Gas to Power Journal
Peakload Power and Energy Storage

Focus on Hydrogen & Energy Storage

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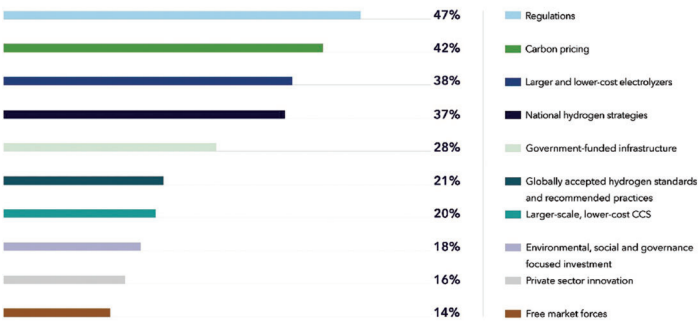
Infrastructure – "greatest hurdle" of a hydrogen economy, DNV finds

Nearly half of the energy companies surveyed by DNV expect to earn 10% of their revenue from hydrogen by 2025, and three quarters by 2030. Lack of infrastructure investment is, however, still the "biggest hurdle to progress" as gas networks as well as turbines and engines need to be converted for hydrogen use.

Most important enablers of a hydrogen economy to 2030



Over 1,100 energy professionals, surveyed by DNV, anticipate hydrogen will make up more than 10% of their company's fuel carrier or feedstock spending by 2025, rising to 57% by 2030. This is a stark rise from a just 9% share today.

Effective CO2-pricing needed

Profit opportunities spur investment, though 80% of respondents cautioned that "the hydrogen economy needs effective carbon-pricing regulations before it can scale-up." Putting a higher price on carbon emissions would incentivise electric utilities and the energy-intensive industry to convert their power plants to hydrogen co-firing.

Repurposing existing infrastructure also has a key role to play, the survey finds, and the right regulations are deemed to be the most powerful enabler.

Turbine manufacturers have already embarked on a race to make their equipment "hydrogen-ready," and many turbines already run on a 30:70 mix of hydrogen and natural gas. Co-firing thermal

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Taiwan's summer LNG imports surge amid nuclear power outage

Peak summer LNG demand in Taiwan has surged due to an earlier-than-expected shutdown of the first 990 MW unit at the Kuosheng nuclear power plant. Decommissioning works are underway and Energy Aspects now expect Taiwan to import 9.7 million tons of LNG through September.

Imports are likely to rise 0.7 million tons of LNG, or 8% year-on-year, according to Energy Aspects calculations, given that flexible gas-fired power generation needs to compensate for Taiwan's missing nuclear baseload power generation capacity.

The Taiwanese energy company CPC Corp has been receiving US LNG shipments from the Corpus Christi export plant in Texas since January under a 25-year supply deal with Cheniere Energy. Taipower, the island's main utility, also strives to import LNG for power generation, separately from CPC.

Cheniere agreed to supply 2 mtpa of LNG to Taiwan for 25 years with the purchase price linked to the US benchmark Henry Hub. The deal opens up a new supply source as Taiwan's annual LNG requirements have risen to nearly 17 million tonnes per annum (mtpa).

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AGENDA

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power plants with green fuels like hydrogen, or ammonia, helps operators reduce their emission footprint.

Revenue share still low

Most energy companies have been dragging their feet when it comes to green fuels, and over 70% only got involved in hydrogen over the past five years. For nearly half of the surveyed companies, hydrogen accounts for less than 1% of their revenue today.

By 2025, nearly half of energy companies involved in hydrogen expect it to account for more than a tenth of their revenue, rising to 73% of companies by 2030. By then, hydrogen will likely also account for more than half of the organisation's spending.

Industry "needs to prepare"

Despite their cautious approach, three quarters say Paris Agreement targets will not be possible without a large-scale hydrogen economy. Some 80% say the hydrogen economy needs effective carbon-pricing regulations. Meaning, there is still much upside in terms of investment.

"Hydrogen has a new status in 2021 as an important, viable and rapidly developing pillar of the energy transition. Yet ambitions and the rate of change in the hydrogen economy are demanding, and the industry needs to prepare," said Ditlev Engel, CEO of Energy Systems at DNV.

Looking ahead, the world needs to transition faster to a deeply decarbonised energy. "In addition to energy efficiency gains, this will require greater renewable power generation and electrification, and the scaling of technologies to remove the carbon from fossil fuels," Engel said, underlining: "Hydrogen will be needed to connect and enable these paths."

Several questions remain, with the view split inconclusively on whether hydrogen trade will become a fully globalized market (42%) or regional market (52%), or whether hydrogen will be priced like oil and gas with free market forces (41%), or like electricity with a regulated or stable rate of return (43%). ■

MAN's PBST to help distribute Rolls-Royce's MTU turbochargers

MAN Energy Solution's PBST brand, developer of turbochargers and exhaust-gas-treatment, has agreed to distribute Rolls-Royce's MTU turbochargers. The cooperation combines PBST's global sales structure and MTU turbocharger technology for high-speed diesel and gas engines.

Turbocharging increases the power of an internal combustion engine by compressing air so that more oxygen flows into the combustion chamber. This allows more fuel to burn, and engine output increases accordingly.

Under the cooperation agreement, PBST will include the MTU turbocharger family ZR1 to ZR5 in its product portfolio and distribute them under the series name HIRO. For Rolls-Royce, this creates a new sales channel in addition to Woodward L'Orange.

"The MTU brand is characterized above all by its in-depth know-how in high-speed applications. Thanks to this product expansion, we are now able to offer our customers exactly the right turbocharger for their high-, medium- and low-speed applications under one roof via the PBST brand," says Dr. Uwe Lauber, CEO of MAN Energy Solutions.

Adaptable for marine, vehicles and power gen

Technically speaking, MTU turbochargers are offered on the basis of a modular system for engines in the 400 to 2,500 kilowatt power ranges in single- and two-stage versions. They are designed and adaptable for marine, rail, construction, heavy land vehicles and power supply.

"Advanced turbocharging helps engines achieve low fuel consumption and high power over a wide speed range. It is an important building block for meeting increasingly stringent emission requirements – without compromising engine performance or efficiency," explained Dr. Otto Preiss, Chief Technology Officer and COO of Rolls-Royce Power Systems. The company is currently working on electrically assisted turbochargers for greater agility, as well as on turbocharger concepts for fuel cells. ■

Assembly of turbochargers on MTU engines

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New regas terminal at Datan Borough

Eager to import more LNG for power generation, CPC has expanded the Tai-Chung regas terminal and is currently developing a new import terminal in Datan Borough at Tao-Yuan, northern Taiwan, which is due to start operations in 2023.

Taipower, the island main utility, is also taking steps to import LNG for power generation and as it plans to develop its own regas terminals, one near Tai-Chung and a second at Hsieh-Ho in North Taiwan. State-owned Taipower signed two non-binding LNG supply deals, with imports designated for its CCGT project at Taichung, where unit 1 of 2 is scheduled to start up in early 2024.

The government in Taipei estimates LNG imports will grow from 150,000 tonnes in 2023 to 3.6 mt in 2032. This growth estimate is based on fuel demand for 1,300 MW of gas-fired generating capacity at a 65% utilisation rate. Taipower currently operates five gas power plants with a combined capacity of over 11,360 MW. ■

Solar plus storage hybrids could reach 7.5 GW in the US by 2025

Energy storage deployments in the United States have risen a staggering 240% over the previous high to 476 MW new-built capacity. Large-scale utility procurements for solar-paired energy storage are expected to boost the US battery market from 1.2 GW in 2020 to nearly 7.5 GW (and 26.5 GWh) by 2025.

Solar-paired storage will account for the vast majority of new installations, as developers aim to capture value from the Investment Tax Credit. "The signs are pointing toward an unprecedented increase in energy storage in the coming months, moving us closer toward achieving our 100 GW by 2030 vision," said Kelly Speakes-Backman, U.S. Energy Storage Association CEO. She is hopeful that US President Joe Biden will continue the regulatory reform to ensure "a more resilient, efficient, sustainable, and affordable electric grid for all."

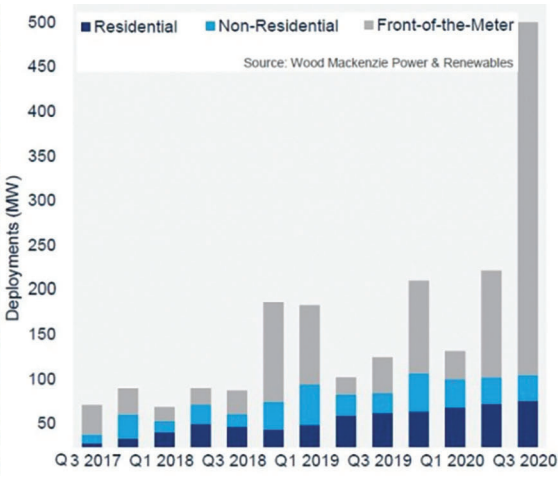
Front-of-the-meter (FTM) storage procurements – particularly in California – have grown dramatically in number and size, paving the way for the US energy storage industry to realize its 100 GW by 2030 goal.

Despite the economic downturn and Covid-related slowdowns, nearly 400 MW and 578 MWh of front-of-the-meter energy storage were deployed in the third quarter, surpassing previous records of 133 MW and 296 MWh for this sector. According to the US energy storage monitor, more FTM units were installed last quarter than in any other quarter over the past seven years.

Residential storage growth six-fold

Falling prices, technology improvement and efforts to ensure eligibility are expected to lead to further growth in the US storage deployments. The residential market is growing steadily and hit 52 MW/ 119 MWh in the third quarter.

"Although the residential storage market has hovered at around 7,000 deployments per quarter in 2020, the sector is now set to expand by 6x through 2025, with increasingly active markets in New York, Massachusetts, PJM, Texas and Florida, among other states," said Wood Mackenzie analyst, Chloe Holden. By contrast, non-residential deployment added just around 30 MW each quarter this year.



Regulator permits DER aggregations

The US energy regulator FERC last year removed regulatory barriers to aggregation of distributed energy resources (DERs) in wholesale electricity markets. Utilities and grid operators can now start to centralise grid services and scale up storage capacity.

"Potential upside from landmark FERC Order 2222 could start to become clear next year as market operators and utilities make plans for implementation," Ms Holden said, suggesting "these decisions will impact where and how quickly storage companies will be able to center grid services. ■

Rolls-Royce invests in Berlin-based provider of decentralised power

UK's prime manufacturer Rolls-Royce is investing in Berlin-based start-up Kowry Energy. Focusing on Sub-Saharan Africa, the German engineers combine photovoltaic and battery storage systems into hybrid power systems. As young company, Kowry can "adapt to the realities" in Africa and the partnership with Rolls-Royce enhances its positioning.

Scalable solar plus storage

Sub-Saharan Africa has some of the lowest electrification rates in the world; hence manufacturers see "great potential" for decentralised power generation projects. Blessed with abundant sunshine, developers can build climate-friendly, local power units for industrial and community customers that operate with minimum use of fossil fuels.

"We believe that solving the climate challenge facing our planet will only succeed with the inclusion of the 600 million people of Sub-Saharan Africa who are living without energy today," said Kowry Energy founder Ndiarka Mbodji. That is why the start-up strives to set up "sustainable energy access with scale and speed," notably through solar PV and battery storage for demand of up to 1 MW.

In 2021, Kowry Energy will be launching projects in Mali and Nigeria and CEO Mbodji is confident to see the company's business model "validated" by a current project pipeline of $17 million.

Investor and partner

Rolls-Royce Power Systems as industry partner and investor provides Kowry Energy with strong positioning in the market. "The start-up can rely on our support and know-how in implementing their projects," said Power Systems CFO Louise Öfverström.

Headquartered in Friedrichshafen, RR Power Systems or the former Tognum AG employs around 9,000 people and achieved revenue of £11.76 billion in 2020, with £1.25 billion invested in research and development. ■

Render of hybrid solar and battery system

Equinor aims to triple its UK hydrogen production to 1.8 GW

Norwegian oil and gas company Equinor has stepped up its hydrogen production target in the UK to 1.8 GW, following a visit of Britain's Energy Secretary Kwasi Kwarteng to Oslo. The aim is to add 1.2 GW capacity to fuel Keadby Hydrogen, the world's first 100% hydrogen-fired power plant under development together with SSE.

Provided a timely regulatory approval, the Keadby Hydrogen unit could start producing clean electricity before the end of 2029. The Scottish utility SSE strives to use hydrogen to replace natural gas in power and heat generation to help reach the UK's climate goal.

Once operational, Keadby Hydrogen will have a peak fuel demand of 1,800 MW hydrogen to generate the equivalent of 900 MW electricity. The zero-carbon power source will help reduce emission from Britain's most industrialized cluster in Humber, north-east England.

Site of SSE's Keadby Hydrogen and existing CCGTs

Grey hydrogen from Saltend

Parts of Keadby Hydrogen's fuel demand will be covered by H2H Saltend, a project to produce hydrogen from natural gas at Saltend Chemicals Park near Hull. This so-called grey hydrogen will be produced by a 600 MW unit through reforming natural gas, with carbon capture storage (CCS) meant to reduce the associated emissions by nearly 90%.

The hydrogen supply will allow local chemical industry as well as the Saltend cogeneration power plant to switch to a hydrogen fuel blend. Ultimately, the green fuel is meant to reduce emissions in the Humber region by nearly one million tonnes annually.

"Without CCS and hydrogen, at scale, there is no viable path to net zero and realising the Paris goals. Our low-carbon projects in the UK build on our own industrial experience and will play a major role in setting the UK's industrial heartlands in a leading position," Equinor CEO Anders Opedal said, adding: "The projects will also contribute to provide hydrogen and low carbon solutions to three to five industrial clusters by 2035."

Gas power unit plus CCS

At Keadby, a small village in North Lincolnshire, Equinor and SSE also plan to build a 900 MW gas-fired power unit, fitted with CCS. The Keadby-3 unit scheduled to start operators in early 2027. The unit 3 will add to the 840 MW Keadby 2 combined-cycle power plant that is being developed by Siemens Energy and due competed in 2022.

SSE and Equinor submitted a development consent application to the UK government this spring. The carbon dioxide, captured ad Keadby-3 will be permanently stored under the seabed in the Southern North Sea. ■

Hydrogen plants in South Australia become profitable this summer

South Australia has the wind and sunshine to evolve into a prime hydrogen supplier. According to Cornwall Insight, a hydrogen plant could make a profit of a $2.3 million this summer, assuming 20% utilisation and quarterly repayment on the $593 million of government debt with interest, operating costs, and net cost of energy.

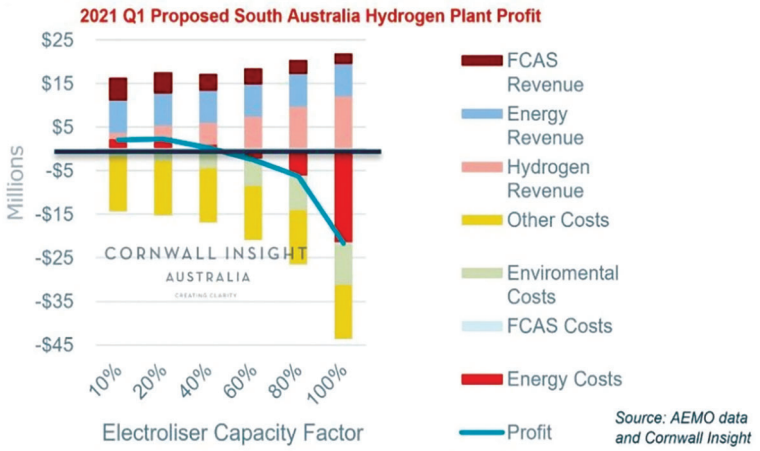
"If the plant was available in summer 2020, it could have made around $47 million in profit – a stark difference compared with a $2.3 million loss in the first quarter of 2019," said Benjamin Macey, senior storage consultant at Cornwall Insight Australia. For the modelling, analysts assumed the hydrogen will be sold at $2/kg which aligns with the Australian Government Technology Investment Road Map goal of enabling clean hydrogen under $2 per kilogram.

Labor Party backs hydrogen and energy storage

The South Australian Labor Party has committed to building a hydrogen production, storage and electricity generation facility if elected at the next South Australia state election in 2022. Their proposal includes a $220 million 250MWe electrolyser, $31 million for 3,600 tonnes of liquefied hydrogen storage and $342 million for a 200 MW CCGT power station.

"If such a plant were in operation at the stated capital costs, it could be profitable," Macey said. In addition to the 20% utilisation factor, approximately 1,517 tonnes of hydrogen would have been effectively produced, which could have been stored or used for emission-free power generation.

"Financing arrangements, using government debt, make the project viable," he explained, hence "it would be difficult to finance on a commercial basis without a clear offtake market and incentive to invest." If we want to compete globally on hydrogen exports, the government needs to assist the industry. Similarities can be made to the support given to battery storage, Macey stressed with reference to over 1 GW of battery projects proposed in South Australia. ■



Fossil power investment in Asia falls 25% to $54 billion through 2030

Investment in fossil generation will fall by one-fourth to below $54 billion, while spending on new wind and solar power units could double to $1.3 trillion over the current decade to 2030, Wood Mackenzie forecasts. Subsidy-free renewables, though, will not be competitive with coal power until 2025 or later.

Governments across Asia are rolling back subsidies, while stronger policy targets and cost declines continue. China, Japan, India, South Korea and Taiwan are leading the green energy build-out, with annual additional wind and solar capacities expected to average at 140 gigawatts (GW) per year, two-thirds of the region's total power capacity additions by 2030.

"Southeast Asia is one of the hottest solar market regions in the world, with installed capacity more than doubling every year since 2018. There will be a momentary slow down with subsidies pulled back, but the region will add over 100 GW of solar in the next ten years," senior analyst Rishab Shrestha told WoodMac's Asia Pacific Power and Renewables Conference.

China's target of 1,200 GW wind and solar capacity by 2030 will require more than 534 GW of renewables to be added over the next decade. This is expected to boost annual wind capacity to over 40 GW from 2021 to 2030.

Japan, meanwhile, will build-out offshore wind capacity to reach its 2050 net-zero target. Similarly, South Korea is also striving to become one of the leaders of offshore wind in Asia with nearly 4.4 GW in the immediate development pipeline.

Test field for solar modules

Asia Pacific is the epicentre of solar technology research and manufacturing. Home to the world's largest solar module manufacturers and PV inverter manufacturing, the region is the test field of many new technologies that have great potential to lower both solar Capex and O&M cost.

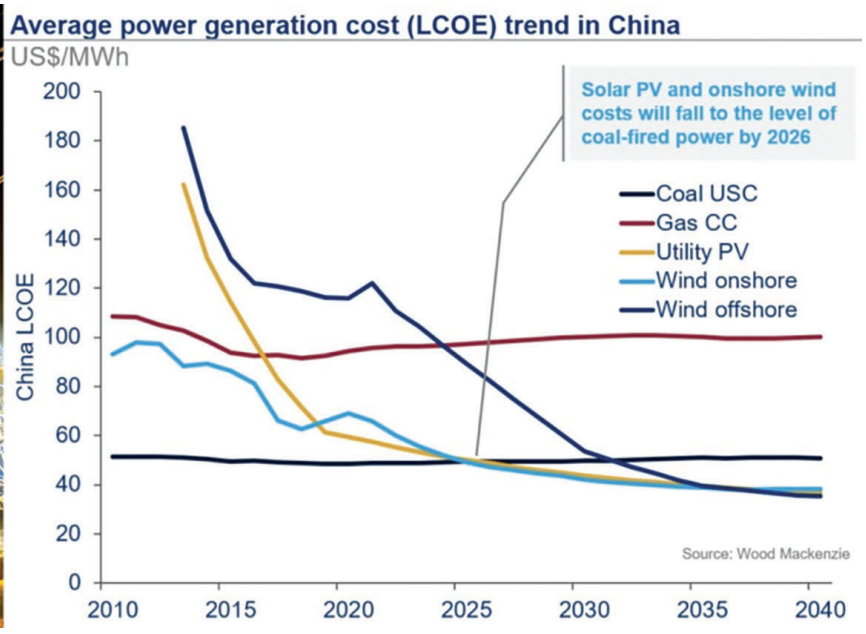
"Solar's economic competitiveness rests on the industry's continued leverage on new technologies to reduce levelised cost of electricity, increase project reliability, and enhance electricity production. We are going to see many technology innovations bearing fruit in the region in the coming years," said WoodMac's principal analyst Xiaojing Sun.

Asia Pacific power generation investments are expected to hit $2.4 trillion in the current decade, with renewables accounting for over half or $1.3 trillion of power investments and research director Alex Whitworth noted: "We expect coal to make up 55% of fossil fuel investments until 2030 but shrink to 30% in the 2030s as gas dominates."

Power-sector emissions set to peak

Thanks to strong renewable build-out, Wood Mackenzie expects carbon emissions from the Asia Pacific power sector to peak at 7.3 billion tonnes (Bt) in 2025, which equates to 1.8 tonnes per person, less than half the level of most developed countries.

Whitworth cautioned, however, that things will take time: "Although we expect a 47% drop in carbon emissions from the power sector from its peak of 7.3 Bt in 2025, inertia in the coal power fleet will prevent Asia Pacific from reaching carbon-free power by 2050. ■



NEWS NUDGES

Gazprom evaluates cost of grey hydrogen

Scientific studies by Gazprom and the Russian Academy of Sciences (RAS) seek to solve technical challenges in producing grey hydrogen through steam reforming in the most cost-efficient way, as well as transporting the fuel to end-users. The findings of the studies will be factored into Gazprom's sustainable development scenarios up to 2050.

Japan's gas-burn on the rise

LNG imports for power generation in Japan have rebounded with steady volumes from the Middle East and Australia and higher cargo numbers from Russia and the US, though LNG deliveries were outpaced by thermal coal shipments. The May 2021 LNG shipments amounted to 4.95 million tonnes, or around 73 cargoes, an 8.2% rise on volumes received in May 2020, according to trade figures by the Japanese finance ministry. ■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Karpowership cannot proceed with 2 GW projects in South Africa

Turkey-based Karpowership had to halt three projects in South Africa with a combined capacity of 2,000 MW after environmental permits were refused. The government in Pretoria claimed Karpowership did not comply with public participation rules, and the company will now have to embark on a long appeal process.

Applications were for the three barge-based gas power projects were first submitted in October 2020. However, the Department of Forestry, Fisheries and the Environment has now announced that projects in the south and east of the country, in Western Cape, the Eastern Cape and Kwazulu-Natal had been refuted.

"The applicant had proposed to locate the three powership projects at the ports of Richards Bay, Ngqura and Saldanha to generate electricity from natural gas to be sent through transmission lines to substations linking to the national grid," the Ministry said, adding: "The powerships were to be assembled off-site and be delivered fully equipped and functional to the different ports."

Karmol LNGT's powership Africa

The energy ministry had underlined the urgency for barge-based power units for emergency use. On April 26, three different municipalities rejected the installations of the proposed emergency power units in Richards Bay, as well as the Western and Eastern Cape.

'Karmol LNGT Africa' en route to Senegal

In Senegal, meanwhile, a Karpowership project nears completion under a joint venture with Mitsui Osk Lines. The Turkish-Japanese venture called Karmol is delivering its first floating storage regasification unit (FSRU) in June to Senegal.

The FSRU, called 'Karmol LNGT Africa' (pictured) will enable Karmol to offer LNG-powered electricity to the West African country for the first time using its floating Powership, 'Karadeniz Powership Ayşegül Sultan'. ■

Mitsubishi supplies blast furnace gas-fired CCGT to Chinese steelmaker

Mitsubishi Power, part of MHI Group, has received an order for a 180 MW combined-cycle power plant fired by blast furnace gas (BFG). Driven by a M701SDAX gas turbine, the CCGT will be built on behalf of the Chinese steelmaker Jiangsu Shagang and is due operational in 2023.

The power plant will make effective use of gas emitted by the blast furnace at one of Jiangsu Shagang's steel factories. The 180 MW unit will provide part of the part of the power needed to run the steelmaking process, and is deemed vital to expand the factory's output.

Special combustion needed for BFG

Blast furnace gas (BFG) has a lower calorific value than natural gas, hence special technology is required to enable its stable combustion. Already in the 1980s, Mitsubishi Power developed a dedicated combustion for BFG- fired combined-cycle power plants.

Today, the Japanese OEM has the strongest track records for this power plant type, with a greater than 60% global market share in BFG-fired gas turbines.

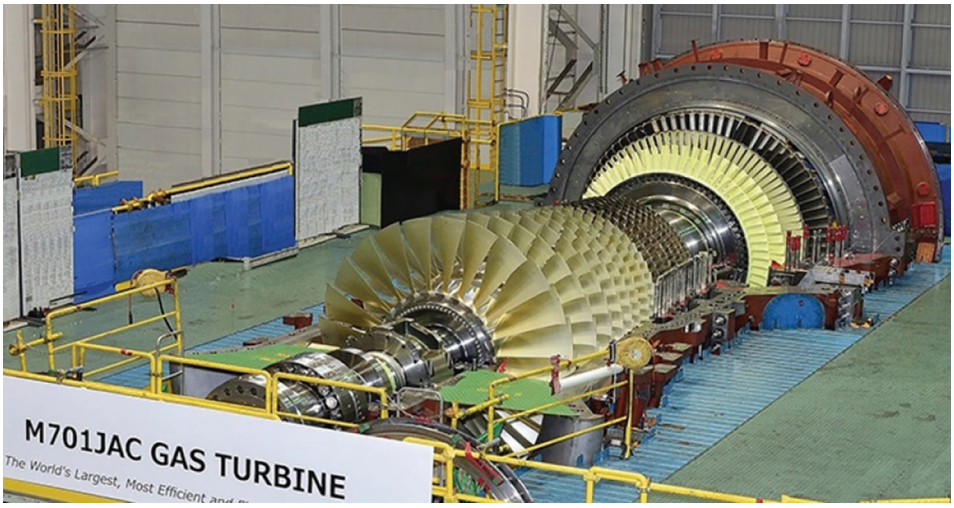
Turbine manufactured at Takasago Works

All components for the onsite BFG-fired power plant will be delivered to Hongchang Plate Co. in Zhangjiagang, a county-level city under the administration of Suzhou situated some 100 km northwest of Shanghai. The CCGT will comprise a gas turbine, heat recovery steam generator, steam turbine, generator, gas compressor, and auxiliary equipment.

The M701SDAX gas turbine will be built by Mitsubishi at Takasago Works in Japan, while the steam turbine and generator will be provided by the Chinese manufacturer Dongfang Electric.

Jiangsu Shagang Group, established in 1975, is one of China's leading steelmakers and mainly produces iron, steel and rolled steel plates. Over the past 16 years, Mitsubishi has supplied the company with four BGF GTCC power plants, mostly 50 MW class units.

Steelmakers, like other energy-intensive industries, face strong pressure reduce their electricity use and emission footprint. Given that BFG-fired power systems make use of by-product gases emitted by steel plants, they improve the overall energy efficiency of the manufacturing process. ■



M701SDAX turbine, as delivered to Jiangsu's BFG-fired power plant

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Ciector Whitelock
Maintenance Manager
Astoria Energy, New York City

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