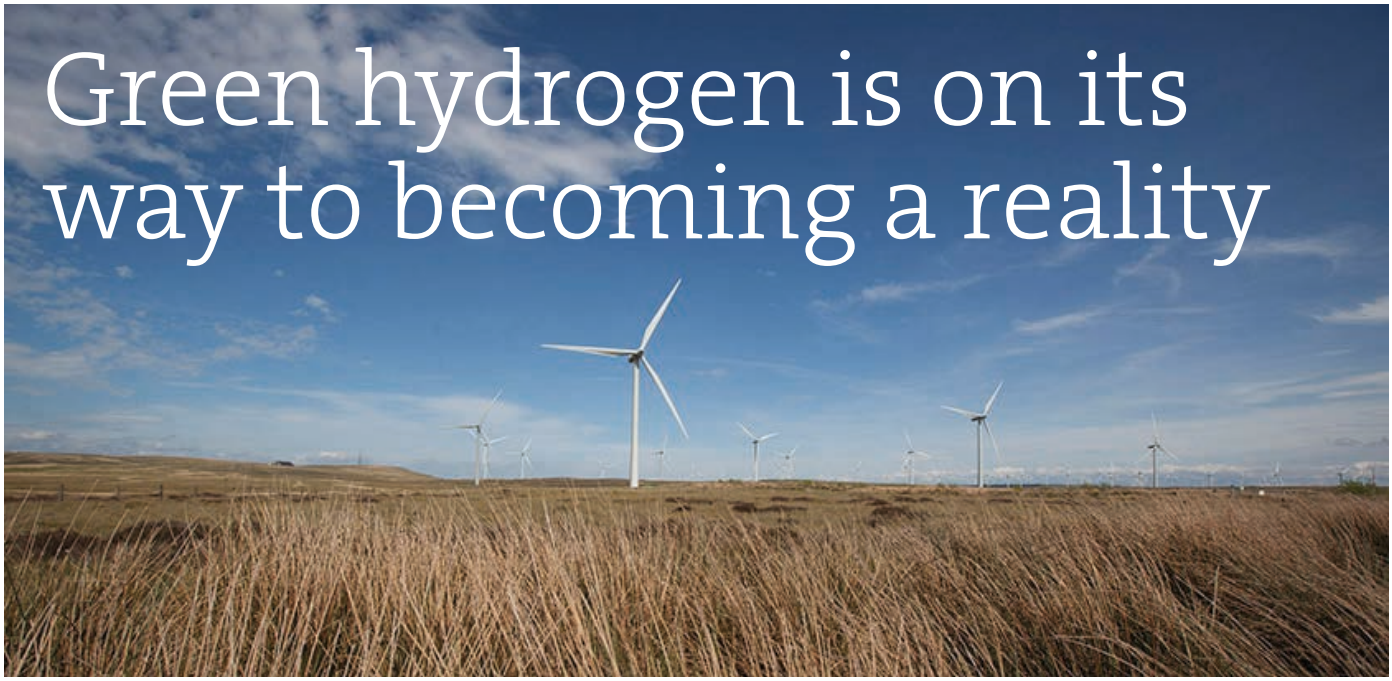
HYDROGEN

Green hydrogen is on its way to becoming a reality



Affordable renewable power and economies of scale mean that cost competitive 'green' hydrogen could be a reality sooner than anticipated. *Jennifer Johnson* reviews recent data and project announcements to assess the market's trajectory.

The hype around hydrogen as a fuel of the future is increasingly translating into investment decisions – and it's about time. The first fuel cell prototype was built in 1889 by the German-born industrialist Ludwig Mond and his assistant, Carl Langer. Promising as the technology was, it would quickly be overshadowed by the cheaper and less intricate internal combustion engine. Over the course of the next century, interest in hydrogen would come in waves, usually when there was an oil price crisis, before receding again.

Now it appears as though the latest and long-forecast boom in hydrogen technologies is finally, and irreversibly, underway. Energy companies of all stripes – from oil majors to utilities – have unveiled sizable hydrogen ambitions in the past year or so despite an uncertain economic outlook. In February 2020, Shell announced it had started feasibility work on what could ultimately be the largest green hydrogen project in the world, or at the very least in Europe.

The plans will see the Dutch oil giant, and partners including Equinor, Gasunie and RWE, install 3–4 GW of offshore wind in the North Sea to power electrolysers located on the Netherlands' northern coast. The project could be expanded to 10 GW of offshore wind by 2040, with all power generated devoted solely to the production of 'green' hydrogen.

Supplying electrolysers

According to a report issued late last year by the International Renewable Energy Agency (IRENA), it is currently 2–3 times more expensive to make green hydrogen than its 'blue' counterpart, which comes from fossil fuels combined with carbon capture and storage.

However, the agency believes that further falls in the price of renewables, combined with economies of scale in electrolyser manufacturing, mean that 'green' hydrogen could be cost-competitive with fossil fuels by 2030. Though low-cost renewable electricity is a necessary condition for cost-competitive green hydrogen, IRENA analysis emphasises that the investment costs for electrolysis facilities must also drop.

For this to happen, today's manufacturing capacity of less than 1 GW would have to grow beyond 100 GW in the next 10 to 15 years.

Expansion this significant might sound like a tall order, but there are signs that real progress is being made. Earlier this year, manufacturer ITM Power opened the world's first gigawatt-scale electrolyser factory in Sheffield, England. The facility will cut the cost of the firm's electrolysers by almost 40% over the next three years, according to its chief executive. In a recent funding round ITM Power raised enough money to build another massive factory that could be up to 2 GW in size.

One of the company's 20 MW electrolysers has recently been selected for a major green hydrogen scheme near Glasgow. Located adjacent to the Whitelee onshore wind farm, developer ScottishPower says the project will be powered by a combined solar and battery storage system with a total capacity of up to 90 MW. If local policymakers greenlight the planning application, the project could supply hydrogen to commercial markets by 2023.

ITM Power is to supply electrolysers to a green hydrogen project located next to Scotland's Whitelee onshore wind farm, the largest of its kind in the UK

Photo: ScottishPower

Charting hydrogen's ascent

According to energy research group BloombergNEF (BNEF)'s recent *1H 2021 Hydrogen Levelized Cost Update* the falling costs of green hydrogen production mean that it will displace fossil-fuelled 'blue' and 'grey' hydrogen in the coming decades. Analysts found that hydrogen made entirely from renewables could be cheaper than fossil gas, on an energy-equivalent basis, by 2050 in 15 of the 28 markets it modelled – assuming scale-up continues on its current trajectory.

These 15 countries accounted for one-third of global GDP in 2019. The

report further claims that the costs of producing green hydrogen from renewable electricity should fall by up to 85% from today to 2050, leading to costs below $1/kg by 2050 in most modeled markets.

'Such low renewable hydrogen costs could completely rewrite the energy map,' says Martin Tengler, Lead Hydrogen Analyst at BloombergNEF. 'It shows that in future, at least 33% of the world economy could be powered by clean energy for not a cent more than it pays for fossil fuels. But the technology will require continued government support to get there – we are at the high part of the cost curve now, and policy-supported investment is needed to get to the low part.'

BNEF's cost predictions are some 17% lower than its previous forecasts for the middle of this century, and the falling costs of solar PV are the key driver behind this anticipated reduction. Analysts now believe that PV power will be 40% cheaper in 2050 than what they had thought only two years ago, driven by more automatic manufacturing, less silicon and silver consumption, higher photovoltaic efficiency of solar cells, and greater yields using bifacial panels.

In all of the markets studied, green hydrogen should steadily become cheaper than both blue hydrogen (from fossil fuels with CCS) and even grey hydrogen made from methane.

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Martin Tengler, BNEF

'By 2030, it will make little economic sense to build 'blue' hydrogen production facilities in most countries, unless space constraints are an issue for renewables,' predicts Tengler. 'Companies currently banking on producing hydrogen from fossil fuels with CCS will have at most ten years before they feel the pinch. Eventually those assets will be undercut, like what is happening with coal in the power sector today.'

Greening industry

The majority of the world's hydrogen is currently used in industry, including in the refining of oil and production of ammonia. There's evidence that the mining sector is also interested in greening its operations through the deployment of hydrogen as a replacement for fossil fuels.

For instance, French utility Engie has partnered with Chilean mining explosives manufacturer Enaex to study the feasibility of producing green ammonia. The proposed project would use 36 MW of solar energy to power a 26 MW electrolyser. The resulting hydrogen would then be used to make ammonia, a key ingredient in ammonium nitrate, used in controlled explosions by miners.

Meanwhile, mining giant Anglo American has been piloting the use of hydrogen in a forklift at one of its Chilean mining operations. Heavily polluting industries are naturally interested in using hydrogen to improve the environmental profile of their activities, thereby extending their economic lives in a decarbonising world.

To this end, BP has partnered with Danish wind producer Ørsted to build a 50 MW electrolyser at the Lingen Refinery in north west Germany. The facility will be powered by energy generated at one of Ørsted's North Sea wind farms, and the hydrogen will subsequently be used in BP's Lingen oil refining operations.

As of last summer, Wood Mackenzie estimates that less than 1% of total annual hydrogen production can be classified as green. Evidently, the sector still has a way to go before the cleanest form of hydrogen is ubiquitous. But the political momentum behind it shows no sign of slowing down and, better yet, this enthusiasm appears to be translating into project decisions. With any luck, hydrogen is here to stay this time. ●