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Argus *Hydrogen and Future Fuels*

Market news, analysis and prices

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Fuelling stations may unlock roads for H2

Increasing availability of refuelling infrastructure could remove one of the key obstacles to decarbonising heavy-duty transport in Europe, writes Aidan Lea

Battery electric vehicles dominate the zero-emissions car market, and are expected to continue to do so — the inefficiencies of converting renewable electricity into hydrogen will always make it a struggle to compete with direct electrification, save for some niches such as taxi fleets. But hydrogen could play an important role for hard-to-electrify heavy-duty transport, and this has been backed up by recent private-sector refuelling projects.

In March, UK-based ITM and trading firm Vitol announced a refuelling joint venture aimed initially at the UK market. Its refuelling outlets are designed to cater for cars and trucks, but buses and trucks are the target market to begin with as public bodies and firms come under pressure to decarbonise fleets.

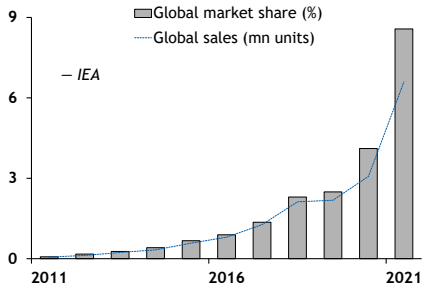
A few days later, German refuelling firm H2 Mobility announced it had received €110mn ($119mn) and plans to more than treble its 90 stations to 300 by 2030. It will face competition from US refiner Phillips 66 and Swiss firm H2 Energy, which are collaborating to deploy up to 250 refuelling stations across Germany, Austria and Denmark, it was announced in February. And in March, Spanish integrated oil and gas firm Cepsa announced plans to install hydrogen refuelling stations every 300km on the main arteries connecting Spain with other parts of Europe.

In the background, the EU is steadily upgrading its alternative fuels infrastructure directive into binding regulation for its members. The member of the European Parliament responsible for delivering the legislation, Germany's Ismail Ertug, has pushed to strengthen the mandate for hydrogen fuelling stations to one outlet per 100km, down from every 150km previously, along the Trans-European Transport Network (TEN-T) the bloc is planning. Member states would also be obliged to deploy regular electric vehicle charging points under the proposals.

The regulation still has several more stages of approval ahead, but investment in hydrogen infrastructure is essential to unlock investment, European Commission Sustainable and Intelligent Transport deputy head Axel Volkery says.

"We need a very clear political signal that sufficient refuelling infrastructure will be there in 2030 across the TEN-T network so that manufacturers have the certainty when their fuel-cell trucks get into serious production they will find the infrastructure for refuelling," says Volkery. "If we don't send that signal now, then we risk losing that investment momentum and we cannot afford that if we want to support the [EU's] 2030 increased climate ambition."

Global electric car sales



The hard cell

But fuel-cell trucks will face stiff competition from battery counterparts. Many automakers are hedging their bets — Sweden's Volvo, for example, has a range of electric trucks but last year launched its Cellcentric fuel-cell truck joint venture with German peer Daimler Truck.

While transport will use electricity when possible, there is a tipping point when other fuels beat batteries. "It's clear for me we're not going to fly across the Atlantic on batteries… you may do it on hydrogen or synthetic fuels. At the other end, to drive to the supermarket you don't need hydrogen," says Nigel Brandon, Imperial College Chair in sustainable development in energy. "Trucks and buses is the crossover, you'll find companies investing in both… light-duty has been won by batteries but the truck market is there to win."

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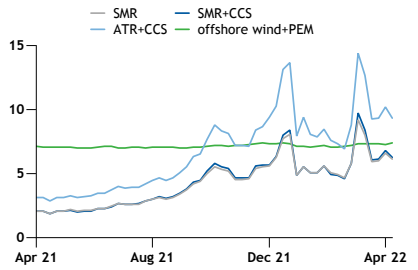
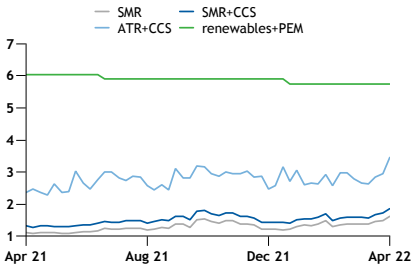
HYDROGEN PRICES

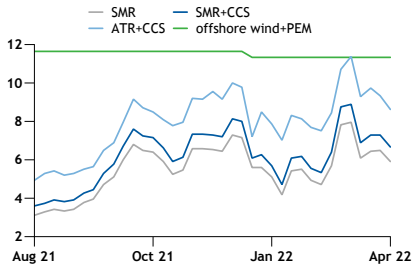
Northwest Europe average cost €/kg



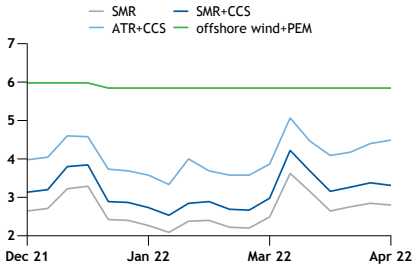
North America average cost $/kg



Northeast Asia average cost $/kg



Exporter average cost $/kg



Regional hydrogen cost markers			12 Apr
	Process	**$/kg**	**± 5 Apr**
Baseline			
Northwest Europe	SMR	6.67	-0.67
North America	SMR	1.62	+0.13
Northeast Asia	SMR	5.91	-0.59
BAT+			
Northwest Europe	SMR+CCS	6.83	-0.72
North America	SMR+CCS	1.86	+0.15
Northeast Asia	SMR+CCS	6.67	-0.64
Low-C			
Northwest Europe	ATR+CCS	10.18	-1.14
North America	ATR+CCS	3.46	+0.50
Northeast Asia	ATR+CCS	8.62	-0.73
No-C			
Northwest Europe	Island renewable+PEM	8.07	nc
North America	Island renewable+PEM	5.75	nc
Northeast Asia	Island renewable+PEM	11.32	nc
Exporter			
Exporter baseline	SMR	2.80	-0.05
Exporter BAT+	SMR+CCS	3.31	-0.06
Exporter low-C	ATR+CCS	4.49	+0.09
Exporter no-C	Island renewable+PEM	5.84	nc

Argus hydrogen taxonomy			
	Purity	**Pressure**	**tCO2e/tH2**
Baseline	99.9%	30 bar	<11.3, >8.0
BAT+	99.9%	30 bar	<2.88, >1
Low-C	99.9%	30 bar	<1, >0.5
No-C	99.99%	30 bar	<0.01

CO2e emissions on a gate-to-gate basis

Pump prices, 70MPa			Apr 22
	Unit	**Price**	**+/- Mar 22**
Japan			
Tohuku	¥/kg	1,210.00	nc
Chubu	¥/kg	1,210.00	nc
Tokyo	¥/kg	1,210.00	nc
Kinki	¥/kg	1,210.00	nc
Kyushu	¥/kg	1,210.00	nc
Germany			
Germany	€/kg	9.50	nc

MARKET DEVELOPMENTS

FFI, Eon eye 5mn t/yr green hydrogen supply by 2030

Australian green hydrogen developer Fortescue Future Industries (FFI) and German utility Eon have signed an agreement aimed at supplying hydrogen produced in Australia to Germany and the Netherlands.

The initial agreement aims for FFI to deliver 5mn t/yr to Eon by 2030. This would be equivalent to around 165TWh of natural gas and one-third of the calorific energy Germany imports from Russia, FFI chief executive Andrew Forrest says, referring to the green hydrogen as "Freedom Energy".

The hydrogen will be produced in Australia from electrolysers powered by wind and solar energy. The project would take up "just a few tens of kilometres of land" in Australia, Forrest says, and adds that the country has thousands of kilometres of available land suited for wind and solar. FFI has also planned hydrogen production at various locations globally, and is targeting green hydrogen production of 15mn t/yr by 2030, and 50mn t/yr by 2050.

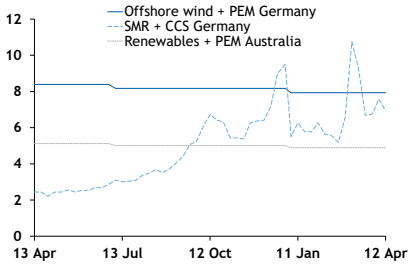
The companies will work together with the Australian and German governments on developing the project as quickly as possible.

First supplies could be delivered in 2024, Eon chief operating officer Patrick Lammers says. It is expected the first use will be blending into the natural gas grid, which would not require substantial investment and would enable a gradual build up of hydrogen supply before it completely replaces natural gas, Lammers says.

The hydrogen will initially be transported as ammonia, but Forrest expects it to eventually be transported as liquefied hydrogen. He argues that doubts around the viability of liquefied hydrogen are reminiscent of those around LNG before that market took off.

By Killian Staines

Production costs $/kg



German RES industry warns on hydrogen tender plans

Germany's renewable energy sources (RES) industry has warned against the economy ministry's plans for combined electrolysis and renewables sites tenders, which would subsidise the joint production of renewable power and hydrogen.

Wind energy association BWE's head of European affairs Mirko Moser-Abt says that the obligation enshrined in the draft bill — to directly link the solar or onshore wind power installation and the electrolyser — is too strict. The restriction will unnecessarily limit the operating hours of the electrolyser, Moser-Abt says.

Germany's ministry of economic affairs and industry plans to launch a new tender segment as part of a raft of new draft legislation aimed at accelerating the energy transition. The draft bill stipulates that the electrolyser may only use power generated by the connected renewable site, or sites. The hydrogen produced by the electrolyser must be used exclusively to generate power, and may not be fed into the gas or hydrogen grid beforehand.

The annual tender volume would start at 400MW in 2023, rising to 700MW in 2025 and to 1GW in 2028. The first tender deadline would be 23 December 2023, the second on 1 July 2024. After that, the tender deadlines would be on 1 January and 1 July every year. From 2024, the tender volume would increase by the volumes not awarded in previous tenders.

Research institute RLI criticised the bill's limitation regarding the use of hydrogen, arguing there should be the possibility of using it locally, for instance in small-scale commercial or industrial applications. RLI recently published a study on behalf of renewable energy retailer Green Planet Energy suggesting a 375 MW/yr tender scheme of small, decentralised electrolysers under Germany's hydrogen strategy.

By Chloe Jardine

NEWS

China outlines hydrogen development plan for 2021-35

The Chinese government has laid out a medium and long-term development plan for hydrogen in 2021-35, in response to its initiative to accelerate the country's transformation to a low-carbon society.

China is targeting bringing 50,000 hydrogen fuel-cell vehicles on to roads by 2025 and will build a number of hydrogen refuelling stations. It is also aiming for green hydrogen production to reach 100,000-200,000 t/yr by 2025, with a carbon reduction target of 1mn-2mn t/yr. This represents a small share of overall production — China produced more than 21mn t of hydrogen in 2019, mostly from coal.

Actual output could be higher in 2025, if coal-focused Inner Mongolia achieves its aim of raising green hydrogen output to 500,000 t/yr by then. The region last August laid out plans to develop seven wind and solar power projects that could produce almost 67,000 t/yr of hydrogen as part of this drive, which includes a target of 100,000 t/yr by 2023.

The country aims to establish a complete technology innovation system for hydrogen and bolster production and supplies of clean hydrogen by 2030, in an effort to meet Beijing's goal of carbon neutrality by 2060 and for carbon dioxide emissions to peak by 2030. Sustainable growth in hydrogen production should boost long-term demand for metals, market participants say, particularly rare earths, such as lanthanum and cerium, which are used to make hydrogen catalysts, purification materials, and storage and transportation materials, as well as solid oxide fuel cells.

China also plans to develop a diversified application ecosystem of hydrogen energy by 2035, significantly increasing the proportion of hydrogen production that uses renewable feedstock resources in the country's total energy consumption.

EHB targets 28,000km of hydrogen pipelines by 2030

The European Hydrogen Backbone (EHB) initiative has stepped up its ambitions for a pan-European hydrogen pipeline network in response to EU proposals to boost green hydrogen production and imports.

An industry association of gas transmission system operators (TSOs), EHB now targets almost 28,000km of hydrogen pipelines by 2030 and 53,000km by 2040, with around 60pc repurposed existing natural gas pipelines and 40pc new pipelines. This time last year, EHB proposed an 11,600km network by 2030, rising to 39,700km by 2040. EHB now comprises TSOs from 28 countries, up from 21 countries last year.

EHB proposes five supply and import corridors by 2030. One would connect supply from Tunisia and Algeria through Italy to central Europe, leveraging existing pipelines in Italy, Austria, Slovakia and the Czech Republic.

A southwest corridor would transport green hydrogen produced in the Iberian peninsula through France into western Germany, and could eventually provide access to imports from Morocco.

A corridor in the North Sea would build on Dutch plans for 2027, expanding this to a network connecting Rotterdam with the ports of Zeebrugge and Antwerp in Belgium, Wilhelmshaven and Brunsbuttel in Germany, and Le Havre in France.

A Nordic and Baltic corridor could support hydrogen exports to central Europe. But this would consist mostly of new pipelines, making it especially dependent on funding and a quick permitting and planning process, EHB says.

A fifth corridor could connect buyers in central Europe to regions with abundant renewable energy potential, such as Romania, Greece and Ukraine, through repurposed gas pipelines. But there is uncertainty around the evolution of future natural gas flows in this region, which affects development of this corridor, EHB says.

By Killian Staines

Planned total investment by 2040*			€bn
	Low	Medium	High
Pipeline	62.7	74.1	91.0
Compression	17.2	26.6	52.4
Total investment cost	**79.8**	**100.7**	**143.3**
Annual Opex	1.6	2.4	3.2

European Hydrogen Backbone

**For 53,000km, costs range depending on system design*

NEWS

OCI and NorthH2 partner on green methanol, ammonia

Dutch hydrogen firm OCI and the NorthH2 consortium have entered a partnership to develop an offtake agreement for the former's plants in the Netherlands.

OCI says this will enable a stable, large-scale supply of green hydrogen, allowing it to decarbonise its production processes and the downstream food, fuel and consumer goods chains, and reduce the Netherlands' dependence on natural gas.

NorthH2 was launched by Shell, gas system operator Gasunie and Groningen Seaports in February 2020. Norway's state-controlled Equinor and German utility RWE have since joined, followed by Dutch utility Eneco and OCI last month. The companies are working on a project that aims to bring 1GW of Dutch offshore wind capacity on line by 2027 to produce green hydrogen. It expects 4GW of generation capacity to be on line by 2030, and more than 10GW by 2040 — enough to produce 1mn t/yr of green hydrogen.

Switching to green hydrogen at OCI plants is "technologically straightforward and relatively fast", the company says, with around 50pc of current global hydrogen production already used as a feedstock in ammonia and methanol production.

Methanol and ammonia "are the most efficient green hydrogen carriers", OCI chief executive Ahmed El-Hoshy says. Both products are used as building blocks in a wide range of sectors and products, such as transport, furniture, clothing, healthcare and cosmetics, automotive and windmill blades. Ammonia is largely used to make agricultural fertilisers, and both products are emerging as new clean fuel for shipping.

By Giulia Squadrin

UK doubles H2 target to 10GW in energy security plan

The UK government has doubled its target for low-carbon hydrogen production capacity by 2030 from 5GW to 10GW, as part of its Energy Security Strategy.

At least half of the hydrogen will come from renewables and the rest from domestic natural gas using carbon capture and storage (CCS). The government will publish delivery roadmaps for CCS and hydrogen "to provide clear signals to industry to invest this month", it says.

The government will encourage production via electrolysis with annual allocation rounds for hydrogen production contracts, hoping by 2025 to have least 1GW of production capacity on line or in construction. The application window for the first round will open from July to September and successful applicants will receive funds in 2023, with the government expecting projects to be in operation by 2025. It has set aside £100mn ($130mn) for this round.

In the first phase, the government will negotiate business model funding packages bilaterally with applicants, but from 2025 onwards, it plans to implement a price-competitive auction process — comparable with the contracts for difference used to scale up the wind power industry. The UK says it will also design a hydrogen certification scheme by 2025.

The government says it plans to blend hydrogen up to 20pc into the natural gas grid and will take a final decision on this next year.

The UK has also announced a £26mn hydrogen innovation fund for demonstrations of fuel switching with a view to rolling out successful methods, with carbon-intensive sectors such as steelmaking, chemicals, and food and drink likely candidates. Applications open this month and projects must be complete by March 2025.

From this month, hydrogen projects will also be able to apply to the £240mn Net Zero Hydrogen Fund announced in the National Hydrogen Strategy last year, for funding to subsidise capital expenditure and front-end engineering design studies.

By Aidan Lea

Q&A

Plug Power backs liquid hydrogen

Hydrogen company Plug Power's VP of Strategy and M&A Kevin Kopczynski sat down with Dylan Chase on the sidelines of the CERAWeek by S&P Global conference in Houston.

You are putting your back into hydrogen liquefaction. Does liquefaction not add significantly to costs?
The market that we serve is a material handling market. Our major customers like Walmart, Amazon and General Motors are mission critical. You have to be able to supply them. Liquid does two things for us. Number one, it enables us to store enough on site that they can have about a week of supply there because the supply chain is quite tight. Number two, it helps the logistics costs of actually moving the hydrogen to the customer site. The combination of those two really make liquid the only option. With gaseous hydrogen you are limited by what you can store on-site and then you are really constrained on how far you can move it. Once you get beyond 100 or 200 miles, your costs go up.

Do you think that message on liquefaction is getting through to the market?
Plug Power is the market for this — like 95pc of this market. I think we previously had a lot more scepticism around liquid, particularly in Europe, but now I think some of the wisdom is coming through. Then you think longer term about trains, aeroplanes, maybe even heavy-duty trucks. Liquid again makes sense. And if we move to pipelines, there is still going to be a demand for liquid in these future applications that are further out.

'We intend to curtail our plants at certain times of the year because there are pricing signals that we will respond to. It is baked into our approach here'

Are there particular grid challenges in the US?
It is no different than developing large-scale renewable projects anywhere. You are always looking at what is the local permitting regime, the interconnection capacity, the nodes on the grid, where all these things align. Around 70pc of the cost of a green hydrogen molecule is the cost of the electron that went into it. All of the projects that we have announced are really a combination of a power price play and logistics. We intend to curtail our plants at certain times of the year because there are pricing signals that we will respond to. It is baked into our approach here. So I think our projects will be real good complements to the US grid.

What are some policy steps that can help hydrogen development?
In the US, we are closely watching Build Back Better legislation, as a $3/kg production tax credit [PTC] would dramatically accelerate everything we are talking about. We also are able to take advantage in the US of an investment tax credit that applies to fuel-cell technology or fuel-cell equipment. We have a joint venture with Acciona in Spain and so we see these European things in discussion and some of them are pretty scary. Like to be qualified as green hydrogen, it needs to be totally islanded from the grid. With those policies, Europe is going to have challenges to do the amount of power that is needed. To further restrict like that, that to me would really stifle development.

When does demand rise enough so that regulatory support can be pulled away?
If the PTC does not come, we are still going to go with this first batch of plants. What we are marching toward is not really natural gas parity. It is diesel parity. And if you look at it on an energy content basis, plus the efficiency of a fuel cell, that is something that I think we can see in a five year-ish kind of timeframe.

Proposed hydrogen tax credit in Build Back Better Act		$/kg
Emissions per kg of H2 produced	Standard	Non-prevailing wages
4-6kg CO2e	0.5	0.1
2.5-4kg CO2e	0.6	0.1
1.5-2.5kg CO2e	0.8	0.1
0.45-1.5kg CO2e	1.0	0.2
0-0.45kg CO2e	3.0	0.6

Unabated SMR emits around 9kg CO2 per kg of H2

ANALYSIS

'Fierce' competition for hydrogen talent

The development of a genuine global hydrogen market will depend on many things, and one underappreciated resource is people, writes Emmeline Willey

Readying the workforce the hydrogen industry might need in 10 or 20 years' time means beginning a recruitment drive now. A sector whose future trajectory — and therefore its career prospects — remains highly uncertain faces obvious challenges in attracting talent, but in its favour it also has the promise of something new, different and attractive to an environmentally conscious workforce.

"The scarcest resource around hydrogen will be talented people," says Julio Friedmann, chief scientist at CO_2-removal firm Carbon Direct. "We simply must invest in education, training and skill development to scale and succeed — welders and electrochemists and project developers." The US Department of Energy will allocate $6.1mn to university programmes to support decarbonisation innovation for future industry workers. The announcement is "a good opening ante for a long, long game", Friedmann says.

In the US, hydrogen may create up to 700,000 jobs, says a collaborative industry report from the Fuel Cell and Hydrogen Energy Association — but it will not produce the workers needed to fill them.

An even greater shortage may be seen in Europe, thanks to its ambitious targets, recently turbocharged by a desire to reduce dependence on Russian gas. The electrolyser industry needs to grow at a "crazy speed", says Nils Aldag, chief executive of German electrolyser manufacturer Sunfire. The previous "2x40" targets of 40GW of electrolysers inside the EU, and another 40GW exporting from outside the EU, were already considered ambitious, Aldag says. But the newly proposed targets would require over 200GW in Europe alone, he says. "There is a huge need to go from hundreds of people employed in electrolyser companies today to thousands and one day tens of thousands of people," Aldag says.

'We need... people that are capable of putting football fields of electrolysers into an industrial environment and connecting that to an industrial use'

"Talent and resources will be a bottleneck," says Kajsa Ryttberg-Wallgren, executive vice-president and head of business unit hydrogen at Sweden's H2 Green Steel. While so many projects are in the research and design stages, the main bottleneck is experienced engineers. But as growth continues, she warns, that shortage can be expected to spread to operations and construction.

"We need execution people," Aldag says. "People that are capable of putting football fields of electrolysers into an industrial environment and connecting that to an industrial use. I think this is highly underestimated."

Come and build it

The pool of hydrogen-specific talent is extremely small. Experienced workers must be recruited from industries such as ammonia, gas or oil, so that they will be able to train graduates. "We get a lot of young people coming in and they want to learn it, but they need to learn it from someone," says Ryttberg-Wallgren, adding that competition for such talent will be fierce. "The question then is, how do you differentiate yourself as a company to attract this talent?"

"You need to do exactly what the tech industry has done for the last decade, and that is to compete very, very hard," says Philip Alsen, VP of talent acquisition at H2 Green Steel. What makes tech companies succeed is "feeling that purpose, inclusiveness, the opportunity to contribute to something larger", he says.

While the near-future of hydrogen may depend upon industry transfers and recent graduates, the 2050 hydrogen dream depends on a strong 2050 workforce.

"We need to show the young talent what it will be like to be an engineer in 2030, because that is most likely different from what it was like in 1990," says Alsen. Even operational jobs will look different — operators will not be "lifting heavy things", says Ryttberg-Wallgren. "It's going to be control panels, it will be highly digitised. It is a different skillset and a different type of worker."

IN BRIEF

Air Liquide plans at least 15,000 t/d of H2 by 2030

French industrial gas supplier Air Liquide plans to boost its hydrogen production to 2,000 t/d by 2025 and 15,000-50,000 t/d by 2030, from 100 t/d in 2021. Hydrogen will be used to fuel buses and light commercial fleets by 2025, expanding to heavy-duty vehicles, cars and rail by 2030. The company says it will explore hydrogen fuelling for maritime and aviation between 2030 and 2035. It projects that it could triple revenue from hydrogen sales to over €6bn ($6.57bn) before 2035, and increase electrolysis capacity to 3GW by 2030. Air Liquide envisions using autothermal reforming and partial oxidation with carbon capture and storage (CCS) to produce large quantities of low-carbon hydrogen, and also hopes to provide CCS as a service to other clients. It is partnering with energy technology company Siemens Energy for polymer electrolyte membrane electrolysis.

Germany's Sunfire raises almost $100mn, signs 640MW deal

German electrolyser firm Sunfire has raised €86mn ($94.5mn) in its latest fundraising round from investment fund Blue Earth Capital and Danish fund manager CIP. The investments take the total for round D to $215mn, which will enable Sunfire to scale up its manufacturing. It has agreed to deliver up to 640MW of alkaline electrolyser capacity to CIP, which will supply some of the hydrogen needed for CIP's planned power-to-x plants. Sunfire has also announced a deal to supply Finnish firm P2X Solutions' 20MW alkaline electrolyser project, which will come on line in 2024.

Cepsa sets out 2030 hydrogen plans

Spanish integrated oil and gas company Cepsa plans to have green hydrogen production capacity of 2GW at its two Spanish refineries in 2030, and to leverage their location on the country's south coast to export and import between Europe, Africa and the Middle East. The firm has abandoned a planned hydrocracker at its 240,000 b/d Algeciras refinery, and will instead phase out grey hydrogen production and use at its Spanish refineries, replacing it with green hydrogen by 2030. The company aims to install hydrogen refuelling stations every 300km on the main arteries connecting Spain with other parts of Europe. It also plans to offer hydrogen, green ammonia and other low-carbon bunker fuels to the shipping industry.

Australia's NSW gets 5.9GW of proposals for H2 hub

Australia's New South Wales (NSW) state government call for expressions of interest for a proposed hydrogen hub received private-sector plans to develop up to 5.9GW of electrolyser capacity, more than eight times the government target of 700MW. There was a total of 21 potential projects with green hydrogen output of almost 268,000 t/yr. The NSW government has committed A$70mn to accelerate the development of hydrogen hubs in the state, starting with Hunter Valley and Illawarra. Australian firms Origin Energy and Orica said recently that they also plan to develop a hydrogen hub in the Hunter Valley region.

Australia pledges hydrogen funding

The Australian government has announced investments in hydrogen and LNG in its 2022-23 budget. The budget allocated A$300mn ($224mn) to support LNG and hydrogen production at Darwin in the Northern Territory, together with associated carbon capture and storage infrastructure. It also includes A$247.1mn to support increased private-sector investment in low-emission technologies including hydrogen, and the continued development of a hydrogen guarantee of origin scheme. The hydrogen sector will also receive another A$100mn to support pre-final investment decision activities and early work to prepare the port of Newcastle in New

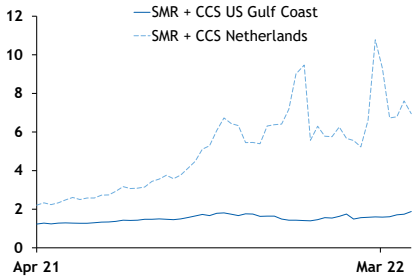
IN BRIEF

South Wales to take hydrogen. A further A$200mn will be spent on low-emission manufacturing facilities using hydrogen and hydrogen derivatives such as ammonia, as well as carbon capture utilisation and storage in Pilbara, Western Australia.

Norway's Yara to build ammonia bunker terminals

Norway-based fertiliser firm Yara International has ordered the building of 15 floating terminals to be used to supply green ammonia for bunkering in Scandinavia by 2024. The terminals will be built by technology company Azane Fuel Solutions. Last year, Azane — joined by other technology firms AMON Maritime and ECONNECT Energy — received public funds from Norway's Green Initiative programme, Innovation Norway and the Norwegian Research Council to construct a pilot floating terminal for bunkering ammonia, to be commissioned in 2023.

US v Dutch production costs $/kg



US, Europe to support H2-ready LNG projects

The US on 25 March committed to help Europe reduce its dependence on Russian oil and natural gas by boosting LNG infrastructure projects that could support hydrogen deployment in the future. US president Joe Biden and European Commission president Ursula von der Leyen committed to efforts to construct "hydrogen-ready" LNG infrastructure as part of the plan to reduce European dependence on Russian fossil fuels by 2030. The plan would accelerate permitting for US LNG projects and support European import infrastructure designed with hydrogen in mind.

EU launches gas, LNG, hydrogen purchase platform

The European Commission has launched a platform for common purchasing of gas, LNG and hydrogen that it hopes will help to phase out dependency on Russian gas. The voluntary co-ordination mechanism brings together the commission and EU member states to make "optimal" use of the EU's collective political and market weight, the commission says. The goal is to refill gas storage facilities in time for winter and enhance long-term co-operation with key supply partners, including for hydrogen and renewables, and to enable member states to work together to develop an international market for hydrogen, officials say.

Developers eye hydrogen project off Welsh coast

UK-based renewables developer Source Energie is collaborating with sustainability consultancy Environmental Resource Management (ERM) on plans for a floating deepwater wind-to-hydrogen plant in the Celtic Sea 60km off the Pembrokeshire coast. In the first stage, the project will deploy around 300MW of hydrogen capacity costing around £0.7bn ($0.92bn), followed by an expansion to 1GW and eventually to 2GW. The location is close to demand in Ireland and industry in south Wales, and the hydrogen could be transported ashore via subsea pipelines, the firms say. The plant would comprise floating 10MW modules — incorporating a wind turbine, desalination unit, hydrogen electrolyser and storage — which ERM has developed. The companies are seeking approval from the Crown Estate. They hope to receive an answer by early 2023, with the goal of starting production in 2027.

Dutch firms plan green ammonia import terminal

Three Dutch companies — Gas system operator Gasunie, bulk handler HES International and storage tank operator Vopak — have joined forces to develop an import terminal for green ammonia as a hydrogen carrier in the port of Rotterdam, with the aim of starting operations in 2026. A final investment decision will depend on contracts with potential customers and required permits, they said. They aim to "soon" launch a market consultation to enable participants to register their interest "in the supply, storage and transshipment of green ammonia and hydrogen".

DATA

No-C Hydrogen						12 Apr
	Process	Legacy colour	Unit	Price	Price in $/kg	± 5 Apr
Netherlands	Wind + PEM	Green	€/kg	6.58	7.17	nc
Netherlands	Grid + GOO + ALK	Green	€/kg	17.63	19.21	-1.81
UK	Wind + PEM	Green	£/kg	4.88	6.37	nc
UK	Grid + GOO + ALK	Green	£/kg	16.98	22.17	-2.84
Germany	Wind + PEM	Green	€/kg	7.28	7.93	nc
Germany	Grid + GOO + ALK	Green	€/kg	17.67	19.25	-1.30
France	Wind + PEM	Green	€/kg	8.35	9.10	nc
France	Grid + GOO + ALK	Green	€/kg	21.62	23.55	-4.94
Spain	Diurnal + PEM	Green	€/kg	4.72	5.14	nc
Spain	Grid + GOO + ALK	Green	€/kg	17.87	19.47	-0.92
US west coast	Diurnal + PEM	Green	$/kg	4.19	4.19	nc
Canada	Wind + PEM	Green	C$/kg	9.19	7.31	nc
Oman	Diurnal + PEM	Green	$/kg	5.28	5.28	nc
Namibia	Diurnal + PEM	Green	$/kg	7.35	7.35	nc
Japan	Wind + PEM	Green	¥/kg	1,533	12.34	nc
South Korea	Wind + PEM	Green	W/kg	14,689	11.98	nc
Australia	Diurnal + PEM	Green	A$/kg	6.53	4.89	nc
Vietnam	Wind + PEM	Green	$/kg	9.64	9.64	nc
Chile	Diurnal + PEM	Green	$/kg	5.83	5.83	nc

Low-C hydrogen						12 Apr
	Process	Legacy colour	Unit	Price	Price in $/kg	± 5 Apr
Netherlands	ATR + CCS	Blue	€/kg	9.24	10.06	-0.95
UK	ATR + CCS	Blue	£/kg	9.75	9.75	-1.38
Germany	ATR + CCS	Blue	€/kg	9.21	10.03	-0.84
Spain	ATR + CCS	Blue	€/kg	8.71	9.49	-0.94
France	ATR + CCS	Blue	€/kg	9.60	10.46	-1.62
US Gulf Coast	ATR + CCS	Blue	$/kg	3.18	3.18	+0.30
Canada	ATR + CCS	Blue	C$/kg	4.69	3.73	+0.70
Japan	ATR + CCS	Blue	¥/kg	1,224	9.85	-0.83
South Korea	ATR + CCS	Blue	W/kg	9,061	7.39	-0.63
Australia	ATR + CCS	Blue	A$/kg	6.28	4.70	+0.74
Trinidad	ATR + CCS	Blue	$/kg	6.64	6.64	-0.61
Qatar	ATR + CCS	Blue	$/kg	6.88	6.88	-0.53
Abu Dhabi	ATR + CCS	Blue	$/kg	7.23	7.23	-0.53
Russia west	ATR + CCS	Blue	$/kg	1.00	1.00	+0.02
Russia east	ATR + CCS	Blue	$/kg	1.54	1.54	+0.06

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BAT+ hydrogen						12 Apr
	Process	Legacy colour	Unit	Price	Price in $/kg	± 5 Apr
Netherlands	SMR + CCS	Blue	€/kg	6.38	6.95	-0.66
UK	SMR + CCS	Blue	£/kg	6.15	6.15	-0.94
Germany	SMR + CCS	Blue	€/kg	6.36	6.93	-0.65
Spain	SMR + CCS	Blue	€/kg	5.87	6.39	-0.80
France	SMR + CCS	Blue	€/kg	6.08	6.62	-0.85
US Gulf Coast	SMR + CCS	Blue	$/kg	1.88	1.88	+0.14
Canada	SMR + CCS	Blue	C$/kg	2.30	1.83	+0.16
Japan	SMR + CCS	Blue	¥/kg	845	6.80	-0.63
South Korea	SMR + CCS	Blue	₩/kg	8,019	6.54	-0.64
Australia	SMR + CCS	Blue	A$/kg	3.82	2.86	+0.33
Trinidad	SMR + CCS	Blue	$/kg	6.04	6.04	-0.62
Qatar	SMR + CCS	Blue	$/kg	6.17	6.17	-0.54
Abu Dhabi	SMR + CCS	Blue	$/kg	6.16	6.16	-0.53
Russia west	SMR + CCS	Blue	$/kg	0.71	0.71	+0.02
Russia east	SMR + CCS	Blue	$/kg	0.91	0.91	+0.02

Baseline hydrogen						12 Apr
5 Apr	Process	Legacy colour	Unit	Price	Price in $/kg	± 5 Apr
Netherlands	SMR	Grey	€/kg	6.21	6.77	-0.62
UK	SMR	Grey	£/kg	4.60	6.00	-0.86
Germany	SMR	Grey	€/kg	6.22	6.78	-0.60
Spain	SMR	Grey	€/kg	5.78	6.30	-0.74
France	SMR	Grey	€/kg	5.94	6.47	-0.78
US Gulf coast	SMR	Grey	$/kg	1.49	1.49	+0.12
Canada	SMR	Grey	C$/kg	2.20	1.75	+0.14
Japan	SMR	Grey	¥/kg	735	5.92	-0.58
South Korea	SMR	Grey	₩/kg	7,234	5.90	-0.60
Australia	SMR	Grey	A$/kg	3.21	2.40	+0.31
Trinidad	SMR	Grey	$/kg	5.23	5.23	-0.56
Qatar	SMR	Grey	$/kg	5.38	5.38	-0.49
Abu Dhabi	SMR	Grey	$/kg	5.37	5.37	-0.49
Russia west	SMR	Grey	$/kg	1.68	1.68	+0.05
Russia east	SMR	Grey	$/kg	0.62	0.62	+0.01

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Baseline hydrogen						12 Apr
	Process	Legacy colour	Unit	Price	Price in $/kg	± Apr 5
Netherlands	Grid + ALK	Yellow	€/kg	17.52	19.08	-1.81
Netherlands	Grid + PEM	Yellow	€/kg	16.95	18.46	-1.69
UK	Grid + ALK	Yellow	£/kg	16.74	21.86	-2.84
UK	Grid + PEM	Yellow	£/kg	16.11	21.03	-2.65
Germany	Grid + ALK	Yellow	€/kg	17.54	19.11	-1.31
Germany	Grid + PEM	Yellow	€/kg	16.99	18.51	-1.21
France	Grid + ALK	Yellow	€/kg	21.49	23.41	-4.95
France	Grid + PEM	Yellow	€/kg	20.64	22.48	-4.60
Spain	Grid + ALK	Yellow	€/kg	17.75	19.34	-0.92
Spain	Grid + PEM	Yellow	€/kg	17.21	18.75	-0.86
US west coast	Grid + ALK	Yellow	$/kg	7.18	7.18	+0.47
US west coast	Grid + PEM	Yellow	$/kg	7.42	7.42	+0.44
US Midwest	Grid + ALK	Yellow	$/kg	6.92	6.92	+0.57
US Midwest	Grid + PEM	Yellow	$/kg	7.18	7.18	+0.53
US east coast	Grid + ALK	Yellow	$/kg	7.75	7.75	+1.01
US east coast	Grid + PEM	Yellow	$/kg	7.95	7.95	+0.94
Japan	Grid + ALK	Yellow	¥/kg	2,265	18.23	-1.26
Japan	Grid + PEM	Yellow	¥/kg	2,191	17.64	-1.17

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