



Coal outages make Australia the world's most volatile power market

Unplanned coal power plant outages and transmission issues have made Australia's National Electricity Market (NEM) experience the most fluctuations in daily prices of any system worldwide. Price spreads are widest for Queensland and South Australia, Rystad Energy finds, suggesting 46 GW/640 GWh of pumped hydro and utility-scale battery storage will be needed to balance the grid by 2050.

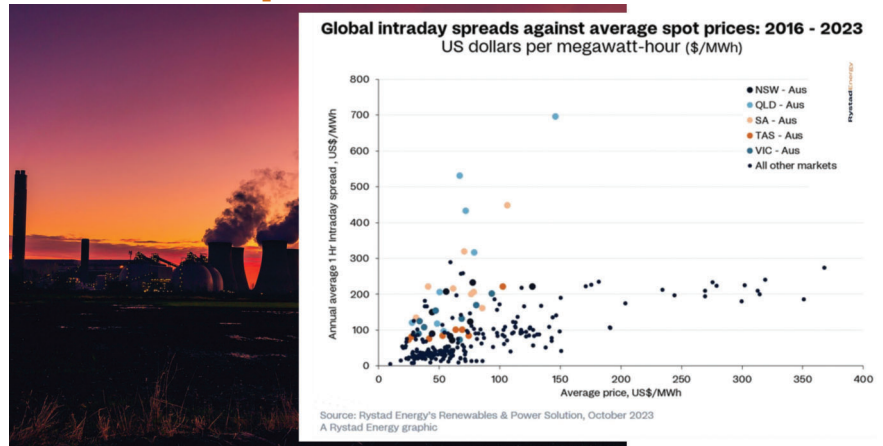
Rystad Energy analysed public price data from 39 electricity markets globally, using the average one-hour intraday spread for a year as the key metric. Australia's NEM holds the unwanted title of 'most volatile', analysts said, explaining volatility is driven by "significant supply issues."

Loss of 14% of NEM's coal capacity

NEM interconnects power markets in Queensland, New South Wales (NSW), Victoria, Tasmania and South Australia, with electricity generated from coal reaching 0.36 TWh in September – close to the all-time low of 0.35 TWh. Callide B turbine 2, Callide C turbine 1 & 2, Bayswater turbine 1, Yallourn West turbine 3 and

Eraring turbine 2 were all offline in September, totalling 3.0 GW of capacity, or 14% of the NEM's coal-fired generation capacity, analysts pointed out.

Unexpected coal power outages were partly compensated by gas peaking plants and renewables, though the remaining coal-fired units were also dispatched more: At a state level, Victoria's coal power fleet operated at a capacity factor of 74%, with NSW at 55% and Queensland at 61%.



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Coal-to-gas switch vital to stabilise Vietnam's cleaner energy supply

Converting Vietnam's coal-fired power stations to run on regasified LNG is essential to ensure energy security and help meet the government's Net Zero by 2050 emissions target. The minister of industry and trade confirmed that several coal-fired power projects are awaiting approval to get redesigned to run on cleaner-burning gas instead.

According to the ministry, five coal-fired power projects are currently being postponed as they struggle to secure debt financing, namely: Vinh Tan III Thermal Power Plant (1,980 MW), Song Hau II Thermal Power Plant (2,120 MW), Quang Tri Thermal Power Plant (1,320 MW), Cong Thanh Thermal Power Plant (600 MW), and Nam Dinh I Thermal Power Plant (1,200 MW).

BP may supply LNG to Cong Thanh project

The investor at Quang Tri, Thailand International Power Company (EGATi), has already announced it will suspend the project while the Cong Thanh Group filed for a permit to convert their project in Thanh Hoa province from coal to LNG.



PetroVietnam's Thi Vai LNG terminal

A representative from BP indicated there have been talks with the Cong Thanh Group to supply LNG and collaborate on realising the fuel switch. If approved, it could become a role model for other delayed coal-fired power projects.

Regasified LNG from Vietnam's recently added

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High solar penetration push power prices down at daytime, while elevated gas prices cause rising electricity rates in the evenings and at night when missing solar power gets compensated by fossil-fuelled plants. Unexpected outages of coal power station sent prices soaring, while more frequent and devastating cyclonic winds or bushfires caused problems on major transmission lines.

Massive storage build-out required

To balance the system and handle supply fluctuations, analysts reckon that 46 gigawatts (GW)/640 gigawatt-hours (GWh) of pumped hydro and utility-scale battery storage capacity would have to be installed by mid-century – a significant increase from the current 2.8 GW.

"Volatility can be unsettling for retailers who lack proper hedging strategies and for consumers who bear the brunt of resulting cost fluctuations. To tackle this, Australia should prioritize the enhancement of transmission infrastructure and invest in storage solutions to mitigate the impact of volatility," commented Rystad's senior analyst David Dixon. ■

Oversubscribed queue for UK grid connection discourages investment

Excess renewable energy projects eager to link to the UK power grid are discouraging investment in fossil-fuelled projects, making the regulator Ofgem consider rule changes to tackle queue issues, including grid connection amnesty. Centrica is convinced such changes would "massively accelerate investments" as less than 10% of available sites for grid connection in England and Wales are available before 2030.

"We have effectively lots of projects ready to go, but we just need people that are in the queue with no money to get out of it," Centrica CEO Chris O'Shea told Bloomberg, commenting on a report by the consultancy Charles River Associates (CRA).

"A longer wait for connections increases uncertainty for developers," the CRA study points out: Projects designed to generate 371 GW of electricity are lined up and wait to connect to the British power grid, but only about half of them have an expected completion date before 2029, the report finds. Worse still, only 30% to 40% of them are likely to ever be realized, analysts suggest as the vast majority of pro-

jects is still in early phases of development.

Grid connection amnesty

Both Ofgem and National Grid are taking steps towards a Transmission Entry Capacity (TEC) amnesty, designed to allow certain generators to get out of the queue without incurring the usual charges. Up to 8 GW of unwanted capacity, reserved across some

50 projects, could that way be taken off the current waiting list – allowing others to connect faster.

According to Ofgem figures, the latest TEC queue now exceeds 340 GW of new power generation capacity with firm grid connection agreements, 40% of which is not in line to be effective until 2030 or beyond.

National Grid plans to waive cancellation charges – but so far only for those who said they want to leave the register during the amnesty window between October 2022 and April 2023, and have submitted relevant cost information. The group of beneficiaries from the waiver may be extended, though. The lost income recurred from the fee waiver, meanwhile, will be recovered from all users of the grid via Transmission Network Use of System (TNUoS) charges. ■



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Thi Vai terminal is being delivered to clients at Phu My industrial zone – though most of the fuel will be used to generate electricity.

Two combined-cycle Nhon Trach 3&4 units (750 MW each), situated near the regas terminal, are scheduled to start operations in early 2024.

Aspiring for LNG-fuelled power

Vietnam has been suffering from a protracted gas shortage and hence rushes to build LNG import capacity as the government wants to strengthen the role of gas in the energy mix. The latest Power Development Plan envisages that there will be 13 new LNG power plants with 22,400 MW total capacity, and two more with 3,000 MW each will come online by 2035 to balance the demand within three regions: North, North Central Coast, and South.

To fuel this additional gas power capacity, there are further LNG regas terminals under development: The Export-Import Bank of Korea (Kexim) has signed a memorandum

to finance a \$3 billion integrated LNG regas and power generation project in southern Vietnam that will be co-developed with a 3 GW power complex in Long An province near Ho Chi Minh City, previously known as Saigon.

Moreover, Japan's Tokyo Gas and Marubeni set up a joint venture together with the Vietnamese manufacturer Colavi and PetroVietnam Power to build an on-shore LNG receiving terminal with a capacity of 2.5 mtpa and 1.5 GW gas-fired power station in Quang Ninh province. The project will cost an estimated \$1.92 billion, with commercial operations slated to start in the second half of 2027. LNG shipments will likely be arranged by Tokyo Gas which is understood to be close to striking a Power Purchase Agreement (PPA) with the electric power arm of PetroVietnam for all electricity produced at the Quang Ninh CCGT. ■

Gas to Power Journal

Publisher
Stuart Fryer

Editor
Anja Karl
Tel: +44 (0)7733 684 682
anja@gastopowerjournal.com

Advertising
David Jeffries
Tel: +44 (0)7973 642 086
djeffries@lngjournal.com

New Business & Databases
Stephan Venter
Tel: +44 (0) 207 017 3407
venter@gastopowerjournal.com

Subscriptions
Margarita Tokere
Tel: +33 (0)7 67 62 58 77
margarita@gastopowerjournal.com

Layout & Production
Vivian Chee
chee@thedigitalship.com

Cost of carbon, not gas makes German power prices soar; IFO says

It's hardly the price of gas that pushes up the price of electricity – the main driver in the EU and particularly in Germany is now the CO2 price that gas- and coal fired power plants have to pay for their emissions, the ifo institute finds. As these costs get passed through to end-users, there is a wrangling about a subsidized 'industrial electricity price.'

What is neglected in the political discussion: "There is already a legally coordinated instrument in the EU for these cost increases: electricity price compensation," ifo President Clements Fuerst said, dismissing the idea of an industrial electricity price, also referred to as a 'bridge price', as "not convincing."

Transitioning to such a bridge electricity price, in his view, is "imponderable under European law and would lead to a drastic expansion of the circle of recipients."

The subsidies are meant to be paid through the Climate- and Transformation fond (KTF) and for 2024, the coalition government has already budgeted up to €2,6 billion in a resolution on August 9. If the instrument of power price compensation gives way to an industrial power price, this could increase the number of beneficiaries from 341 last year to about 9,000 next year – ushering in a "subsidy race" in Europe.

EU-ETS made power gen costs explode

The cost for power generator having to buy carbon permits under the European Emission Trading Scheme (EU-ETS) have

been exploding since 2020: The price of carbon had for long been less than €20 per ton, but lately peaked at €100/t, while the price for natural gas in Europe has almost gone back to normal after the supply shock in 2021 and 2022, an ifo position paper reads.

An average CO2 price of €90, like in the first half of this year, is increasing the marginal cost of fossil power generation. For a gas-fired power plant with CO2 emissions of 500 gram per kilowatt-hour (kWh), this results in 4,5 cent/kWh in carbon costs. Given that such plants are often dispatched for peaking power supply, the cost of carbon gets added to the wholesale power price. If the marginal power plant is coal-fired, the effect is even higher as burning coal produces almost double the emission than burning gas.

The essential point is, according to ifo findings, that even if more than half of Germany's electricity is produced by renewable energy sources – the price setting is based on fossil peaking plants.

The German economy is struggling these days: As the only one among G7 countries, Germany expects to have a shrinking gross domestic product in 2023. The end of Rus-

sian gas imports through Nord Stream and rising energy prices have caused the energy-intensive industry in Germany to scale back production. Several companies want to relocate to countries with lower energy prices, which sparked a debate about whether Germany is at risk of deindustrialization and led to calls for subsidised electricity prices for certain industry.

ifo advises against 'policy of scarcity'

"Policy for Germany as an industrial location shouldn't cling to structures that are no longer competitive," the ifo President stressed, indicating that electricity costs in Germany are likely to be higher over the long term than in many other countries. Through its nuclear phaseout and refusal to tap its own shale gas resources, the German government is pursuing a policy of scarcity, Fuerst noted, adding that other countries are benefiting more from renewables while storage is still expensive.

Looking ahead, the aim should be to use market signals, i.e., prices geared to current shortages, and to expand infrastructure to achieve more efficient use of the available energy supply. ■

European carbon price (in € per tonne)

daily closing prices for CO2 trading; source: Frankfurt stock exchange



World is on track to see fossil fuels peak before 2030; IEA finds

The global energy crisis has ushered in the beginning of the end of the fossil fuel era: The International Energy Agency (IEA) sees a “phenomenal rise of clean energy technologies” that would make demand for coal, oil and gas to reach a high point before 2030. By then, renewables could account for half of the global power mix, up from around 30% today.

The share of coal, oil and natural gas in global energy supply – stuck for decades around 80% – starts to edge downwards. In the IEA’s latest World Energy Outlook, fossil fuels are forecast to fall to 73% by 2030, allowing global energy-related CO₂ emissions to peak by 2025.

The energy world is set to change significantly by 2030 as clean energy technologies will surge based on today’s policy settings alone: “The transition to clean energy is happening worldwide and it’s unstoppable. It’s not a question of ‘if’, it’s just a matter of ‘how soon’ – and the sooner the better for all of us,” said IEA Executive Director Fatih Birol. He urged governments, companies and investors to “get behind clean energy transitions rather than hindering them.”

Solar will generate more electricity than the entire United States does currently, and renewables will account for near 50% of the global power mix, up from around 30% today.

China turns to clean energy

Energy demand in China – the world’s largest consumer – is expected to peak around 2025 as its economy slows and undergoes structural changes. China’s GDP growth is forecast to average just under 4% per year to 2030,

Solar PV capacity additions in the IEA’s Stated Policies Scenario, 2015-2030



putting a lid on energy demand.

If China’s near-term growth were to slow by another percentage point, this would reduce 2030 coal demand by an amount almost equal to the volume currently consumed by the whole of Europe. Oil import volumes would decline by 5% and LNG imports by more than 20%, with major implications for global balances, IEA analysis finds.

Dynamic growth in clean energy sources will help reduce China’s fossil fuel demand and make emissions decline. In 2022, China was home to around half of wind and solar additions and well over half of global EV sales worldwide.

But the world’s demand for fossil fuels

around the world will likely stay “far too high” to remain far too high to achieve the Paris Agreement goal of limiting the rise in average global temperatures to 1.5 °C.

Analysts hence propose a five-pillar strategy, namely:

- Tripling global renewable capacity
- Doubling the rate of energy efficiency improvements
- Slashing methane emissions from fossil fuel operations by 75%
- Establishing large-scale financing mechanisms to support clean energy investments in emerging and developing economies
- Pursuing measures to ensure an orderly decline in the use of fossil fuels.

US gas-burn recovers but set to fall in 2024 due to renewable build-out

Gas-burn for power generation has risen by 3% to about 42% of the US power mix due to relatively low prices for the fuel, retirement of 10 GW of coal-fired generating capacity and addition of 5 GW highly efficient gas turbine capacity. Come 2024, however, analysts anticipate a significant drop in fossil fuel-fired generation as the renewables build-out progresses.

Some 40 GW of solar and wind-based generating capacity is scheduled to enter service next year, up 16% from this year,

making the share of electricity produced from renewables rise from 22% this year to 25% in 2024. The rapid build-out of renewables with near-zero operating costs is reducing the need to dispatch gas- and coal-fired power plants – particularly if renewables are paired with energy storage.

Fuel cost of gas cheaper than coal

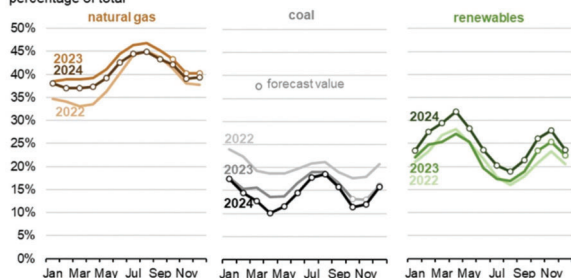
Between March and July 2023, the US Energy Information Administration (EIA)

estimates that the cost of producing power from combined-cycle natural gas power plants averaged \$25 per megawatt-hour (MWh), lower than the estimated \$31/MWh cost for generation from coal-fired power plants. During the

same months last year, the cost of operating CCGTs stood at \$55/MWh – 90% higher than for coal-fired power plants (\$29/MWh). The price of gas will likely increase in 2024, which should bring the costs of generating electricity from coal and natural gas closer together. Analysts peg next year’s cost of gas-fired electricity \$32/MWh compared with an average \$29/MWh for coal-fired power.

However, the share of gas in the American power mix is hence forecast to fall to 41% next year, EIA analysts find. Despite a rise in overall electricity output in 2024, analysts expect the contribution of both natural gas and coal will fall, displaced by offshore wind and solar power. Solar PV will power the lion’s share of new renewable capacity, with a staggering 25 GW to be added throughout 2023, complemented by an 8 GW rise in wind-generating capacity.

U.S. electric power sector generation share for selected energy sources percentage of total



Data source: U.S. Energy Information Administration, Short-Term Energy Outlook, October 2023



MAN and Energy Dome join forces on CO₂ battery technology

Bavaria-based MAN Energy Solutions and Energy Dome, an Italian provider of long-duration energy storage (LDES), have entered into a memorandum for non-exclusive collaboration. Energy Dome's first commercial CO₂ battery plant in Italy will use a 20 MW CO₂ expander from MAN with the turbomachinery to be shipped in summer 2024 for installation.

Energy Dome's technology is based on a closed thermodynamic transformation of CO₂ between its gaseous and liquid states. When operating in charge mode, the CO₂ is withdrawn from an atmospheric gasholder, the Dome, and compressed into an inter-refrigerated compressor, driven by a motor.

The heat generated from the compression is stored in a thermal energy storage system, whereas the CO₂ is liquefied and stored in vessels under pressure at ambient temperature with zero atmospheric emissions. This allows for high-density energy storage without using extreme cryogenic temperatures.

In discharge mode – whenever energy is needed – the CO₂ is heated up, evaporated and sent into an expander before it flows back into the Dome. The expander drives the generator in order to feed climate-neu-

tral electricity into the grid.

"To fully renewable energy, we need for efficient and cost-effective ways to store it," Claudio Spadacini, CEO of Energy Dome said, underlining "our CO₂ Battery is a concrete solution that will change how long-duration energy storage is adopted; [and] the combination of MAN Energy Solutions' turbomachinery know-how with our design ensures that anyone considering the adoption of our technology solution can do so with confidence."

With the collaboration, both man-

ufacturers want to "leverage their collective strengths and expertise to accelerate the deployment of sustainable energy storage plants," added Matteo Falco, Head of Industries, Region Europe at MAN Energy Solutions. ■



Close-up of CO₂ battery

Siemens Energy to deliver grid stabilisation and battery in Ireland

The first-ever hybrid grid stabilisation and battery storage plant will be delivered by Siemens Energy at Shannonbridge in Ireland. The synchronous condenser uses a generator with a connected flywheel and is essentially a big "rotated mass" which delivers 4,000 MW of inertia to compensate for frequency fluctuations in the grid, while the 160 MWh battery stores excess renewable energy.

Fast renewables build-out is vital for Ireland as the country aims to reach net-zero by 2050 and to reduce emissions by 51% by the end of the decade. Moreover, Ireland is facing a significantly growing electricity demand, in part due to its global digital and data hosting industry.

However, fluctuating supply of wind and solar power can cause sudden drops in frequency, which could lead to load shedding measures to avoid power cuts. To pre-empt this risk, the generator and rotating flywheel at Shannonbridge immediately deliver iner-

tia onto the system while the large-scale battery can store or release excess renewable energy. With 160 MWh storage capacity, the battery could supply around 9500 households with electricity for a full day.

Flexibility on offer

The current market mechanism in Ireland allows operators to sell services like inertia, short circuit power and reactive power as provided by the synchronous condensers to the transmission system operator (TSO). To support this, Siemens Energy will also provide an energy management system allowing the customer to respond to market demands and power needs in real-time.

"Battery storage systems will play an increasingly pivotal role in tomorrow's global energy infrastructure," said Tim Holt, member of the Managing Board of Siemens Energy, stressing the Shannonbridge hybrid solution will "help ramp-up renewables by offering storage and stabilization technology in one connection." ■



Combined-cycle plant in Rayong

NEWS NUDGES

DOE to fund Mistral energy storage

The United States Department of Energy (DOE) plans to fund projects that will use 84 MWh of Invinity's next-generation product, code-named Mistral, in six sites across the country. The projects were selected because they can deliver stored electricity for a period of 10 hours or more and are deemed vital for turning variable wind and solar production into a reliable, round-the-clock power source.

Knight demonstrates X15 engine

Knight Transportation has successfully tested Cummins' new X15N natural gas engine in Southern California – realizing NO_x and greenhouse gas reductions without compromise to performance. The truck is fuelled exclusively with renewable natural gas and the field testing with Knight-Swift will continue through full production of the X15N powertrain in 2024.

Hamriyah IPP commissioned in the run-up to COP28 in Dubai

All three blocks at the Hamriyah Independent Power Plant (IPP) have been commissioned in the emirate of Ajman near Sharjah, delivering 1,800 MW of electricity to the grid in the run-up to the COP28 Climate Summit in Dubai. The 1,800 MW power station is driven by GE Vernova H-Class gas turbines operating in combined-cycle mode.

Sharjah Hamriyah Independent Power Company (SHIPCO), the owner of Hamriyah IPP, pointed out the CCGT is the most efficient gas power plant operating in the Middle East and Africa (MEA). This helps lower emissions in Ajman city – the capital of the UAE's smallest emirate – as well as in neighbouring Sharjah.

Most of the electricity generated by Hamriyah IPP is being sold to Sharjah Electricity, Water and Gas Authority (SEWA). The three 9 HA.01 turbines, installed at the CCGT, are expected to generate a 1.8 GW of power with up to 4 million fewer tons of CO₂ per annum



Night-time view of Hamriyah IPP

when compared to generating the same amount of electricity with legacy technology.

The UAE's aims to reach net zero carbon emissions by 2050 and SEWA chairman Saeed Sultan Al Suwaidi vowed the Hamriyah IPP will "strengthen Sharjah's grid with lower carbon power" and is expected to meet up to 40% of the emirates' electricity needs.

Innovative financing structure

"The Hamriyah IPP was a special project in many regards," GE Vernova's MEA chief executive Josef Anis said with reference at the plant's innovative financing structure to the global workforce that executed it during the Covid-19 pandemic and the record-setting H-class technology powering it.

Together with Japan's Sumitomo Corp, GE Vernova's financial services arm in 2021 raised \$1 billion in project financing. On reaching financial close, the co-developers

formed an equity consortium, SHIPCO, for the project with Shikoku Electric Power Company and Sharjah Asset Management, the investment arm of Sharjah Government, to build, own, and operate the project.

SHIPCO chairman Omar Almulla specified the commercial operation of all three blocks was the result of over 11 million hours of work done by more than 1,500 people from over 20 countries from across SEWA, SHIPCO, GE Vernova, and other stakeholders. GE Vernova built the plant under a turnkey EPC contract and delivered the three 9 HA.01 turbines, three H83 generators, three STF-D650 steam turbines powering three A74 generators, and three heat recovery steam generators (HRSGs). The American manufacturer also plans to provide parts, repairs, and maintenance services for power generation assets at the site for about 25 years. ■

Sembcorp and IHI eye retrofitting Sakra power plant with ammonia

Singapore's Sembcorp Industries and Japan's IHI Corp have agreed for GE to join their efforts of retrofitting the 815 MW Sakra cogeneration plant to ammonia co-firing. Sakra was Singapore's largest and most efficient CHP when commissioned in 2001 and the retrofit is aimed to reduce its carbon footprint, said Sembcorp CEO Southeast Asia, Koh Chiap Khiong.

The partnership extends an accord between Sembcorp and IHI, sealed in 2022, to explore ammonia direct combustion systems. The aim is to deploy a retrofitable, 100% ammonia capable combustor that is compatible with specific GE turbine models, Sembcorp explained.

Decarbonising Singapore's fossil power plants

The project is meant to assist Sembcorp, Singapore's largest power producer and major LNG importer, to generate low-carbon energy from its existing fossil power plants and bolster industry confidence for setting up an ammonia value chain in the Asian island and city state.

The Sakra cogen plant, a 600 MW combined-cycle gas power plant, had been intended to operate with at least 30% hydrogen when it was built together with Keppel Infrastructure. Separately, a risk assessment is underway for the use of 100% of ammonia in a combined-cycle gas turbine. Both GE and MHI are competing to deliver relevant equipment.

IHI is developing ammonia combustion



Sakra CHP on Jurong Island

technologies and infrastructure that can be "safely retrofitted" to existing power plants, thereby establishing "true reductions in carbon emissions," the company's managing executive Jun Kobayashi said. The retrofit of such technologies also helps "future-proof existing investments in power generation," he added.

GE Vernova will bring its expertise in engineering and manufacturing gas turbine combustors and balance of plant systems. "We hope this collaboration will pave the way for power plant operators to adopt carbon-free combustion fuels such as ammonia in GE gas turbines, to significantly contribute towards lowering carbon emissions in the power sector in Asia and beyond," said GE Gas Power Asia CEO Ramesh Singaram. ■

PowerSouth and Mitsubishi start up Lowman Energy Center

US utility PowerSouth Energy Cooperative and Mitsubishi Power have commissioned the 693 MW Lowman Energy Center (LEC) in Leroy, Alabama, where it replaces a now-retired 556 MW coal-fired plant. The new combined-cycle plant is powered by Mitsubishi's air-cooled M501 JAC gas turbine and can produce enough energy to supply 300,000 homes annually.

Fully operational as of late September, the Lowman CCGT features outstanding operability, including reduced start-up time and reliable long-term performance. The flexible plant supports the growing energy needs of PowerSouth's distribution members in Alabama and Northwest Florida.

Because the Lowman CCGT uses excess heat to boil water for the steam turbine unit, energy can be captured that would have otherwise been wasted which boost efficiency and lowers emissions. Mitsubishi supplied the main generating equipment and will provide service and maintenance for the plant under a long-term service agreement. ■

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