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OPINION

The promise of green hydrogen

Hydrogen made from water has been discussed as an energy carrier for 150 years. A steep decline in its cost means it may at last become viable

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Jules Verne, the great 19th-century writer often described as “the father of science fiction”, was remarkably accurate in forecasting features of the moon landings and of modern submarines. In the case of hydrogen fuel, though, the world has not yet caught up with his predictions.

“I believe that water will one day be employed as fuel, that hydrogen and oxygen, which constitute it, used singly or together, will furnish an inexhaustible source of heat and light,” a character says in Verne’s 1875 novel *The Mysterious Island*. “Water will be the coal of the future.”

That vision remains futuristic. Small volumes of green hydrogen, produced from the electrolysis of water using renewable energy, are being made. But there is no firm supply or demand, and the technologies for establishing large-scale new markets for hydrogen are still in their infancy.

The potential of green hydrogen, however, remains compelling: it is one of the few feasible solutions available for curbing the emissions from difficult-to-decarbonise sectors including industries such as steel and long-distance freight transport. It could also provide a zero-carbon solution for long-term energy storage, used for power generation to back up solar and wind power in places that suffer from long periods of low sun and wind.

Thursday was [National Hydrogen and Fuel Cell Day](#) in the US, as designated by a [Senate resolution](#). The date is a nod to the atomic weight of hydrogen, which is about 1.008. Writing that as a date is 10/08, which the way Americans put it is October 8.

Most of the US, to be quite honest, did not mark Hydrogen Day in any way. But the event was a reminder that interest in the use of hydrogen, which has gone in and out of fashion for decades, is currently in a very strong upswing.

Wood Mackenzie [research](#) in August suggested that a “tipping point” for low carbon hydrogen could be approaching. A year ago there were green hydrogen projects with a total capacity of 3.2 gigawatts under development. By August of this year, that had more than quadrupled to more than 15 gigawatts of capacity. Ben Gallagher, our subject matter expert for carbon and emerging technology, has forecast that by 2040 the cost of green hydrogen will have fallen by up to 64%.

Green hydrogen today is much more expensive than grey hydrogen produced from natural gas or brown hydrogen produced from coal. Even in 2040, it is still likely to be uncompetitive in some parts of the world, depending on fuel costs and carbon prices. But the rapid decline in costs means that in some places it could start to be competitive as soon as 2025. In Germany, for example, green hydrogen is expected outcompete hydrogen from fossil fuels in most scenarios by 2035.

Germany, the Netherlands and Belgium are likely to be among the first markets to develop a viable green hydrogen industry. There is plenty of demand for hydrogen from the chemicals industry, particularly for ammonia production, there is no local source of low-cost natural gas, and there is carbon pricing that will help support emissions-free producers.

So it was no great surprise this week when Ørsted, the offshore wind developer, and Yara, the fertiliser group, [announced a plan](#) for a 100-megawatt wind-powered electrolyser to produce green hydrogen for making ammonia in the Netherlands. The project still requires public co-funding and “the right regulatory framework”, but if those are secured it could be on stream as soon as 2024-25.

Back in the US, the purpose of Hydrogen Day was to raise the industry’s profile, to prevent it being left behind by progress in other countries. The US Fuel Cell and Hydrogen Energy Association this week published its [“road map to US hydrogen energy leadership”](#), setting out the steps it says are needed including regulatory reform and funding for R&D. The group, which is backed by companies including Chevron, Shell, Exelon, Microsoft, Engie and Toyota, said the hydrogen industry was “at a crossroads”, and urged the government to act quickly. “The time to boost support for hydrogen is now,” it said.

One factor that could help the hydrogen industry in the US is that, unlike many energy technologies, it enjoys bipartisan support. The Senate's Hydrogen Day resolution was proposed by Lindsey Graham, a Republican senator from South Carolina who has been an advocate for the technology since the 2000s. And Joe Biden, the Democratic challenger for the presidency, has published a [climate plan](#) that includes a pledge to support R&D for "affordable, game-changing technologies" in clean energy, including "using renewables to produce carbon-free hydrogen at the same cost as that from shale gas."

Depending on the outcome of the elections on November 3, that could be a significant pointer towards the future of hydrogen in the US.

In brief

JPMorgan has [announced](#) it is "adopting a financing commitment that is aligned to the goals of the Paris Agreement". One consequence is that the bank will start setting emission targets for 2030 for its financing portfolio, with a focus on the oil and gas, electric power and automotive manufacturing sectors. The bank is also setting up a new "Center for Carbon Transition" with centralised access to sustainability-focused financing, research and advice.

HSBC, meanwhile, will target [net zero emissions](#) across its entire customer base by 2050, its chief executive told Reuters.

More than 1,000 companies, with a combined market capitalisation of over US\$15.4 trillion, have now [signed up](#) to the [Science-Based Targets Initiative](#), which encourages companies to set targets to reduce emissions in line with the goals of the Paris agreement.

OPEC published its latest annual [World Oil Outlook](#), which as usual was full of interesting data and analysis. The forecasts for oil demand, shown in Chapter 3, are particularly interesting. OPEC predicts that world oil consumption will drop to about 90.7 million barrels a day on average this year, but rebound strongly to 97.7 million b/d next year, in its reference case forecast.

OPEC's longer-term outlook is very similar to Wood Mackenzie's most recent base case [forecast](#): oil demand growth slows around the mid-2020s, but continues until the end of the 2030s before levelling off. Rising fuel efficiency and a growing market share for EVs mean that oil demand for passenger cars starts falling around the mid-2030s, in OPEC's view. There is less scope for improved efficiency and electrification of commercial vehicles, however, and growing numbers of trucks will be coming on to the roads as a result of economic growth and rising living standards. OPEC expects fuel consumption for trucks to keep growing into the 2040s.

China would need to spend more than \$5 trillion to achieve its goal of carbon neutrality by 2060, according to Wood Mackenzie's Prakash Sharma. That is the sum it would need to invest in solar, wind and storage while more than doubling its total annual power generation.

Prince William, the Duke of Cambridge and future king of the UK, has launched a competition called the Earthshot Prize, described as “the most prestigious global environment prize in history”. It is offering five £1 million prizes a year for ten years, to reward ideas for tackling climate change, cutting waste, reducing pollution and protecting nature. The first prizes will be awarded next year.

The blackouts in California in August were “an extraordinary event” caused by an extreme heat storm, the failure of planners to have sufficient generation resources available in the early evening, and practices in the day-ahead market, according to a preliminary analysis from the grid operator and regulators.

India is considering a plan that would force its most inefficient coal plants to close, Bloomberg reported.

BlackRock has called on AGL of Australia to accelerate the closure of its coal-fired power plants. BlackRock is one of the company's five largest shareholders.

Kelcy Warren, who was a co-founder of the midstream group Energy Transfer back in 1996, is stepping down as chief executive at the end of the year, although he will remain executive chairman. The company now has more than 90,000 miles of gathering and transmission pipelines, and transports about 25% of the natural gas and 35% of the crude oil produced in the US.

Chrysaor, the privately-held UK E&P company, is buying Premier Oil in a reverse takeover. Premier is heavily indebted, and had been in the process of a refinancing. Wood Mackenzie's Neivan Boroujerdi said Chrysaor had a strong balance sheet and solid cash generation, “but it needed to take advantage of this strength, as its portfolio was in steep decline”.

Many offshore oil and gas facilities in the Gulf of Mexico were evacuated and onshore installations began storm preparations as Hurricane Delta approached. Delta was expected to make landfall in Louisiana on Friday.

The US offshore wind development pipeline increased last year to 28.5 GW, up 10% from 25.8 GW the previous year. New York was the state with the most capacity going through permitting, followed by Massachusetts, New Jersey and Connecticut.

And finally: wind turbines and UFOs. Some recent unfounded [speculation](#) about possible attacks on wind turbines gives me an excuse to tell the story of how I briefly became involved in a purported UFO sighting and made the front pages of the tabloids.

In 2009, we celebrated my father-in-law's 80th birthday at his home in rural Lincolnshire with a few evening fireworks. The next morning, we noticed a broken blade on one of the turbines at the wind farm in the next field. I worked for the FT at the time, and my wife told me I should call the newsdesk to tell them about this important story. "Blades fail from time to time, it happens," I said. "It really isn't news."

So you can imagine my surprise when the broken blade ended up [on the front page of The Sun](#) with the headline "UFO hits wind turbine". People had seen the fireworks, and assumed that the "strange lights" in the sky could only be of extraterrestrial origin. It was [confirmed](#) a month later that the cause had indeed been "mechanical failure", not collision with a flying object. A disappointment to UFO hunters, but a relief to the wind industry that alien attacks are not, apparently, going to be an additional challenge it will have to face.

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(This piece is worth reading in conjunction with [this column](#) by Robert Armstrong in the FT from August)

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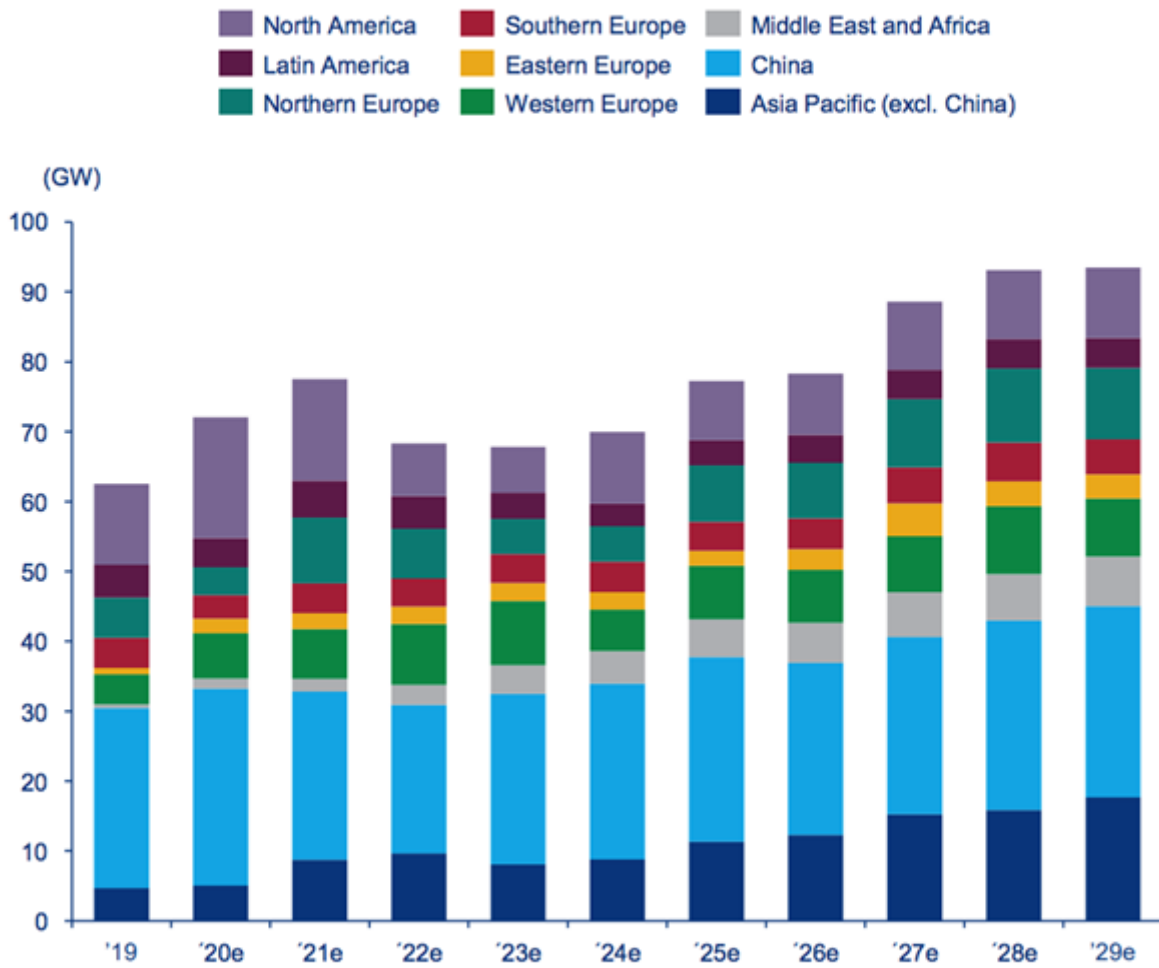
Quote of the week

“As Saudi Arabia is to oil, the UK is to wind – a place of almost limitless resource, but in the case of wind without the carbon emissions, without the damage to the environment. I remember how some people used to sneer at wind power, twenty years ago, and say that it wouldn’t pull the skin off a rice pudding. They forgot the history of this country. It was offshore wind that puffed the sails of Drake and Raleigh and Nelson, and propelled this country to commercial greatness.” – Boris Johnson, the UK prime minister, used his [speech](#) to the Conservative Party conference to set out a vision of a “green industrial revolution” that could create millions of jobs, based in part on a boom in offshore wind power.

Chart of the week

This chart, from Wood Mackenzie’s latest global wind power [market update](#), shows expected installations of wind capacity worldwide out to 2029. Although the Covid-19 pandemic is still raging, our analysts have actually raised their prediction for future installations by 2% since the last forecast three months ago. The pandemic has hit expected wind investment in India, but in China and the rest of the Asia-Pacific region, prospects for developments have improved. China remains by far the largest single national market for wind turbines, and over the coming decade it is expected to be the largest for offshore installations.

Global grid-connected forecast: 2019 to 2029e



Source: Wood Mackenzie

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