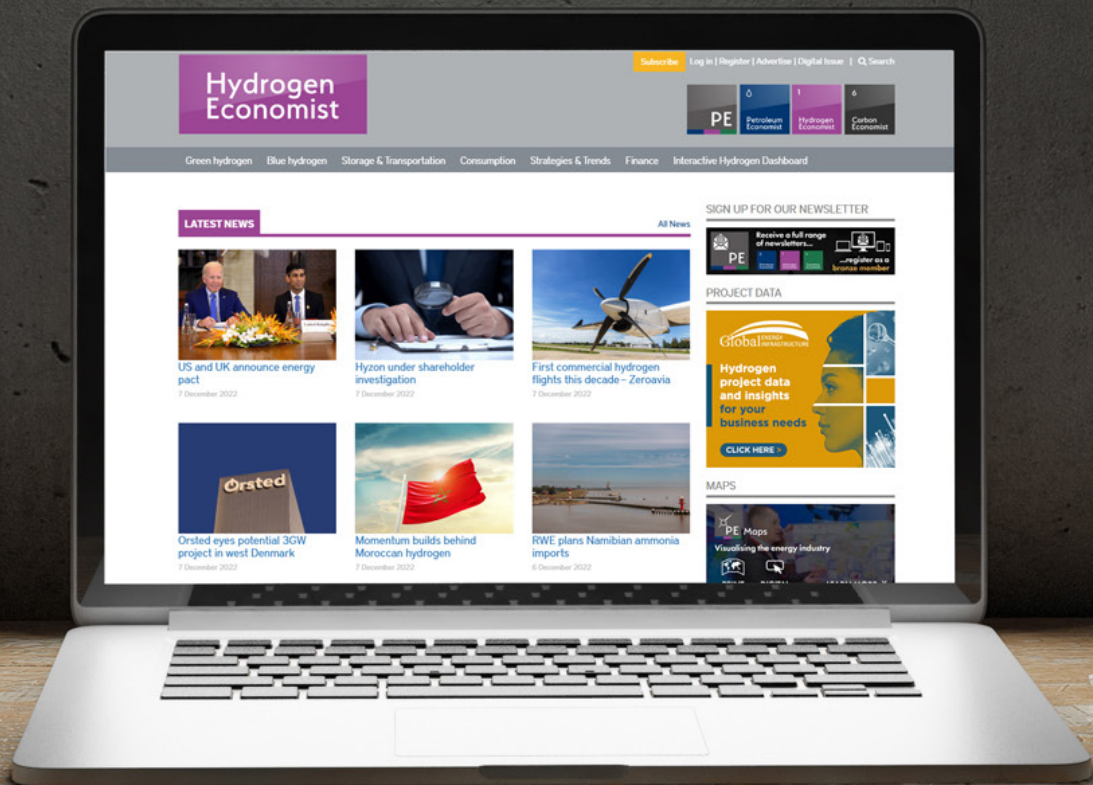


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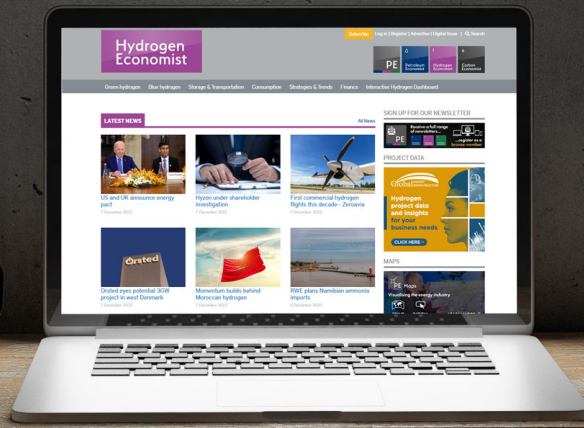
MENA 2022



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articles covering the MENA region in 2022

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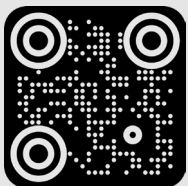
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WELCOME

A shifting energy landscape

Hydrogen Economist

Nations across MENA are emerging as key players in future hydrogen production and trade. Keep up to date with Hydrogen Economist's MENA coverage

As the year draws to a close, the Middle East and North Africa region has seen substantial interest as a potential hub for low-carbon hydrogen. While similarities exist between countries in the region, such as a strong focus on exporting hydrogen and its derivatives to markets in Europe and Asia, it would be a mistake to assume that there is not major variation in strategy between each nation.

For the countries that already play a major role in oil and gas markets, such as Saudi Arabia and the UAE, hydrogen presents a way to decarbonise scope 3 emissions of its customers without stranding too many assets. Other MENA countries may currently play a marginal role in oil and gas markets, but their strong green hydrogen production potential could shift the dial in the coming decades.

Since our inception in 2021, *Hydrogen Economist* has kept a close eye on news developing in the region via our staff in London and our global contributor network. We stand alone as a service dedicated to providing the highest quality analysis focused on the hydrogen

sector, and our coverage of projects and partnerships in MENA is no exception.

From megaproject announcements to deals with gas-starved Europe to potential challenges around technology performance, our wide-ranging coverage aims to provide our readership of senior executives throughout all aspects of the hydrogen industry—including oil and gas majors, renewables stalwarts, and financial and technical services—with accurate and actionable insights.

We invite you to read a selection of our MENA coverage for free in preparation for the year ahead. And we urge you to become a member of the expanding *Hydrogen Economist* community in order to access our in-depth analysis on not only the MENA region, but every aspect of the global hydrogen industry, every month.

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VIEW ONLINE



FID due on Neom this year

GREEN HYDROGEN / Project worth \$5bn is progressing, says Acwa Power on Q3 results call / **Tom Young**

Saudi utility Acwa Power hopes to take FID on the \$5bn Neom green hydrogen project before the end of the year, the firm says.

The Neom development is owned by Acwa (with 33.3pc), US industrial gases company Air Products (also with 33.3pc) and state economic zone developer Neom Company (with 33.34pc) each own a share of the Neom development—the largest planned green hydrogen project in the world, which is due to produce 1.2mn t/yr of green ammonia to be sold by Air Products to global markets.

“We are making solid progress at the Neom green hydrogen company, where we are working toward achieving financial close by the end of this year,” says Acwa CEO Paddy Padmanathan.

4GW
of renewable energy

The project partners awarded a \$900mn EPC contract award to Air Products in April. The company and its subsidiaries will carry out the EPC work both in Saudi Arabia and on overseas value chains.

The \$5bn green hydrogen-to-ammonia complex will be situated in Neom, a city planned on the Red Sea coast in the northwest of Saudi Arabia.

The facility will use more than 4GW of renewable energy—2GW of wind and 2GW of solar—to produce hydrogen that will be converted into ammonia. Solar power may be produced at around a recent Saudi tender price of \$0.0104 kW/h.

Germany’s Thyssenkrupp Chlorine Engineers will supply a 2GW electrolyser to the project.

Further projects

Acwa is also pursuing a project in Oman with Air Products and Omani state-owned energy group OQ that is running about two years behind Neom.

The firm is also looking to develop a third project in the Middle East or Africa and has signed memorandums of understanding evaluating potential projects in Oman, South Africa and Egypt. **PE**



Mena faces energy storage troubles

ENERGY STORAGE / Battery technology is struggling to take off in the region, presenting a potential hurdle for future green hydrogen production / Polly Martin

The Middle East and North Africa (Mena) region has seen a proliferation of renewable energy projects—both to decarbonise domestic energy use and for dedicated green hydrogen production—but the deployment of storage solutions remains on the back burner. Battery technology, in particular, is struggling to take off in Mena compared with Europe, according to law firm Bracewell.

“The Middle East is at the vanguard of renewable energy development, with the largest solar projects in the world and a number of jurisdictions looking seriously at onshore wind capacity. Deployment of battery storage systems is still really low,” says Tom Swarbrick, a partner at Bracewell’s Dubai office.

A particular challenge is the region’s heat and humidity. “Performance of batteries is reduced significantly in these extremes of weather,” he says. This requires additional investment in cooling systems to prevent overheating, which “makes utility-scale deployment uneconomical”.

He cites an example of a developer in the UAE that considered but ultimately refused to include a battery storage element to a solar project due to “ultra-low” tariffs, as “even a marginal increase would have made those bids uncompetitive”.

Smoothing out hydrogen

A lack of battery storage capacity could present a potential hurdle

for future green hydrogen production, particularly if Mena projects aim to produce 100pc renewables-derived hydrogen for export to Europe.

While the off-grid nature of such projects means even the strictest definitions of ‘green’ hydrogen can be met, it also limits options for managing intermittent renewable electricity, particularly depending on electrolyser type. Alkaline electrolysers—the type ordered for Saudi Arabia’s flagship Neom project—have been designed to run on a constant source of electricity. Technical performance optimisation is therefore expected to be a key focus for Mena projects.

“As an asset class, [hydrogen] is adjacent to oil and gas and so there is considerable regional expertise. However, it is still a relatively nascent technology, and the first projects will require significant investment—both R&D and expenditure on the physical asset—and may not turn a profit,” says Swarbrick. He notes that “there is also a lot of variation in the technology, so there is no guarantee that solutions now will endure”.

“For now, that means developers are faced with a choice of investing now and hoping to secure first-mover advantage—which is risky—or waiting until the technology settles and the path to profit becomes clearer,” he adds. While inflation “may be a concern around the edges”, it has not been raised by developers Bracewell is in conversation with when considering participation in the sector. **PE**

**“Performance of batteries is reduced significantly in these extremes of weather”
Swarbrick, Bracewell**

Cairo shows the world its hydrogen ambitions

HYDROGEN / Egypt used its role as Cop27 host to showcase its ambitions to become a leading supplier and to court green hydrogen investment / **Clare Dunkley**

Hosting Cop27 at a time when clean energy development is becoming central to its domestic economic strategy was a stroke of good fortune for Egypt. And it exploited the opportunity to the full. The government firmed up eight provisional deals with foreign investors to develop green hydrogen production facilities and set out a strategy to become a leading supplier of the energy carrier.

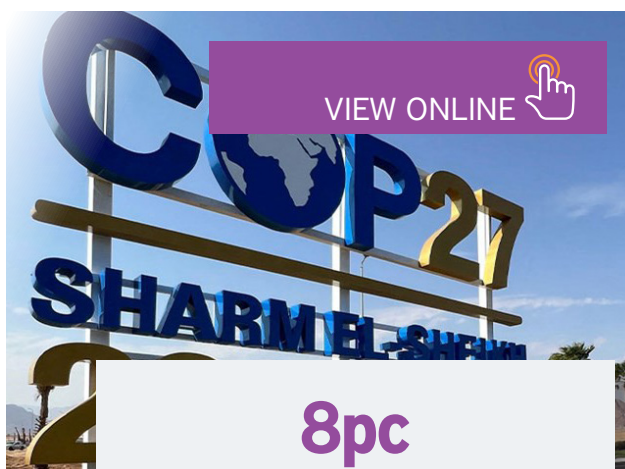
The broad contours of Cairo's green hydrogen strategy have been gradually emerging over the past two years. The North African country boasts bountiful resources of sun, wind and spare land, and a massive carbon-intensive fertiliser industry requiring abatement. It also has proximity to a European continent desperate to secure long-term alternatives to Russian gas, and ownership of the Suez Canal, one of the world's busiest waterways, at a time when the need to reduce emissions from the shipping industry is gaining attention.

More than a dozen international firms—often with experience in the country's successful renewables buildout and from countries with which Cairo enjoys strong political ties—have announced provisional plans to develop production facilities for green hydrogen, ammonia and other hydrogen-based fuels in the Suez Canal Economic Zone (SCZone).

Nevertheless, the government had been promising for months to codify its plans into a comprehensive strategy, developed in cooperation with multilateral financial institution the European Bank for Reconstruction and Development for unveiling at Cop27.

The strategy, while vague in parts, signalled the scale of Cairo's ambitions. According to a cabinet statement released just before Cop27, green hydrogen is seen contributing as \$10–18bn to Egypt's GDP by 2025. By 2040, it hopes to secure an 8pc share of the global market.

Reflecting increasing European enthusiasm for collaboration with Egypt and other North African countries to ensure the supplies necessary to meet EU decarbonisation targets, German chancellor Olaf Scholz co-chaired a green hydrogen roundtable with Egyptian president Abdel Fattah el-Sisi. The Egyptian head of state also joined Belgian prime minister Alexander de Croo to launch the



8pc
Egypt's target share of global green hydrogen market

Global Renewable Hydrogen Forum, a consultative grouping of producing and consuming governments, investors and financiers.

Showstopper

Another showstopper was the signing of eight framework agreements with international investors to develop hydrogen and ammonia production facilities in Suez—firming-up memorandums of understanding (MoUs) inked over the past year and confirming Egypt as the leader in efforts by countries across Middle East and North Africa to secure a share of the fledgling market.

The ability to attract the hydrogen industry's emerging leaders validates the country's appeal: a pact with Australia's Fortescue Future Industries calls for the production of 330,000t/yr of green hydrogen using 7.6GW of renewables.

Also on display was Cairo's ability to leverage its close relations with the wealthy Mideast Gulf states to garner clean energy investment: Abu Dhabi-owned Masdar confirmed plans for a 2GW green hydrogen plant in the Suez Canal Economic Zone, one of two it intends to build in the country, a week after announcing plans for a 10GW windfarm. Riyadh-based Alfanar also committed to a 500,000t/yr green ammonia scheme. Other Gulf investors are circling: Doha-owned QatarEnergy, backed by the Qatari sovereign wealth fund, is considering investing at least \$1bn in a green hydrogen and ammonia project on the banks of the canal.

And Norway's Scatec used Cop27 to nominally launch the first phase of its Suez project, which entails developing 15,000t/yr of green hydrogen capacity for use in producing up to 90,000t/yr of green ammonia at the existing fertiliser plants nearby owned by UAE and local co-investor Fertigllobe. SCZone projects planned by India's Renew, France's EDF and TotalEnergies, the UAE's Amea Power and UK-based Globeleq also passed from MoU to framework agreement stage. Negotiators may lament a climate summit that largely failed in its headline ambitions, but Cairo will celebrate the event as a resounding success. **PE**



Egypt starts green hydrogen plant trials

GREEN HYDROGEN / The Misr facility will eventually produce green ammonia for export / **Tom Young**

Egypt has officially started trial operations at Africa's first green hydrogen plant in Ain Sokhna. The Misr facility will eventually produce 15,000t/yr of green hydrogen from an electrolyser powered by 260MW of solar and wind assets. The green hydrogen will be used as a raw material to produce up to 90,000t/yr of green ammonia at plants owned by fertiliser firm and lead developer Fertiglobe.

The project partners—which also include green energy firm Scatec, construction firm Orascom and Egypt's sovereign wealth fund—are testing the electrolyser ahead of an expected FID in 2023. The 100MW proton-exchange-membrane electrolyser has already been partially installed.

Ain Sokhna is located near the Suez Canal, making it well-placed for exports.

“The development of Africa's first integrated green hydrogen production plant in record time reflects what can be achieved by joining forces to achieve shared ambitions,” says Sultan Ahmed al-Jaber, chair of Fertiglobe.

“We are confident that Fertiglobe will continue to leverage its expertise in hydrogen and ammonia to provide additional quantities of low-carbon fuels.”

Fertiglobe will take advantage of its existing infrastructure and customer base to market the ammonia generated by the plant.

**“We are taking full advantage of our existing ammonia production and global distribution infrastructure”
Hoshi, Fertiglobe**

“Thanks to the addition of an electrolyser to our state-of-the-art facilities and ammonia production infrastructure in Egypt, we are taking full advantage of our existing ammonia production and global distribution infrastructure, including [fertiliser supplier] OCI's ammonia import pier in the port of Rotterdam,” says

Ahmed al-Hoshi, CEO of Fertiglobe.

The firm has already started selling low-carbon ammonia cargoes to Japanese buyers.

Fertiglobe is a partnership between OCI and the Emirati state oil company Adnoc. The firm is also expected to join Adnoc and holding company ADQ as a partner in a new 1mn t/yr blue ammonia project at Ta'ziz in Ruwais. **PE**



South Korean firms sign up for Saudi ammonia project

AMMONIA / Companies from the East Asian country are looking to secure supplies of green ammonia and want full involvement in the value chain / [Tom Young](#)

South Korean utility Keppco has signed a memorandum of understanding (MoU) with Saudi sovereign wealth fund PIF, state-owned Korea National Oil Corporation, utility Korea Southern Power, technology firm Samsung C&T and steel firm Posco Holdings to develop a 1.2mn t/yr green ammonia project in Saudi Arabia.

The firms have identified a good location for the plant through a pre-feasibility study and will advance the project further next year.

The South Korean firms aim to participate in the entire ammonia value chain—including production, conversion and transport.

Keppco will use the green ammonia to co-fire with coal in power plants. The firm, which is majority owned by the South Korean state, aims to use 5-10mn t/yr of green ammonia for power generation by 2030.

Keppco has already signed an MoU to explore the potential to develop large-scale green hydrogen and ammonia production projects with Saudi utility Acwa Power.

Acwa is already working with Posco to jointly explore the development of green hydrogen and ammonia projects to supply Posco's power generation and steelmaking operations.

1.2mn t/yr

Potential size of new Saudi project

Building out

Acwa is developing the \$5bn Neom green ammonia plant in Saudi Arabia with US industrial gases company Air Products and is looking to develop another project based on the Neom model.

Cop27 has seen a number of MoUs announced on hydrogen as importers such as South Korea, Japan and the EU seek to build their value chains.

Saudi energy firm Saudi Aramco and Indonesia NOC Pertamina recently added to the list of MoUs, agreeing to conduct a pre-feasibility study on the development of a clean ammonia and hydrogen value chain, including potential carbon capture, utilisation and storage at Pertamina's existing facilities. **PE**



VIEW ONLINE



BP signs green hydrogen MoU with Mauritania

GREEN HYDROGEN / The northwest African nation is increasingly attracting interest from European developers / **Polly Martin**

BP has signed a memorandum of understanding (MoU) with the government of Mauritania to explore large-scale green hydrogen production in the country. The major will carry out studies on the technical and commercial feasibility of developing hydrogen projects, starting with a data collection campaign to assess the suitability of the wind and solar resources in selected locations.

BP is leading on Mauritania's Greater Tortue Ahmeyim project, which is on pace to produce first gas in Q3 2023 and export the first cargoes of an expected 2.3mn t/yr of LNG by the end of that year.

"We are already developing one of the world's most innovative gas projects with the support of the Mauritanian government. And we now intend to expand our partnership into low-carbon energy by exploring the potential for a world-leading green hydrogen development, which could position Mauritania at the

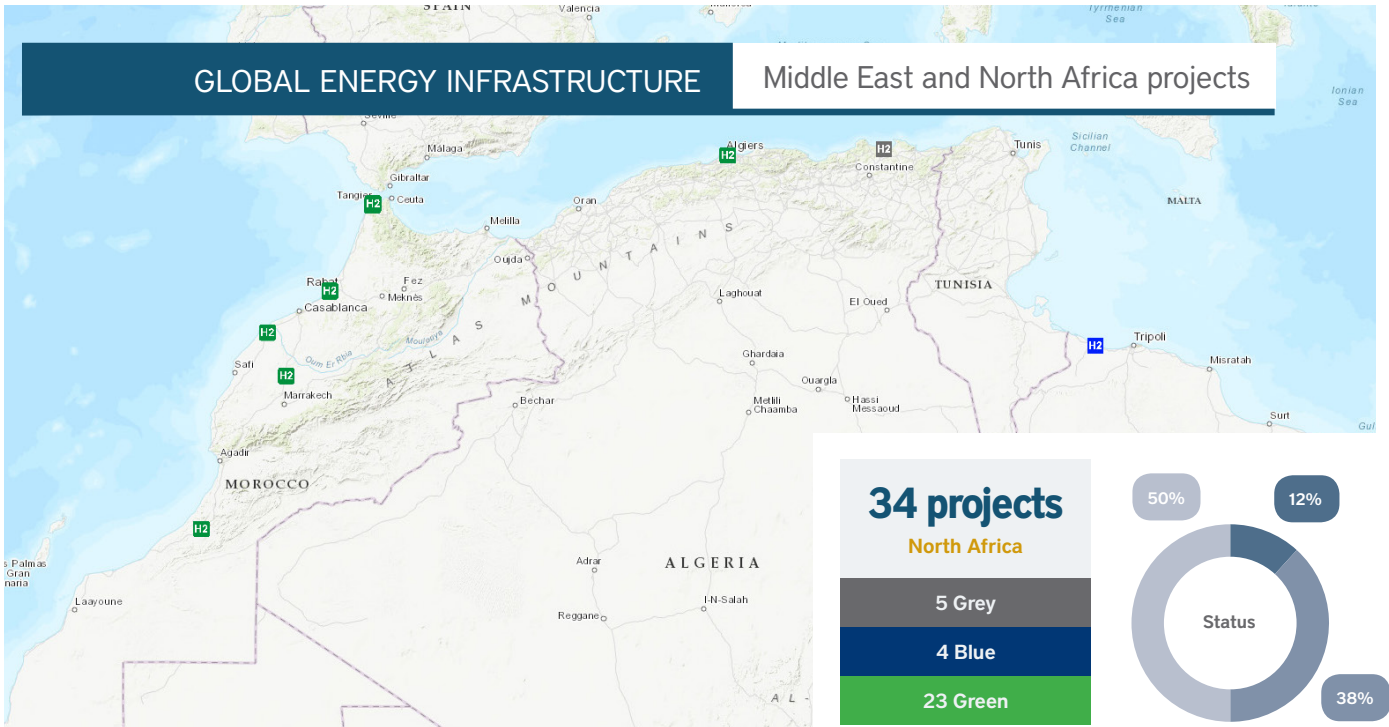
2.3mn t/yr
of LNG by the end of 2023

forefront of the energy transition," says Anja-Isabel Dotzenrath, BP's executive vice-president of gas and low-carbon energy.

Mauritania has previously signed an MoU with Africa-focused developer Chariot Energy for a 10GW green hydrogen project. In September, Total Eren—30pc-owned by TotalEnergies—entered into a partnership agreement with Chariot to co-develop the project. **PE**

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UAE powers up clean energy push

GREEN HYDROGEN / Funded by soaring oil revenues and spurred by the European energy crisis, the federation's renewables and hydrogen plans are rapidly advancing / **Clare Dunkley**

The UAE is abuzz with clean energy activity. Abu Dhabi and Dubai are in the process of tendering a trio of giant renewables projects, promising to extend the emirates' regional lead in decarbonising electricity supply.

Europe's energy crisis is also spurring the government's efforts to map out a long-term hydrogen strategy, while state oil company Adnoc delivered its first test cargo of green ammonia to Germany in late October.

The flurry of activity comes as Abu Dhabi prepares to host next year's Cop climate talks.

The UAE and its constituent emirates have set an array of decarbonisation-related targets—supplemented since October 2021 by the pledge to reach net zero by 2050. The federal government aims for renewables to account for 44pc of energy consumption by the same year and for 30pc of electricity supply by the end of this decade.

Abu Dhabi's key corporate emitters—chiefly Adnoc and state-owned power generator Taqa—also have internal carbon-reduction goals.

Dubai aims to meet a quarter of its energy requirements from

carbon-free sources by 2030 and 100pc by mid-century.

The emirate took the lead in the renewables buildout last decade, motivated less by environmentalism than by the financial burden created by dependence on imported gas. By late August, state-owned Dubai Electricity and Water Authority had 1.6 GW onstream at the Mohammed bin Rashid al-Maktoum solar park, with another 1.2GW under construction.

The utility kicked off the tendering process for the sixth phase in September, with expressions of interest due in November to develop a 900MW PV facility at the site.

Abu Dhabi has caught up swiftly over the past five years—driven initially by pressures on its own gas supplies and the security risk of depending on imports from Qatar, its relations with which had grown increasingly tense.

Large-scale solar

Commissioning of the 2GW Al-Dhafra PV plant, due next year, will add to the 1.18GW Sweihan PV facility, which opened in 2019, and the 100MW Shams concentrated solar power/gas hybrid project completed in 2012, taking installed solar capacity to just under 3.3GW and leapfrogging Dubai.

30pc

2030 target for renewables' share of power supply

In September, Abu Dhabi-headquartered Emirates Water & Electricity Company (Ewec) released a 19-strong developer shortlist for a 1.5GW PV facility at Abjan. The request for proposals is expected by year-end.

Meanwhile, a client team of Ewec and waste management firm Tadweer is due to receive bids in December to develop the emirate's first utility-scale waste-to-energy (WTE) plant—designed to process 900,000t/yr of solid municipal waste from a landfill near Al-Dhafra into c.90MW of clean power. Again, Dubai was quicker off the blocks in announcing in mid-September that its landmark WTE project—billed as the largest in the world at 1.9m t/yr and 215MW—was 85pc complete, with partial startup due next year and completion in 2024.

Sharjah, which has the headline environmental goal of becoming the Middle East's first 'zero-waste city' by 2030, beat both the main emirates by inaugurating its 300,000t/yr, 30MW WTE facility in May.

Hydrogen for Europe

The UAE's fast-evolving hydrogen plans are being shaped by internal and external drivers, with the latter increasingly to the fore. Plans emerging over the past two years to move into large-scale hydrogen production are in part a response to the need to develop alternative export revenue streams to replace future declines in earnings from oil sales.

The government says it aims to capture 25pc of the global low-carbon hydrogen market by 2030—a rather improbable ambition given the growing number of countries now looking to enter the industry. A 'hydrogen alliance' of local stakeholders was created in early 2021 to coordinate the sector's early development, followed by the launch of three

giant hydrogen and ammonia production projects, one blue and two green, later that year.

However, external events over the past six months have pushed Abu Dhabi—the only emirate with the gas and the spare land to produce either variety of the fuel at scale—to accelerate and reshape its plans in response to the European race to replace Russian gas imports.

In September, Germany's energy ministry awarded a contract to a domestic team of services firm GHD and research company Fraunhofer-Gesellschaft to help prepare a national hydrogen development strategy.

The two countries formed the Emirati-German Energy Partnership in 2017, and Kassel-based Wintershall acquired a stake in Abu Dhabi's giant Ghasha ultra-sour gas concession the following year, but the energy collaboration has deepened since Moscow's invasion of Ukraine.

A state visit by German chancellor Olaf Scholz in September, three weeks after Russia's Gazprom indefinitely halted deliveries via the Nord Stream 1 pipeline, resulted in a new agreement—the Energy Security and Industry Accelerator—to speed-up projects of common interest in areas including hydrogen.

Earlier that month, Adnoc, which is leading the emirate's blue hydrogen development, delivered a 13t test cargo of blue ammonia to German metals company Aurubis. The shipment was its first to Europe, with initial efforts to nurture a supply chain focusing on Asia, specifically Japan and South Korea—traditionally the bedrock of demand for the emirate's energy exports. **PE**

25pc
Targeted share of global
hydrogen market by 2030





UAE delivers first blue ammonia to Germany

BLUE AMMONIA / State oil company Adnoc has shipped a test cargo to German metals firm Aurubis / [Polly Martin](#)

Abu Dhabi state oil company Adnoc has delivered a 13t test cargo of blue ammonia to German metals firm Aurubis—the first low-carbon ammonia shipment from the UAE to Germany.

Adnoc signed an agreement in March this year to supply blue ammonia to Aurubis as well as German energy companies RWE, Steag and Gewec. The firm is also due to test exports of blue hydrogen to the port of Wilhelmshaven using liquid organic hydrogen carrier technology.

Adnoc sold its first demonstration cargoes of blue ammonia, produced by its fertiliser venture Fertiglobe at the Ruwais industrial complex, at “an attractive premium to grey ammonia” to Japanese firms Itochu, Idemitsu and Inpex in 2021. The state company is expected to take FID on its 1mn t/yr blue ammonia facility at the new Ta’ziz industrial complex this year, with startup

expected for 2025.

Aurubis plans to use the ammonia in an eight-week pilot testing the partial replacement of natural gas in the production of copper wire rod. The company says the use of ammonia can reduce the amount of natural gas required in the process by up to 20pc.

**“The creation of a blue—and in the future, green—ammonia value chain between Germany and the UAE is not just theoretically possible, but practically feasible”
Harings, Aurubis**

“We want our production to be climate-neutral well before 2050. Ammonia can be an important component of the hydrogen supply chain to achieve this goal,” says Aurubis CEO Roland Harings.

“This pilot project highlights the pioneering role we play in the decarbonisation of our industry,” he continues. “It demonstrates that the creation of a blue—and in the future, green—ammonia value chain between Germany and the UAE is not just theoretically possible, but practically feasible.” **PE**



Oman offers green hydrogen project sites

GREEN HYDROGEN / Auction of government-owned land part of strategy to become a key global producer and exporter / [Stuart Penson](#)

Oman has invited international developers to bid for project sites on government-owned land as part of a new strategy aimed at achieving 1mn t/yr of green hydrogen production by 2030.

First-round auctions will open on 6 November, with site awards expected in 2023.

The auction process will be managed Hydrom, a new subsidiary of state-owned Energy Development Oman, which the government has set up to execute its hydrogen strategy.

“We at Hydrom look forward to working with international partners to build the future of energy,” says Firas al-Abduwani, managing director of Hydrom.

“The bid round we announced is the first of its kind globally and we are convinced it will help accelerate the development of the green hydrogen industry in Oman and globally.”

Hydrom is regulated by the Ministry of Energy and Minerals, and its mandate includes facilitating the development of common infrastructure and associated hydrogen hubs, together with the Public Authority for Special Economic Zones and Free Zones.

Oman’s potential for green hydrogen production has already attracted huge interest from international developers. In May, Saudi government-affiliated Acwa Power and US industrial

gases company Air Products signed a joint development agreement with Oman-owned OQ to establish a green hydrogen and ammonia production facility at Salalah, the sultanate’s southern industrial hub.

Acwa says the project is similar in scale to the \$5bn Neom development in northwestern Saudi Arabia, which it is also developing with Air Products. Neom is expected ultimately to have a capacity of 1.2mn t/yr of green ammonia.

Separately, international developer Intercontinental Energy is partnering with Oman’s OQ and Enertech,

a Kuwaiti government-backed clean energy investor and developer, on a project to produce 1.8mn t/yr of green hydrogen and up to 10mn t/yr of green ammonia in Oman.

In addition to its potential as a hydrogen exporter, Oman also wants the industry to help it reach its 2050 net-zero goal.

“Green hydrogen presents itself as a key vector that enables Oman to pursue its decarbonisation, economic and energy security objectives,” energy minister Salim al-Aufi says.

“With the abundant renewable energy resources which Oman is blessed with and with the appropriate structuring of the sector, Oman is positioned as one of the most attractive nations to produce green hydrogen competitively and at large scale.” **PE**

1mn t/yr
2030 green hydrogen
production target