought down the cost of wind and solar power, and made them cost-competitive with gas-fired generation and nuclear power. Initially, technological constraints delayed the roll-out of renewable power generation which increased scepticism over the viability of alternative energy sources – any delay in the rollout of green hydrogen due to technological issues could be met with the same scepticism, but you would be brave to bet against its progress.

Q: What are the risks?

A: 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 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 wide-scale 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 amongst 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.

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