



Black & Veatch studies how to best extract white hydrogen Down Under

Black & Veatch (B&V) is providing concept designs for H2EX Limited to explore and extract natural hydrogen in South Australia. The rush for natural H₂ – dubbed white or gold hydrogen – is gaining momentum with 40 companies searching for deposits and explorations already underway in the US, Spain, France, Albania, Colombia, South Korea, Australia and Canada.

The development study will help H2EX fast-track its first exploration wells at its PEL 691 license on the Eyre Peninsula. "If successful, hydrogen will be a great source of energy for power generation and transport in the region," said H2EX managing director Mark Hanna.

Natural hydrogen is viewed as a potential cost-effective, low-carbon energy source, hence the number of companies in search for it has risen to over 40 at the end of last year, up from just ten in 2020. Canada-based producer Hydroma already extracts white hydrogen at an estimated cost of \$0.5 per kilogram. Depending on the deposit's depth and purity, projects in Spain and Australia aim



for a cost of about \$1 per kg, which would be "solidifying white hydrogen's price competitiveness."

Low on cost and carbon intensity

In addition to the low cost, white hydrogen can also have a low carbon intensity. At a hydrogen content of 85% and minimal methane contamination, the carbon intensity is around 0.4 kg carbon diox-

continued on page 2

Low spot LNG prices in April give buyers room for optimization

Asia's spot LNG price for April delivery has been hovering around \$9/MMBtu and is likely to settle around \$8.5/MMBtu, Rystad analyst Masanori Odaka finds. For some buyers in China, Japan and South Korea, this is lower than their oil-linked term contract prices at \$10-12/MMBtu, leaving room for optimisation – particularly as Oman and Australia's Ichthys tender spot cargoes.

Major buyers like CNOOC, CNPC, Sinopec, KOGAS and JERA are expected to exercise the downward quantity tolerance (DQT) clause – if their long-term LNG contracts allow – and then snap up spot cargoes at a cheaper price.

Oman just offered two cargoes for either Asia and Middle East delivery in May, and Australia's Ichthys, is offering two cargoes for 31 March to 4 April delivery and 10 to 14 June loading. In addition, Russia's Sakhalin Energy could potentially offer some cargoes for May loading, Rystad En-



ergy understands, while Indonesia's Tangguh has tendered four cargoes on a free on-board (FOB) basis in April and May.

continued on page 2

AGENDA

SUPPLY

ADNOC to deliver 1 mtpa of LNG to Germany's SEFE over 15 years **2**

CARBON CAPTURE

BP picks delivery partners for NZT Power, aims for FID in September **3**

CCUS to decarbonise steel and gas power deemed uneconomic by 2030 **3**

MARKETS

Up to 58 GW capacity in PJM could close by 2030 without replacement **5**

FLEXIBILITY

Uniper UK repurposes retired gas power plant to provide grid inertia **6**

PROJECTS

B&W bags \$246 million contract for 1 GW coal-to-gas conversion in May **7**

Continued from page 1, top story

ide equivalent (CO₂e) per kg hydrogen gas – though the intensity can quickly rise to 1.5 kg CO₂e per kg H₂ if the hydrogen content of the reservoir is 75% combined with some 22% methane and other contaminant gases.

In South Australia, Black & Veatch will provide a two concept designs on H2EX's exploration license PEL 691 on the Eyre Peninsula. One of them will be for drilling and completion of an exploration well. The other for surface facilities to purify, process and deliver natural hydrogen and helium – including co-production of both resources, if found together.

"Helium is also a high-value and scarce commodity. Recent drilling in South Australia has found high concentrations of helium, too," H2EX's Mark Hanna pointed out.

Natural H₂ cheaper than manufactured one

If a way can be found to drill and extract the lowest-cost hydrogen, it could be up to 75% more cost-effective than manufacturing hydrogen, e.g. through steam methane reforming (SMR). With the study, B&V and H2EX seek to unlock first-mover benefits to source and sell the clean fuel to power generators in Australia, and beyond. The study

is partly funded by the Australian government which is investing more than \$500 million (US\$332 million) to support the development of hydrogen hubs.

The South Australian government recently added hydrogen to its list of regulated substances in 2021. This led to many companies applying for exploration permits in the region, with Gold Hydrogen securing a five-year license to develop its Ramsay project. The company found high hydrogen concentrations of up to 86% during drilling in late 2023, and plans to conduct further drilling in 2024 to launch a pilot feasibility study soon. ■

ADNOC to deliver 1 mtpa of LNG to Germany's SEFE over 15 years

Germany's SEFE Securing Energy for Europe GmbH has signed a Heads of Agreement with ADNOC to buy 1 million ton of LNG per annum over a 15-year period to stabilise Europe's power generation sector. The LNG will be primarily be sourced from the Ruwais LNG project and ADNOC expects deliveries to start in 2028.

The Ruwais LNG project is set to be the first LNG export facility in the Middle East and North Africa region to run on clean power. When completed, the project, consisting of two 4.8 mtpa LNG liquefaction trains with a total capacity of 9.6 mtpa, will more than double ADNOC's LNG production capacity to around 15 mtpa.

This is the second term deal for LNG supply from Ruwais, followed by a 15-year offtake accord with China's ENN signed in December last year. Under that deal, a Singapore-based intermediary will ship the contracted volumes to China, where ENN will distribute it to industrial and utility customers.

Commenting on the deal with SEFE, Fatema Al Nuaimi, vice president of

ADNOC's downstream business said: "This LNG agreement, the first with a European company from the Ruwais lower-carbon LNG project, underscores ADNOC's position as a reliable and responsible global energy provider. Gas accounts for almost a quarter of Germany's primary energy use," she noted, adding the deal builds upon ADNOC's delivery of the first LNG cargo from the Middle East to Germany in 2023.

SEFE chief executive Frédéric Barnaud called the supply agreement for Ruwais LNG the "start of a new chapter" in a partnership spanning over 15 years. "We aim

to further build on our existing relationship and explore joint low-carbon energy developments," he noted. ■



ADNOC vice president downstream, Fatema Al Nuaimi, and SEFE head Frédéric Barnaud sign the HoA

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Continued from page 1

Robust demand – in parts of Asia

Asia imported a total 50.2 million tonnes of LNG in weeks 1 to 10 this year, compared to 47.6 million tonnes for the same period in 2022 and 47.5 million tonnes over the same timeframe in 2023, indicating that supply to the region "remains robust," analysts noted. LNG demand in China and India is picking up as their economies recovers. In Japan, in contrast, utilities benefit from rising availability of nuclear power plants for baseload electricity supply while gas storage are fairly healthy which limits imports.

JERA, Japan's largest electricity producer, briefly shut combined-cycle gas turbine (CCGT) Unit 7-1 and Unit 7-2 at its Kashima

power complex on 11 March due to technical issues, but then restarted both units within 24 hours, according to Japan Electric Power Exchange (JEPX). Moreover, JERA's Sodegaura gas-fired power plant Unit 2 – with 1 GW nameplate capacity – began maintenance work on 12 March without a planned restart date.

Thermal coal is also less in demand amid rising nuclear contribution. JERA notified that its 1.07 GW-coal-fired Taketoyo power plant Unit 5 has been offline since February, with no announced restart date. In western Japan, J-Power's Tachibana coal-fired power plant – with 1.05 GW nameplate capacity – has been offline since 15 February. ■

BP picks delivery partners for NZT Power, aims for FID in September

BP has alerted Technip Energies, leader of a consortium with GE and construction partner Balfour Beatty, to prepare for the execution phase of the 860 MW Net Zero Teeside power project. FID for the world's first commercial-scale gas-fired power station with carbon capture, is meant to be taken in September – or earlier – with first commercial operation envisaged for 2027.

In a Letter of Intent, BP – one of the joint venture partners for NTZ Power together with Norway's Equinor – asked the chosen project delivery partners to prepare for a timely start of construction, equipment delivery, installation and commissioning once the project has reached financial close. The landmark project has been shortlisted for government funding and may well reach FID early.

With the Development Consent Order already been granted, construction works could start immediately upon financial close.

The 860 MW abated gas-fired power sta-

tion is set to provide flexible, dispatchable power equivalent to the average electricity needs of around 1.3 million British homes. Powered by an GE 9HA.02 gas turbine and a steam turbine, the CCGT will integrate with a carbon capture unit using Techip's Canopy by T.EN solution which is based on Shell's Cansolv CO2 capture technology.

Similar technology used for Calpine CCGTs in Texas

For NTZ Power on Teeside, UK, Technip Energies will use similar carbon capture technology as for Calpine's Baytown Energy Center, an 896 MW combined-cycle power unit in Texas. Technip, Shell Catalysts and Zachry Group won an EPC contract to

design and built the unit to capture up to 95% of CO2 emissions from the CCGT's process flue gas.

Both Shell and Technip have been cooperating on the licensing and execution of projects based on Shell's Cansolv CO2 capture system. In recent years, they experienced rapidly growing demand for affordable and proven CCS solutions.

Baytown Energy Center entered commercial operation in June 2002, with 810 MW baseload and 896 MW peaking capacity. The combined-cycle plant consists of three Siemens Westinghouse combustion turbines with three heat recovery steam generators and has been singled out as a 'Showcase Plant' by the U.S. Department of Energy.

CCS retrofit at the Bayton Energy Center has a similar concept and design as Calpine's Deer Park CCS project at a 1,100 MW combined-cycle gas cogeneration unit in Texas, for which Technip already executed a FEED study which leverages Shell technology. Learning from the ongoing Dear Park CCS project will be leveraged at Bayton and also at the NZT Power venture on Teeside. ■



CCUS to decarbonise steel and gas power deemed uneconomic by 2030

Plans to retrofit Carbon Capture Utilisation and Storage (CCUS) at steel mills and gas power plants should be abandoned, the London-based think tank Carbon Tracker finds, as both applications will be outcompeted by cleaner alternatives. Tata Steel and British Steel already favour electric arc furnaces, analysts noted, while hydrogen turbines will likely be cheaper sources of flexible power than gas-CCS plants by 2030.

To make the CCUS sector profitable, most project would need a stable carbon price of at least £100 per ton to compete with unabated technologies, analysts found. It's hence high time to curb the enthusiasm for CCUS, Carbon Tracker stressed, after analysis of various carbon capture projects showed these ventures have a track record of over-promising and under-delivering at escalating costs.

The UK government's CCUS strategy, set out in December 2023, aims to capture 20-30 million tonnes of CO2 per annum by 2030, backed by £20 billion in taxpayer

funding. But since then, cost estimates for deploying CCUS have more than doubled, Carbon Tracker found, while the need for carbon capture could be much smaller. The need for gas-fired power plants with CCS, for instance, could be one-third of earlier estimates due to the growth of renewables, battery storage and flexible technologies, analysts found.

Abating biomass-based power generation

through CCUS – notably the 2,600 MW Drax power station – is “unproven at this scale,” analysts noted given that the largest current project is a 50 MW biomass power plant in Japan. “The Drax conversion could lock taxpayers’ money into a long (15-25 years) and costly (£26-43 billion) subsidies contract,” Carbon Tracker analyst Lorenzo Sani suggested, noting offshore wind power could be three times cheaper. ■

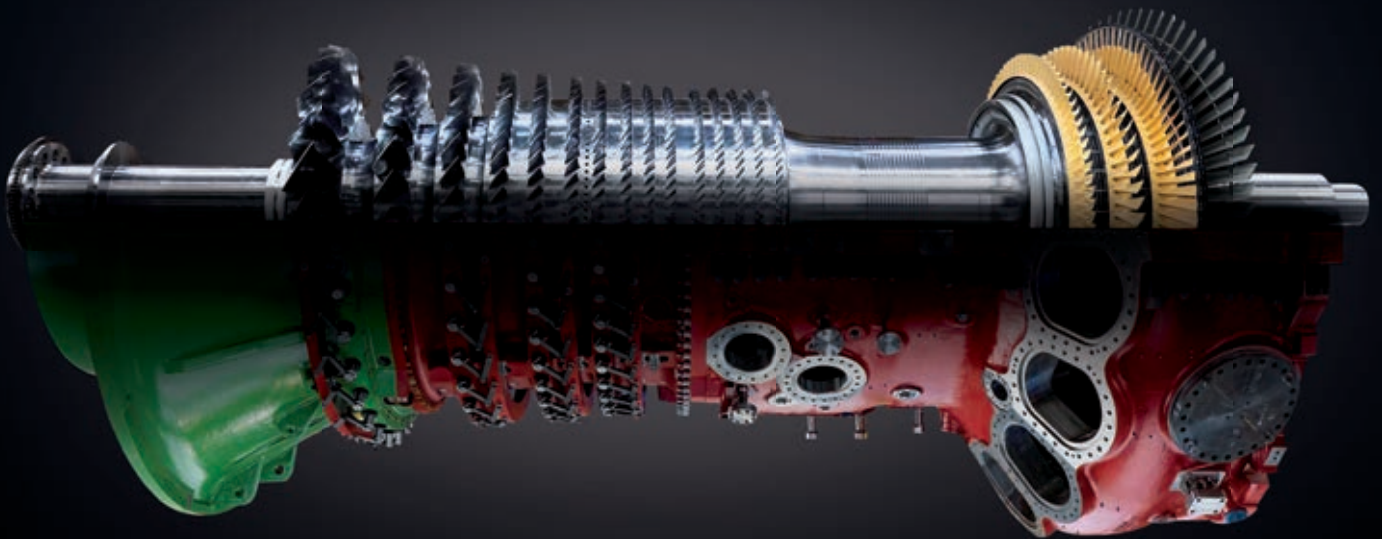
	Installed Capacity 2022 Mton	Carbon Capture Cost £/tonCO2		Carbon Capture Cost	
		low	Carbon Capture cost range	Low	high
Natural Gas Processing	34.31	15	20	15	35
Hydrogen/Ammonia	8.8	40	25	40	65
Ethanol	1.78	15	20	15	35
Other Chemical	1.75	15	20	15	35
Power Generation	1.65	65	85	65	150
BECCS					
Cement					
Iron and Steel	0.8	50	30	50	80
Direct Air Capture	0.004	550	250	550	800

Source: Carbon Tracker report: Curb your enthusiasm: Bridging the gap between the UK's CCUS targets and reality

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Up to 58 GW capacity in PJM could close by 2030 without replacement

Between 24 GW and 58 GW, or 12% to 30% of installed capacity in PJM Interconnection in the US Northeast could be retired by 2030 – without immediate replacement, the grid operator warned in a monitoring report. Of the total capacity up for closure, some 33.8 GW is considered uneconomic based on forward capacity prices.

But these estimates are uncertain as rising wholesale electricity prices, or capacity payments for grid services, could keep some of the capacity online for longer, analysts noted. For once, energy prices and fuel prices were significantly lower in 2023 than in 2022. Theoretical energy market net revenues hence fell by 44% for a new combustion turbine, 46% for a new combined cycle, 67% for a new coal plant, 57% for a new nuclear plant, 61% for a new onshore wind plant, 62% for a new offshore wind plant and 65% for a new solar plant.

Intermittency issues as wind & solar replace gas power

Though the amount of potential retirements is roughly equal to the 54.2 GW that was permanently closed in PJM from 2011 to 2023 – there was a wave of new flexible, gas-fired capacity coming online at the time. Now, it's renewables that are being built out.

"Renewables can replace a significant amount of the energy output but cannot replace the capacity," analysts wrote in the monitoring report, warning: "The simple fact is that the sources of new capacity that

could fully replace the retiring capacity have not been clearly identified."

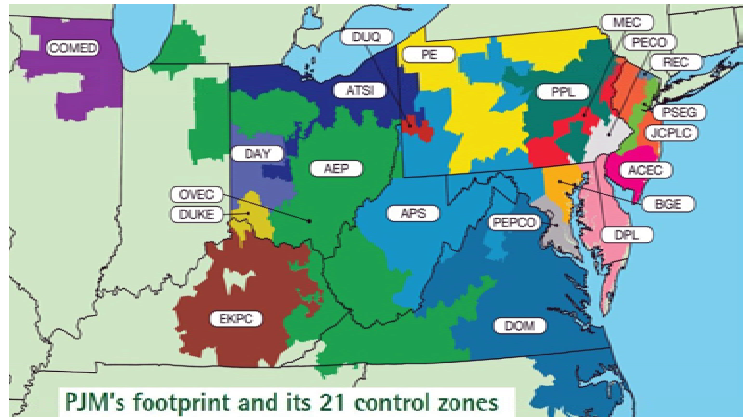
Currently, there is some 196 GW of installed capacity in PJM and the grid operator plans to connect about 7.2 GW of new project by mid-2025 and 230 GW – mainly wind and solar power – over the next three to five years.

Analysts hence underlined the need for reliability through must-run dispatchable power units, stable fuel supply and the need for some dual fuel capacity to bolster security of supply. These days, some plants that do not clear in the capacity market auction and announces to retire is then deemed 'system-critical' and is not allowed to close. "The substantial overpayments that result from PJM's interpretation of the current rules create an incentive to request Reliability Must-run (RMR) contracts because the RMR payments generally exceed market revenues," analyst noted, dismissing this

practise excessively expensive for the ratepayer.

To avoid this, power plant owners should be mandated to give at least 18 months' notice – instead of currently 3 month – to PJM if they want to retire a generating asset. That way, the grid operator has enough time check and resolve reliability issues, e.g. by advancing replacement projects.

Overall, analysts underlined "PJM and its market participants must no try to become all knowing system planners. (...) They need to resist the temptation to try to define the correct market prices rather than creating a competitive design that permits market fundamentals to determine prices."



Malaysia's backup power supply "sustainable" thanks to hybrid plants

Power reserve margins, or backup power supply, in Peninsular Malaysia will "stay sustainable" between 28% and 36% through 2030 while demand is set to rise by 2.9%, according to government projections. Hybrid projects, like Masdar's 2 GW solar, wind and battery system, will help meet electricity demand in the event of a sudden power plant outage.

Reserve margins are primarily guaranteed by flexible, load-following gas peaking power plants but hybrid renewable and energy storage installations can also full-fill this role, and at increasingly cost-competitive rates.

The UAE clean energy company Masdar, together with Malaysia's Citaglobal Berhad, are hence looking to develop various hybrid projects as part of National Energy Transition Roadmap (NETR). 10 flagship projects are expected to generate over 25 billion

ringgit (\$5.5 billion) in investment and some 23,000 jobs. But analysts underline the need for a regional carbon pricing mechanism to give clean energy sources a clear economic edge over coal-, gas and fuel oil-powered plants.

Electricity demand in Peninsular Malaysia is forecast to reach 19,480 MW this year and could rise to 20,049 MW by 2030, spurred by industrial development and especially the establishment of energy-hungry data centres.

TNB's Aziz power plant to co-fire hydrogen

To support the energy transition, the government is hoping for 12 billion ringgit of direct investment in renewables, energy storage and hydrogen co-firing. In this context, The Malay power company power company Tenaga Nasional Berhad (TNB)

has partnered with Widad Business Group to develop a 2.1 GW combined-cycle gas power station at Kapar, Selangor, which will capable to co-fire hydrogen when entering commercial operations in early 2031.

Funding for the 9.5 billion ringgit (\$2bn) project will be arranged through a 60:40 joint venture by TNB and Widad Business Group, whose founder Tan Ikmal Opat Abdullah will be the company's "first undertaking in CCGT development." Based on the technical know-how gained from this project, Widad wants to develop more flexible gas power plants in the future. Gas power projects like the Kapar CCGT will help TNB halve its reliance on coal generation by 2035, and slash its emission intensity by 35%. Natural gas is fuelling 41% of Malaysia's of installed power generation capacity at 15.8 GW, or 35% of its electricity output of around 60 TWh.



Electricity pylons in Malaysia

Uniper UK repurposes retired generators to provide grid stability

Two turbines at Uniper's Killingholme power station in the UK have been converted to synchronous condensers with flywheels to stabilise the grid. The steam turbines of the retired gas power plant were transformed by Siemens Energy and are now reused, together with a rotating grid stabiliser, to provide inertia, short circuit power and reactive power – without burning fossil fuels.

Commissioned in 1992, Killingholme was one of the UK's first gas power stations. When National Grid ESO launched the Stability Pathfinder project, Killingholme was

identified as a prime site. For this, Uniper sought to repurpose steam turbine generators decommissioned after the power station was converted from a combined cycle plant to an open cycle plant in 2017.



Flywheel at the repurposed Killingholme plant

A team of engineers from Uniper and Siemens Energy removed the steam turbine and reused the generator as a grid stabilizer. Then they added a flywheel in place of the turbine to provide maximum inertia. This conversion provides much needed services to the grid.

All major equipment for the project was supplied, installed and commissioned by Siemens Energy, notably flywheels, auxiliary systems, electrical start-up systems, excitation systems, and protection. The scope of supply also includes the fully redundant Omnivise T3000 control system including vibration monitoring for the synchronous condenser and its implementation into the existing control room.

Today, the Killingholme facility helps National Grid to counter sudden drops in frequency and voltage to avoid the risk of power supply disruption. Various decommissioned fossil power stations could be converted that way, making use of some existing equipment to help facilitate the green energy transition by balancing inherently intermittent wind and solar power supply. ■

RWE considers building 3 GW of H2-ready power plants in Germany

RWE is evaluating plans to build 3 Gigawatt (GW) of hydrogen-ready gas power plant capacity in Germany by 2030 as part of government tenders to ensure security of supply as the renewables roll-out progresses. However, CEO Markus Krebber warned that the government's hydrogen strategy still lacks vital details – particularly as "time is really pressing now."

"So far we only know the key points. Coordination with Brussels is still pending," Krebber commented on the German government's power plant strategy that includes plans to put 10 GW of new gas-fired power generation capacity up for tender. Though this is viewed as a good start, the RWE CEO urged "the first tenders must take place this year at the latest so that the power plants can start operating before the end of this decade."

New capacity needed quickly

"As we need the capacity quickly, it must be ensured that it is actually built," he stressed, adding RWE wants to realise H2-ready plants would "mainly" at the sites of its existing coal-fired power plants. "We are also working on developments at sites not only in North Rhine-Westphalia, but also outside of it, to prepare more," Krebber specified, noting RWE wants to build at least 3 GW by the end of 2030.

But more clarity on the supply of clean hydrogen via a dedicated H2 pipeline networks and payments for flexible plants is needed for RWE and its peers, before and FID can be taken. The German gov-



ernment had announced in February it will put 10 GW of, and utilities are keen to bid for subsidies that Berlin has committed to provide as part of a new capacity mechanism.

H2-ready gas power projects or plant retrofits are also emerging in the UK and in the Netherlands. Pointing to RWE's acquisition of the 1.4 Magnum gas-fired power plant in the Netherlands in 2022, Krebber said can operate on a mix of 30% hydrogen and 70% fossil gas, and that a "full conversion to hydrogen by the end of the decade is possible".

As for supply, RWE wants to source carbon-free hydrogen from Norway and deliver it to northwest Europe together with its strategic partner Equinor, which aims to build a hydrogen pipeline across the North Sea. The Essen-based company is producing its own hydrogen in Lingen using a high-temperature solid oxide electrolyser (SOEC) from Sunfire. The electrolyser with an output of 250 kilowatts (kW) is part of a test facility where nine project partners are testing how hydrogen can be transported and stored safely and reliably through pipelines. ■

B&W bags \$246 million contract for 1 GW coal-to-gas conversion

Babcock & Wilcox has received limited notice to proceed (LNTF) to convert two coal-fired boilers at a 1,000 MW power plant in North America to run on natural gas. B&W expects to proceed to the full contract in the fourth quarter of 2024, when it would start to design and install the new burners, air systems and fans for the fuel switch.

Engineering and design work will begin immediately under the LNTF, with the coal-to-gas conversion contract at approximately \$246 million, B&W said without disclosing the name of the customer nor the name of the power station.

Fuel conversions vs CCS retrofits

In the face of more stringent emission regulations, utilities across North America and the world are evaluating options to extend the life of their thermal power generating assets. The US Environmental Protection Agency (EPA), for once, has set out new rules that require coal-fired power stations and new gas-fired ones to capture or mitigate 95% of CO₂ emissions by 2035.

Coal power stations set to keep running into the 2040s and gas power units with a capacity of 300 MW and more that operate at least half of the time are expected to in-

stall CCS that removes 90% of their carbon emissions by 2035. Alternatively, gas power units need to be co-fired with 30% hydrogen by 2032 and 96% hydrogen by 2038. Existing gas-fired power plants, however, are exempt from the novel regulation – at least for now.

“Replacing coal or oil with cleaner-burning fuels like natural gas, biofuels or hydrogen is often a cost-effective way for plant owners to lower emissions while maintaining reliable power generation capacity,” B&W Thermal senior vice president Chris Riker noted. As for the unspecified 1 GW fuel conversion project, he pointed out company’s extensive field construction experience and Babcock & Wilcox FPS’ specialized combustion equipment was “ideally suited for large fuel-switching projects.

B&W in early 2022 acquired the Nova Scotia-based Fossil Power Systems (FPS), a leading designer and manufacturer of hy-



drogen, natural gas and renewable pulp and paper combustion equipment. “Our acquisition of FPS places us in a unique role to provide turn-key services for gas conversion projects,” B&W chief executive Kenneth Young said, with reference to “healthy demand and an extensive [project] pipeline across our business.” For the year ahead, he anticipated solid bookings and stronger financial performance. ■

Solar PV and 1 GWh battery to power Google data centre in Arizona

Sonoran Solar Energy Center (260 MW), coupled with a 1 Gigawatt-hour (GWh) battery energy storage, has entered operation in Buckeye, Arizona, to provide all electricity needed by Google’s forthcoming data centre in Mesa. Salt River Project (SRP) and NextEra Energy Resources developed the hybrid power project and will sell excess energy to other customers nearby.

Google aspires to run its data centres and offices campuses solely on carbon-free energy by 2030. For its future data centre in Mesa, Google hence relies on the Sonoran hybrid plant as well as the 88 MW Storey solar and battery storage system in Coolidge, Az, and the Babbitt Ranch 161 MW wind power project north of Flagstaff.

“We’re aiming for every Google campus to operate on clean electricity every hour of every day by 2030, including in Arizona where we are excited to put down roots with our first data center in the state currently under construction,” said Amanda Peterson Corio, Global Head of Data Center Energy, Google. “The collaboration with Salt River Project and NextEra is accelerating decarbonization in Arizona and our own carbon-free journey in the region.”



French nuclear powers Google’s operations in Germany

Over in Europe, Google has signed power purchase agreement (PPA) with the French utility ENGIE to run its data centers in Germany at nearly 80% carbon-free energy, notably nuclear power. Google is working on a new cloud region in Berlin-Brandenburg and the expansion of its existing cloud region in Frankfurt.

Under the terms of the PPA with ENGIE, the French utility will assemble and develop a carbon-free energy portfolio on Google’s behalf which could grow as the company’s needs change in Europe.

Green PPAs can help sustainably-run companies to get a better handle on power prices. These contracts between a power generator and a consumer – for example, between a wind park and a factory – specify the terms for the sale of electricity and guarantee long-term price security. However, the volume of new renewable energy projects backed by PPAs in Germany still trails that of other European countries – but Google’s latest deal with ENGIE is might well prompt other companies to follow suit. ■

NEWS NUDGES

DOE splashes out \$750m to advance US hydrogen

The U.S. Department of Energy (DOE) has announced \$750 million for 52 projects across 24 states to dramatically reduce the cost of clean hydrogen. The projects are expected to enable U.S. manufacturing capacity to produce 14 GW fuel cells per year and 10 GW of electrolyzers per year, enough to produce an additional 1.3 million tons of clean hydrogen.

Hurricane-resistant power plant inaugurated on Antigua

A hybrid solar, batteries and back-up diesel and gas gensets – capable to withstand hurricanes – is now operational on Antigua and Barbuda. Developed by Masdar, the bespoke project includes 720 kilowatts-peak of solar PV panels, connected to an 863 kilowatt-hour battery – enough to fully meeting the island’s current daytime energy demand.

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