



**REUTERS** EVENTS™

# **Hydrogen 2022 post-event report:**

tracking progress  
towards a clean  
hydrogen economy

Made in conjunction with



## Foreword



As a full-service global law firm, active in the energy, natural resources, industrials, infrastructure, construction and transport industries, DLA Piper is at the forefront of the nascent hydrogen sector. Sitting side by side with our renewables, sustainable aviation and mobility practices, we've built a best-in-class, end-to-end offer to support hydrogen projects worldwide.

Our team is present in every major centre of hydrogen activity, export and import. We can advise clients on their hydrogen strategies and projects as they look to vertically integrate and secure supply chains across borders. We are actively engaged on many of the world's flagship hydrogen projects, be they in the pilot or developmental stage. And we have advised a wide range of international bodies on the certification of hydrogen, power-to-X and renewable fuels of non-biological origin.

Our team draws from a deep well of relevant experience in renewable energy generation, infrastructure delivery, industry, transport, and petrochemicals. In addition, our international teams work side by side across borders, applying know-how from one project to other regions where hydrogen can be produced and transported.

As part of this engagement with the burgeoning hydrogen scene, we were delighted to act as gold partner for Reuters Events' Hydrogen 2022 event in Amsterdam, on June 8 and 9, 2022. This paper reviews the most salient points from the event.

DLA Piper is a global business law firm, with a specialist team of lawyers who collaborate across different disciplines advising on all aspects of large-scale hydrogen projects, from establishing hydrogen infrastructure to generation, transportation, and industrial use, successfully navigating the regulatory landscape. For more information about our hydrogen practice or an initial discussion about how DLA Piper can help you to achieve your hydrogen vision, please contact:

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## Executive summary

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Global economies face unique challenges over the coming decades to meet stated emissions targets. Critical to meeting these targets is identifying alternative energy sources that can not only substitute traditional carbon-based fuel sources, but also cater for increased demand. Transitioning to a low-carbon or 'clean' hydrogen-based energy future presents a clear opportunity to ensure a steady supply of power that might not always be directly available from renewable energy sources.

Scaling up clean hydrogen production to replace current carbon-intensive methods will require significant

investment. Expanding hydrogen production is likely to be one of the biggest industrial tasks of the coming decades. The market for 'green' hydrogen, made from renewable energy, is expected to be worth USD9.8 billion by 2028.<sup>1</sup>

In this context, there is growing excitement over the evolution of the clean hydrogen economy, with companies from a wide range of countries and sectors willing to share their innovations and investment contributing to its development.





## A rapidly growing industry

Clean hydrogen is one of the most widely discussed topics in global energy markets today, drawing attention from policy makers and power producers through to leaders in heavy industry. A panel at Hydrogen 2022 agreed that clean hydrogen produced using renewable energy sources is most likely to provide the only viable means to decarbonise major industries such as steelmaking, shipping and aviation.

François Paquet, impact director at the Renewable Hydrogen Coalition, posed the question: “How do we harness this excitement and influence the policy debate? How do we move from announcements to action?”

Hydrogen is already used in heavy industry. At Air Products, for example, it makes up roughly 25% of the company’s product portfolio. Ivo Bols, European president for Air Products, said: “We really want to

contribute with the technology we have, and the experience, to produce, to distribute and to accompany customers in their applications in hydrogen.”

This is “a key role we and others that own the technology have to play,” he said. “We want to move forward, ahead of demand, in terms of creating both the production of significant green hydrogen facilities as well as building up the infrastructure that it takes to carry this green hydrogen to the end users.”

Likewise, Andrea Lovato, executive vice president and global head of hydrogen at Acwa Power, said his company is also keen to be an early leader in the sector, with plans to have one of the largest electrolysis plants in the world come online in 2023. “Green hydrogen is based on renewables, and we have been at the forefront of cost reduction in renewables,” he said.

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The plant the company is planning for the Middle East means that Acwa Power is “already a first mover in Saudi Arabia today, building the largest plant for renewable hydrogen—1.25 million tonnes per year of green ammonia to be exported out of the Kingdom,” he said.

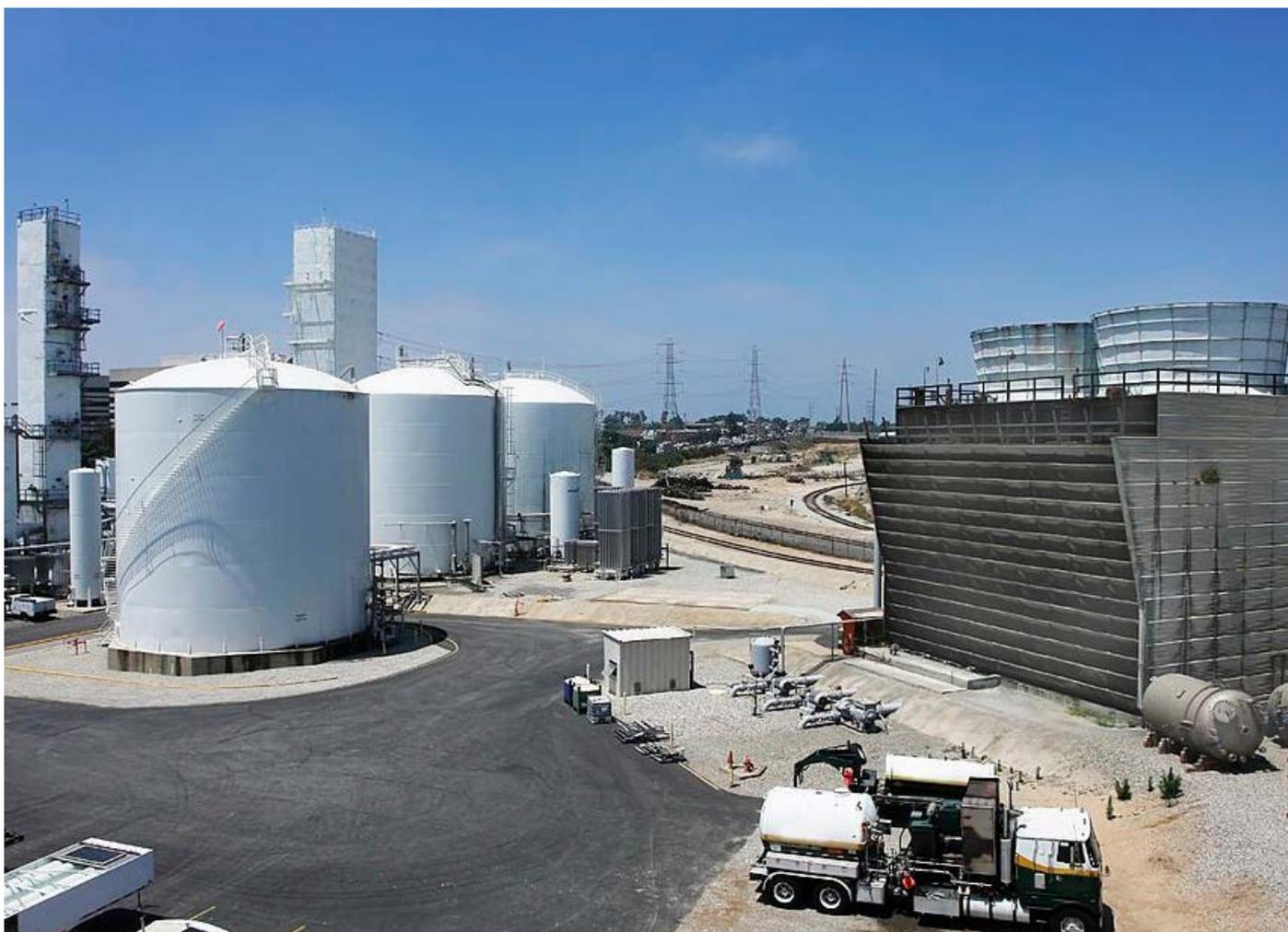
Renewable project developers such as Acwa Power are keen to see the development of green hydrogen markets because they could create significant new demand for low-carbon electricity.

Acwa Power’s dominance in Saudi Arabia—according to Lovato—means the company has access to cheap renewable electricity. “Obviously there is renewable resource in abundance,” said Lovato. “There is a combination of wind and solar. And there is also land available.”

Plus, the Middle East’s vicinity to Europe makes it an ideal candidate to meet part a substantial part of Europe’s green hydrogen needs, he said.

Andre Pina, associate director of hydrogen strategy and origination at EDP, another renewable energy developer, said: “We are now stepping into hydrogen as a way to complement our offering, from direct electrification to indirect electrification.”

EDP has major projects underway—including the FLEXnCONFU and BEYOND schemes in Portugal—and expects an undisclosed amount of clean hydrogen to be produced this year. However, while there is ample capital available to invest, deal flow is still limited at this stage, and the challenge remains to ensure sufficient scale of investment to enable clean hydrogen to compete with fossil fuels.



## Production and projects

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Of all the potential routes to produce clean hydrogen, the most promising is using renewable energy to power the electrolysis of water. Although this is currently one of the most expensive production routes available, with sufficient investment and economies of scale the cost is expected to fall, although the exact amount is subject to large uncertainties and dependent on different technologies and scenarios.<sup>ii</sup>

Belén Linares Corell, innovation director at Acciona Energy, highlighted that electrolyser development could follow a similar cost-reduction path to that seen already in asset classes such as solar or wind, and should ultimately lead to a price-competitive supply of clean hydrogen. “We see a lot of synergies in the development of the technology,” she explained. “We believe electrolysers are going to be similar to solar and wind.

“Green hydrogen is the solution that we really believe has achieved a level of development in terms of technology. We believe that is the option we need to push now, to get prices for green hydrogen around EUR2 per kilogram—basically what our existing gas customers are asking for. The green hydrogen supply is not able to provide these prices today, but gas is changing the geopolitical situation—and this is something that can help those kinds of technologies.”

Furthermore, she explained, “there are other technologies we are exploring beyond electrolysis to produce hydrogen.”

Jon Duffy, chief executive officer of Clean Power Hydrogen, explained that even though the clean hydrogen market is only really getting started, there are already signs of a shortage of electrolysis systems and “demand is going to outstrip supply for quite a number of years.”

Adding to this demand is the fact that green hydrogen is already close to achieving cost parity with fossil fuels in transportation and with carbon-intensive hydrogen production in some industrial applications. “We’re focusing on the things we can do now where there’s no regret,” said Will Rowe, chief executive of Octopus Hydrogen. “The demand for hydrogen is huge” in many niche applications, he said.

The company has centred efforts on applications such as grey hydrogen displacement because, he said, “We wanted to be able to do things today. We wanted to be able to buy electrolysers and install them as opposed to looking at ‘24, ‘25, ‘26 go-live projects that are more subsidy dependent.”

Fortunately, within the technology roadmap for electrolysers, “a lot of cost-down happens because of things we control,” said Eugene McKenna, commercial and strategy director at Johnson Matthey. “There’s going to be vast industrialisation, which is going to take a lot of cost out.”



## The role of large-scale renewables

In a panel hosted by DLA Piper's global co-chair of energy and natural resources, Natasha Luther-Jones, the discussion found that in addition to electrolyzers, clean hydrogen will require a massive buildout of renewable energy as a low-cost source of electricity. "Europe will need to import more hydrogen if it wants to meet its net zero targets," she said. "There are positive signs in the EU indicating that import of green hydrogen produced abroad will become easier."

"However, even more flexible regulation will be needed, alongside incentives on the production side and on the demand side. This means looking at large-scale renewable projects, as well as other solutions across the entire energy spectrum."

As Warner Priest, director of midstream energy at InterContinental Energy, explained, "Some of the largest renewable energy projects in the world are already being built with hydrogen in mind."

Priest went on: "We will be producing up to 10 million tonnes of hydrogen per annum. We're talking in the region of 150 to 200 gigawatts of renewable generation. Our smaller projects will be built over about 10 to 12 years, the larger projects will take about 20 years."

The company is looking to develop projects in Australia and the Middle East, where wind and solar resources are complementary, with a view to exporting hydrogen to markets in Europe and Asia. Maribel Rodriguez Olmo, hydrogen business development manager at Repsol, said that her company is also looking to develop major projects—partly to decarbonise its own operations but also to supply industrial clusters.

Another developer, CWP Global, is planning nine projects across five continents, totalling around 140 gigawatts and 600 terawatt-hours a year. "There's about a quarter of a trillion dollars of investment," said CWP Global chief executive Alex Hewitt. "Everything about it is big."

Hydrogen production is increasingly being targeted in plans for energy hubs that combine access to renewable electricity with gas storage and distribution infrastructure. Hydrogen projects such as the Asian Renewable Energy Hub, in Australia, are seen by developers as a safer bet than shipping electricity directly via interconnectors. "Originally, we were going to send an HVDC [high-voltage direct current] cable from that site to Singapore," said Priest.

"We quickly realised a point-to-point market is risky and there are all sorts of other challenges."

## Hydrogen uses in land and air

With demand for clean hydrogen already starting to outstrip supply, it is also the case that sustained market growth will not be achieved without a significant scaling up of usage across a range of applications. As it stands, there is no shortage of potential use cases. On land, for example, mining is just one of several industries that sees clean hydrogen as a vital tool for decarbonisation.

Sara Edmonson, European lead at Fortescue Future Industries, the cleantech innovation arm of one of the world's largest iron ore mining companies, said: "We have an opportunity to be a system-wide enabler of decarbonisation. Last year we showcased our first hydrogen-powered haul truck."

Aviation is likely to depend, increasingly, on hydrogen as a fuel source, either directly to power aircraft or as a sustainable aviation fuel (SAF) feedstock. As David Morgan, director of flight operations at Easyjet, explained: "Going forward, aviation will look very different. I could go out today and buy a two-seater

electric plane that could fly me around for a while."

With wide-bodied aircraft, "the technology is suggesting that sustainable aviation fuel is going to be the only thing that can power those aircraft," he said. "Short-range aircraft could be powered by hydrogen."

Moving to low-carbon fuels based on hydrogen is important for Easyjet because the company is seeking to cut its net emissions to zero without resorting to carbon offsets that would allow it to carry on using fossil fuels. "Our decarbonisation roadmap does not include offsets," Morgan said.

Aircraft manufacturers are already working towards decarbonisation. All of Airbus's models are certified to run on up to 50% SAF, according to Andy Reynolds, head of ZEROe hydrogen storage and distribution systems at Airbus. The company is aiming to take the SAF level up to 100% within this decade, which "isn't trivial," says Reynolds. "We need to demonstrate the whole safety case works perfectly."





## Hydrogen in mobility

In a panel chaired by DLA Piper partner, Guido Kleve, the discussion focused on hydrogen in mobility. One of the highest-profile end-use cases for clean hydrogen is in transportation. While private cars mostly look set to achieve decarbonisation through electrification, for road transportation—where trucks travel distances that are hard to achieve on batteries—hydrogen could provide an emissions-reducing, sustainable fuel source where the only by-product is water.

“Focusing on electric is maybe in the short run the right decision, because it’s cheap and easy,” said Ferry Franz, director of hydrogen affairs at Toyota Motor Europe. “But heavy transport will not be satisfied with a battery electric vehicle.”

Patrick Huber, head of growth and strategy at Hyundai Hydrogen Mobility, explained that targeting heavy duty vehicles makes a lot of sense as an early use case. “It

was the only way we could provide a sufficient amount of offtake,” he says. “If you want to run a hydrogen refuelling station, which is operationally profitable, you need to sell 95 tonnes of hydrogen per year. This can either be achieved with 750 fuel-cell cars or it can be achieved with 15 trucks. It’s impossible to assume you would have more than 700 cars available.”

Nevertheless, some car manufacturers are looking at the potential for hydrogen-powered cars. As Juergen Guldner, vice president of hydrogen, fuel cell technology and vehicle projects at BMW explained, “We are partnering with Toyota in a very successful cooperation. At BMW, we have developed our own fuel cell system. We are in the last months of testing the second generation of the vehicle and will have a small fleet of prototype vehicles by the end of this year. They will not be for sale or for lease; they will be for public awareness, to test the market.”

## Infrastructure requirements

Besides producing and consuming clean hydrogen, a low-carbon economy will need to store the gas and move it around. Building a hydrogen backbone will be critical for regions such as Europe that have ambitious low-carbon energy targets and many European gas transmission system operators (TSOs) are looking into the extent to which existing infrastructure could be adapted for clean molecules.

As Daniel Muthmann, head of policy and strategy at gas TSO Open Grid Europe, explained, "Since green hydrogen requires a lot of renewables, you are confronted with the same challenge that you have in all energy forms: mostly, you find them not where you need them. You have a logistical challenge. A lot of efficient renewables is not going to be around your industry centres. Logistics plays a big role. If people want to make decisions on setting up new projects, they need confidence."

If gas pipelines can be adapted for hydrogen transport, then "We can help to provide some of that confidence," he added.

Natural gas TSOs have permitted infrastructure on the ground and experience in moving molecules around. In Europe, the industry is also committed to adapting the infrastructure to hydrogen as far as possible. "In the North-Western part of Europe, we have a big opportunity," said Helmie Botter, general manager of hydrogen business development at Gasunie. "We have had this Groningen gas field in the Netherlands and there are a lot of gas pipelines coming from the north to the south."

Because of the decline and closure of the field, "a lot of pipelines are becoming available for hydrogen or alternative transport options," she went on. "We have the opportunity to do it quickly and the cost will be a lot cheaper than building new pipelines. We do not have to disturb society again."

Maria Sicilia, strategy director at Spanish gas firm Enagás, added: "It's clearly stated in the REPowerEU plan: the Russia-Ukraine conflict has changed the European energy landscape and calls for an urgent response and the need to utilise all resources."





## Hydrogen in future energy systems

A growing hydrogen economy will require tighter integration with other aspects of the energy system, from renewables generation to electricity transmission. The volume of clean hydrogen that will be needed to replace fossil fuels is significant. In the UK, for example, there is an ambition to have 10 gigawatts of low-carbon hydrogen production capacity by 2030, explained Daniel Arnold, head of hydrogen for industry at the Department for Business, Energy & Industrial Strategy (BEIS).

“At least half of this will come from electrolytic hydrogen, drawing on the massive scale up of offshore wind, other renewables and new nuclear,” Arnold said. “We see the huge growth in renewables and electrolytic hydrogen production going hand in hand. Hydrogen can play an important strategic role in a decarbonised power system by providing flexible capacity and storage to balance renewables. In the most recent strategy, we really made that link quite explicit. Curtailed generation could be used to make hydrogen that could be stored.”

Hydrogen-powered generation might reduce system costs by up to GBP4 billion a year by 2050, according to BEIS calculations, because it is able to ramp up and down in response to price signals--“much like unabated gas today,” according to Arnold.

Anticipating future needs, the UK is establishing a Future System Operator that will deliver recommendations on the development of a hydrogen economy, he added.

Massimo Valsania, vice president of engineering at EthosEnergy, explained that hydrogen can be used for grid balancing today if blended into the gas network, says. “We can easily use the gas turbine as is and slowly increase the investment,” he said.

Similarly, he went on, natural gas compressors and other legacy assets could be adapted for use in a hydrogen economy.

## Financing the hydrogen economy

Given expected growth in the hydrogen market, it is hardly surprising that investors are watching the evolution of the market with interest. The Dutch multinational Internationale Nederlanden Groep (ING), for example, has earmarked EUR650 million for new energy technologies such as hydrogen. However, "it's no secret that there are, at the moment, a paucity of projects which are reaching FID [financial investment decision]," commented Henry Rushton, energy sector director at ING.

Nevertheless, he added: "We have seen that change quite substantially over the last six months. We're seeing a real acceleration."

Hydrogen projects modelled on traditional renewable energy or oil and gas schemes, with long-term offtake contracts, are likely to be attractive to investors, Rushton said. HY24, the world's largest hydrogen-focused equity investment fund, has raised EUR1.5 billion for projects

across the industry value chain, according to chief investment officer Amir Sharifi.

Hydrogen was "probably the most promising" of the investment opportunities connected to the energy transition, he said. "If a project works for senior debt, then it should work on the equity side," he noted. "A long-term offtake is one of the most important criteria, but I must say that being an equity investor in the current maturity stage of the sector, where the offtakes are not that common, we are still able to go one step ahead on the risk curve by accepting some development risk."

HY24's first two investments in production did not have full offtake agreements but went ahead anyway with the expectation that offtakes would ultimately be forthcoming. "If you want to take one step further on the risk curve, you can move into the mobility space," added Sharifi. "We've taken that leap and invested in two refuelling station networks in Germany where you have captive fleets and visibility of revenues."



## Outlook and conclusions

The need to speed up and scale up clean hydrogen production was already a major concern for global economies before 2022. This year, the conflict in Ukraine has made moving away from oil and gas a national security issue for many countries, particularly in Europe. The change in priorities has driven further interest in developing hydrogen, with schemes such as the European Commission's REPowerEU strategy increasing the ambition around production and utilisation.

Achieving this level of ambition will be challenging. Two decades of progress on renewables up to 2020 has seen fossil fuel's share of the global energy mix drop almost imperceptibly, from 86% to 84%, according to Mikaa Mered, adjunct lecturer on hydrogen markets and geopolitics at the École des Hautes Études Commerciales de Paris business school.

Nevertheless, experts at Hydrogen 2022 were clearly optimistic about the prospects for using hydrogen to help eliminate the remainder. Speaking during the mobility panel moderated by DLA Piper, Craig Knight, chief executive of Hyzon Motors, said that a decade from now hydrogen could be recognised as "the ultimate

egalitarian fuel," delivering "energy independence and energy resilience."

Hydrogen could be "the fuel that resolves conflict over oil and gas, which is killing us," Knight said. "It's in everything already, you've just got to take it out," he added. "The only reason it wasn't competitive to take it out historically is because no-one was paying the full embedded carbon price of the alternative. Hydrogen will be ubiquitous, at cost structures that nothing else can match."

DLA Piper's Guido Kleve concludes: "We currently see nothing less than a race for hydrogen in mobility-related industries such as automotive, chemicals and to a lesser extent aerospace. From a legal perspective, we see a focus on three factors to further accelerate the development of the hydrogen economy: funding, the establishment of the required regulatory framework—which is at last trying to catch up with R&D—and CO<sub>2</sub> pricing mechanisms which will further stimulate innovation in hydrogen. The fact that all stakeholders involved are stepping up in this regard is rapidly separating the wheat from the chaff, and the next phase should be particularly interesting."

DLA Piper is a global business law firm, with a specialist team of lawyers who collaborate across different disciplines advising on all aspects of large-scale hydrogen projects, from establishing hydrogen infrastructure to generation, transportation, and industrial use, successfully navigating the regulatory landscape. For more information about our hydrogen practice or an initial discussion about how DLA Piper can help you to achieve your hydrogen vision, please contact:

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