U.S. POWER INDUSTRY OUTLOOK 2022

Biden Administration Stresses New-Build Renewables; But Rising Gas Prices Gave New Life to Coal-Fired Generators.

BY BRITT BURT AND BROCK RAMEY

lections have consequences," goes the political adage. That was particularly true for the electricity generation business during the first year of the new administration. On Day 1, President Biden issued a flurry of executive orders, including one to make

the electric generation business carbon-free by 2035 as a step toward a netzero carbon economy by 2050.

All federal agencies were instructed to review, with an eye to reversing, all actions taken by the Trump administration that might conflict with or undermine the new president's commitment to decarbonize the electricity business and the broader economy.

"Confronting the carbon crisis" became a catchphrase. In some ways, this follows in the wake of the electricity business, which has been decarbonizing for



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years. That trend has been the product of federal and state tax incentives, state regulatory mandates, and technological gains that have improved the cost competitiveness of renewable energy. A growing preference for no- or low-carbon electricity also continued to gain traction among consumers and businesses during 2021.

A January 20, 2021, executive order revoked several executive orders from his predecessor on energy and electricity. Other Day 1 moves included returning the U.S. to the Paris Agreement and establishing an interagency working group to determine the social cost of greenhouse gases. Former EPA Administrator Gina McCarthy also became the first-ever White House national climate advisor.

"The world must be put on a sustainable climate pathway to protect Americans and the domestic economy from harmful climate impacts, and to create well-paying union jobs as part of the climate solution," the executive order stated.

ENERGY TRANSITION

The U.S. transformation from hydrocarbon-based electric generation to lesseror non-emitting generation accelerated during 2021, and most experts see further acceleration in the years to come.

Although the COVID-19 pandemic cut overall electricity demand by 3.9% in 2020, the virus did not alter the existing trend to build fewer new power plants that burned coal or gas. For the 2022-2026 period, Industrial Info Resources (IIR) expects renewables will continue to constitute the overwhelming majority of new-build U.S. electric generation projects, accounting for about 88% of all new electric generation capacity. Gas will account for about 11% over that fiveyear period, with nuclear, fuel oil and coal sharing the remaining 1% of new generation construction (see map).

About 316,000 megawatts (MW) of new-build generation projects are being tracked with a scheduled construction start date between 2022 and 2026. Not all planned projects will be constructed according to their original schedules. Depending on the technologies involved, and developers' ability to secure financing, offtake arrangements, and regulatory support, we typically see between one-quarter and one-half of all announced projects delayed or cancelled. But then again, new projects are announced on a near-daily basis.

While all 316,000 MW of new generation are not expected to be built as announced, the trend for the 2022-2026 period is clear and consistent with longstanding projections: cleaner and greener new-build generation.

And while coal has been out of favor in the new-build market for some time, the black rock certainly came to the rescue of existing electric generators and consumers in 2021.

Once COVID-19 vaccines became readily available, U.S. consumers responded with a vengeance, driving up gross national product (GNP) and with it, electricity demand. For 2021, the U.S. economy is expected to grow 6.6%, and another 5% in 2022, according to mid-year 2021 projections from the U.S. Energy Information Administration (EIA). Based on projected strong economic growth (and assuming COVID is contained), the agency forecasts 2021 electric demand to grow about 2.7%.

Rising electricity demand in 2021 came as natural gas prices were on the upswing, rising about 60% through the first seven months of 2021, to about \$4 per million British thermal units (MMBtu). For 2021, the EIA projected gas will average \$4.46 per MMBtu.

Generators that could switch fuels increased their use of coal in 2021, driving up coal use about 17% compared with 2020 (Figure 1). The EIA's preliminary estimate of coal use in 2022 by power generators shows a decline of about 9% in 2022, as asset owners switch back to what they assume will be lower-cost gas. But as wave after wave of summer heat drove up electric demand, gas prices similarly went upward while coal stayed relatively flat. Could coal hold onto some of its newfound gains in the electric fuels market in 2022?

Electricity generators drew down on their coal inventories to meet rising demand, according to EIA estimates (Figure 2). Roughly 23% of U.S. electricity was generated by coal in 2021, up from 20% in 2020, the EIA said. In 2022, coal's market share is expected to fall to 21%. Existing coal- and gas-fired generators continued their bare-knuckled fight in the electric fuels market, where a shift of a few pennies per MMBtu can cause generators to swing from one fuel to the other.

New-build coal-fired generation, however, continued to struggle in 2021 and faces a bleak future over the 2022-2026 period. Another recent force increasing King Coal's misery has been the rising influence of environmental,



Figure 1: Electric generators expected to increase use of coal in 2021, 2022 Source: Electric Power Monthly and Short-Term Energy Outlook reports, U.S. Energy Information Administration

U.S. electric power coal inventories million short tons



Figure 2: Coal inventories at U.S. generators forecast to fall below five-year average Source: U.S. EIA Short-Term Energy Outlook (July 2021)





social and governance (ESG) investing, which effectively bans investment in the coal business. By some calculations, ESG assets under management (AUM) soared to more than \$100 trillion by the end of 2020 (Figure 3).

During 2021, generators across the U.S. announced plans to phase out coal in the pursuit of net-zero carbon emissions. That trend is expected to continue in 2022 and beyond.

The Tennessee Valley Authority (TVA), for example, has retired or announced the retirement of about 8,600 MW of coal-fired generation. It is

evaluating the impact of retiring the remaining 6,000 MW of its coal fleet by 2035. That retired generation has been replaced by adding nuclear, solar and gas-fired generation as well as upgrading its hydroelectric power stations.

In a mid-year 2021 announcement, TVA said it planned to invest about \$1 billion to build new gas-fired combustion turbine generators totaling approximately 1,500 MW. The new facilities will replace aging gas-fired combustion turbines.

In announcing that decision, Jacinda Woodward, senior vice president of power operations at TVA, said, "As we



Figure 3: Investors jump onto ESG train Source: United Nations Principles for Responsible Investment

continue to evolve our generation portfolio, natural gas is the right choice at this time because it provides the flexibility and reliability we need to add more solar energy. It's important to remember that solar power is an intermittent generation source, but natural gas delivers reliable electricity even when the sun doesn't shine." TVA will continue to consider natural gas' role in its fuel mix as it studies the closure of its remaining coal fleet by 2035 while adding about 10,000 MW of new solar generation.

TVA's announcement came during a year when asset owners from Oregon to Florida announced plans to accelerate their move away from coal. During 2021, coal plant closure announcements were made by numerous asset owners, including Consumers Energy, Alliant Energy, Vistra, GenOn, Xcel Energy, PPL, Minnesota Power, NRG, Mississippi Power, American Electric Power and Lakeland (Fla.) Electric.

IIR expects a surge in renewable energy construction over the 2022-2026 period, which would push overall new-build generation for that period to nearly 316,000 MW, up nearly 50% from the five-year plans of only one year ago (Figure 4).

COAL OUTLOOK

At mid-year 2021, roughly 42,000 people were working as coal miners, up slightly over the year-earlier number of about 39,700. But the ranks of coal miners have thinned by about 75% since 1985, according to data tracked by the St. Louis Federal Reserve (Figure 5).

In recent decades, employment in industry has been crippled by increased automation of mining, coupled with demand being crushed by ever-more stringent environment regulations, and the rising competitiveness of substitute fuels like gas and renewables.

U.S. generators closed more than 100,000 MW of coal-fired generation between 2010 and 2020, and another 34,000 MW is expected to close during the next five years, according to data tracked by IIR (Figure 6). Though some states, like Wyoming, have tried to erect legal barriers to the closure of coal mines and coal-fired power plants, most observers don't think those laws will be upheld by the courts. Economics more than laws will determine the future of coal and coal-fired generation in the U.S.

Over the 2022-2026 period, construction is unlikely to begin on any new-build coal-fired power plants. Capital spending at coal generators will be for environmental remediation, particularly cleaning up coal ash ponds, and in-plant capital improvements like turbine upgrades.

NATURAL GAS OUTLOOK

Construction on about 35,000 MW of new-build natural gas-fired generators is expected to start during the 2022-2026 period. That's about 11% of the 316,000 MW of new generation that developers plan to begin building during that fiveyear timeframe (Figure 7). The areas with the greatest amount of planned newbuild gas generation are the Great Lakes, the Mid-Atlantic, the Southwest, the Rocky Mountains, and the Northeast. Very little new gas generation is scheduled to be built in the Southeast, Midwest, or West Coast.

Developers and asset owners who have delayed or cancelled gas-fired, newbuild generation typically cite "market forces" as the reason for their decision. That covers a wide range of factors, including an inability to obtain financing, reach offtake agreements, or secure transmission rights. As gas pipelines start to run into opposition, stymied gas pipeline projects like the Atlantic Coast Pipeline are another market force with which developers have to contend. Finally, another powerful market force is a state's regulatory regime, and several have turned against gas in recent years.

Renewables will continue to constitute the overwhelming majority of newbuild U.S. electric generation projects.

That's certainly the case in California, Arizona and New York, where state commitments to reduce greenhouse gas emissions in the electric sector or increase the percentage of renewable energy in the electric mix work against gas. In addition, methane emissions have emerged as another market force working against natural gas generation. Methane is a much more potent greenhouse gas than carbon dioxide, at least over the short term.



Figure 5: U.S. coal-mining employment rises a bit Source: Federal Reserve Bank of St. Louis









The cancellation or delay of approximately 48 new-build gas-fired power plants has been documented in 25 states that were scheduled to begin construction in 2021. The total investment value of those plants was about \$12.6 billion. As more states, and possibly the federal government, enact measures that cut against gas-fired generation, the number of new-build generation projects should continue to decline over the 2022-2026 period.

About 35,000 MW of new-build gas-fired generation is scheduled to begin construction between 2022 and 2026. That is down a little over 10% from last year's five-year tally and about 60% less than what was planned to kick off construction during the 2019-2023 period.





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It was not that long ago that the power industry was proclaiming a "dash to gas," as coal plants closed and before sharp declines in renewable energy costs. But recent trends shows a dramatic slowdown in new-build gas generation. Though most U.S. regions show a decline in planned gas-fired project kickoffs, the most dramatic declines are in the West Coast and Southwest (Figure 8).

RENEWABLES OUTLOOK

Gas' loss has been renewables' gain. Renewables are now projected to account for about 88% of all U.S. newbuild generation capacity over the 2022-2026 period, roughly eight times the amount of gas-fired generation scheduled to be built over that time (Figure 9).

That gap has widened over time. In 2018 looking at a five-year construction



Figure 8: Planned new-build gas-fired generation, by region over five-year periods (GW) Source: IIR



Figure 9: Proposed New-Build Generation, Renewables vs. Gas Source: IIR

cycle between 2019 and 2023, renewables were scheduled to account for about 57% of all new-build generation scheduled to be built in the U.S compared with 41% for gas. But renewables' improving cost competitiveness stemming from efficiency gains, coupled with a growing embrace by regulators and Corporate America, has widened its lead in the new-build race.

Over the next five years, solar is expected to surpass wind for the first time in utility-scale renewable energy construction (Figure 10). The widespread popularity of rooftop solar, both for residential and commercial settings, is not reflected in Figure 10, so the growing popularity of rooftop solar likely would give that energy source an even larger slice of the renewables' pie.

About 1,450 renewable energy projects are scheduled to begin construction over the next five years. Those projects have a total investment value of about \$390 billion.

Again, all of those projects are unlikely to begin construction as scheduled. But over the next five years, the new-build renewable power business looks particularly green in the Rocky Mountains, the Southwest, the Great Lakes and the West Coast (Figure 11).

Nevada and Arizona are the states in the Rocky Mountain region with the largest dollar value of solar projects under development. In the Southwest,



Fig. 10 Planned Renewables Construction, 2022-2026 Source: Industrial Info Resources



Figure 11: Dollar value of planned new-build renewable energy generation Source: Industrial Info Resources



Figure 12: Dollar value of planned new-build windpower, by region Source: Industrial Info Resources

solar project activity is taking place almost exclusively in Texas. The Great Lakes region also has a robust pipeline of solar projects being developed, with Ohio and Indiana in the lead, followed by Kentucky and Illinois, according to project data being tracked.

Although fewer wind projects are being developed than in prior years,

mostly because the areas with the best quality wind resource already have been tapped, the Rockies, Midwest, Southwest and New England are the regions with the largest dollar-value of wind power projects scheduled to begin construction between January 2022 and December 2026 (Figure 12). The Rockies, Wyoming, New Mexico, and Arizona are the regions and states with the largest dollar value of wind projects under development, according to data tracked.

The \$390 billion of renewable energy projects under development include 27 offshore wind projects valued at about \$39 billion. The Atlantic Ocean is far and away the leading body of water for proposed offshore wind power projects. The Biden administration wants to see as much as 30 gigawatts (GW) of offshore wind power developed in the Atlantic Ocean by 2030.

When politicians try to fight against markets, markets often win. We saw that most clearly in the Trump administration, which unsuccessfully fought against market forces to try to restore coal in the electric fuel mix. But Biden is taking the opposite approach, working to accelerate market-driven changes already well underway.

While in years past renewable energy projects would have had to include the cost of a transmission line to bring the energy to a market hub, several renewable energy projects announced during 2021 plan to be built on or near large shuttered plants to take advantage of existing transmission infrastructure.

Examples are NextEra Energy's plan to construct a 690 MW solar plant next to its closed Duane Arnold nuclear plant in Iowa, and Xcel Energy's plan to build a 460 MW solar plant on the site of its soonto-be-closed Sherco plant in Minnesota. There should be many more over the next five years. Use of existing transmission lines also enables a developer to fast-track their project around clogged queues in regional markets.

NUCLEAR OUTLOOK

The outlook for new-build nuclear is as bleak as the outlook for renewables is upbeat. The only planned new-build nuclear project, the Blue Castle nuclear power station in Utah, continues to be developed, with a planned construction start date of spring 2025 and a projected start-up date of mid-2032. The Blue Castle project is expected to utilize two 1,100-MW advanced passive reactors from Westinghouse. This project has been on the books for more than a decade, and its projected costs have mounted as its

commercial operation date has been pushed back. There is a very low probability of this project ever getting built.

At the other end of the spectrum, a small modular reactor (SMR) project called the Carbon-Free Power Project continues to be developed by the Utah Associated Municipal Power Systems (UAMPS), a group of community-owned electric utilities across the intermountain West.

In 2020, the group received a ten-year, \$1.4-billion grant from the U.S. Department of Energy to develop and deploy 720 MW of SMRs in 60-MW modules. Originally, 12 were planned to be built at the Idaho National Laboratory in Eastern Idaho, with construction starting in 2025. But plans for that project were scaled back in mid-2021, as some UAMPS utilities rethought their participation in the project.

Now, the UAMPS project envisions constructing only six modules, but a spokesperson for the group said these modules will be more efficient than previously thought. Instead of 720 MW consisting of 12 60-MW modules, the project now consists of six modules of 77 MW each, for a total of 462 MW.

Across the country in Tennessee, the Tennessee Valley Authority (TVA) is also contemplating SMRs as part of its plan to decarbonize



generation. The agency has big hopes for the smaller nuclear generators, but its long-term resource plan does not contemplate construction beginning until 2027 at the earliest.

The only new-build nuclear project still being constructed in the U.S. is the two-unit addition to the Alvin W. Vogtle Nuclear Power Station in Waynesboro, Georgia. Helmed by Southern Company subsidiary Georgia Power, Unit 3 expected to begin operating sometime during 2022. Unit 4 is scheduled to begin operating about one year later.

As the project missed milestone after milestone in recent years, a construction oversight panel filed ever-gloomier reports about the costs and in-service dates of the two new units. A mid-2021 report from that oversight panel cast serious doubt on Georgia Power's projected in-service dates for Units 3 and 4, and said construction costs could be as much as \$2.4 billion over the most recent agreed-upon amount.

Whenever those units are finished and whatever their eventual cost, expect a pitched fight at the Georgia Public Service Commission (GPSC) over how much of its investment Georgia Power can recoup from its customers. The unit addition's other three owners, all municipal agencies, are not jurisdictional at the GPSC. But whatever that panel decides about Georgia Power's 45.7% stake in the two new units could cast a long shadow over the other three owners' regulatory decisions about the prudence of that investment, the quality of construction, and the effectiveness of construction management.

The other owners of Vogtle units 3 and 4 are Oglethorpe Power Corporation, a 30% owner, the Municipal Electric Authority of Georgia, which has a 22.7% stake, and Dalton Utilities, a 1.6% owner.

Most of the value of work scheduled to be performed on nuclear plants over the next five years exists at the other end of the product life cycle: dismantling and decommissioning shuttered nuclear plants. A dozen closed nuclear stations are awaiting D&D work totaling about \$19 billion.

Roughly two dozen in-plant capital projects for nuclear generators are being tracked, including steam generator replacements, control upgrades, and extended power uprates. The value of this work is about \$1.8 billion.

ENERGY STORAGE OUTLOOK

The outlook continues to brighten for battery energy storage systems (BESS) to become a more significant part of today's marketplace (Figure 13). Regulators are providing incentives and allowing it to enter regional markets as a stand-alone generation resource. BESS is utilized for many applications, including: stand-alone generation resource; grid stability; renewable energy utilization; and storage for thermal generation. Demand for BESS is rising, particularly in areas prone to natural disasters. The fastpaced push in the West Coast and Southwest to integrate these systems into electric markets is another factor creating a boom in this sector.

In ERCOT, there is over 40 GW of BESS in early-to late-stage development being proposed for 2021-2023. This number may decline as projects confront permitting challenges, financing hurdles, and regional transmission constraints.

Another driver for BESS growth is the late-2020 extension of the federal Investment Tax Credit (ITC) for solar energy. The guidelines grant ITCs to BESS assets based on its proximity to solar generation, its ownership, and whether it was being charged at least 75% of the time. The extension of the Production Tax Credit (PTC) for wind energy did not include a BESS provision.

Like many other projects, BESS suffered COVID-19 supply-chain issues. The strong demand growth for lithium may act as a limiting factor in the near term, as projected

demand for that metal, used in electric vehicles, cell phones, smart devices as well as battery energy storage projects, far exceeds estimated supply. There have been calls to expand lithium processing facilities in the U.S., but any such project would be years away from commercial operations.

About 3.5 GW of battery energy storage that will become operational in 2021 is being tracked, an 80% increase over the capacity that began operating in 2020. Another 4.3 GW of BESS capacity is slated to come online in the U.S. by the end of 2022. The West Coast and Southwest are the regions with the highest level of project activity for BESS.

MICROGRIDS OUTLOOK

Currently, the U.S. has 115 operational microgrids that include over 2 GW of generation, according to the EIA. The referenced microgrids range from a segment of 500 kW to more than 100 MW.

Right now, these microgrids are being installed at military bases, universities and colleges, hospitals, police, fire and first responder stations, industrial complexes, government centers, and other settings where a high value is placed on having uninterrupted power. The annual spend to install microgrids is expected to be just below \$1 billion in 2021.

The pandemic dramatically slowed the deployment of microgrids in 2020 and 2021, and may not see a rebound until the pandemic and all its variants is conclusively defeated. COVID created a near-term pause in deployments, but growth should resume, possibly by mid-2022. The regions with the highest interest in microgrids are the West Coast and Southwest.

U.S. large-scale cumulative battery storage power capacity, 2003-2023



eia

Figure 13. Sharp increase expected in deployment of battery energy storage systems Source: US EIA



Natural disasters and prolonged power interruptions tend to drive microgrid deployment decisions, and there has been no shortage of natural disasters and power outages in recent years. Years of wildfires in the West, flooding, hurricanes, and the Texas grid breakdown of February 2021 are likely to lead a wider appreciation of the benefits of microgrids that utilize distributed generation such as solar or wind plus BESS.

The cost of a microgrid will not be irrelevant in a company's or agency's planning. But we expect more projects will achieve financial viability when entities sharpen their proverbial pencils and take a closer look at the cost of a microgrid compared to the cost of power interruptions or unreliable power.

Utility-scale microgrid projects, on the other hand, have encountered a variety of headwinds — including regulatory, permitting and financing — in recent years. Those headwinds have caused many projects to stall or be shelved. Construction costs continue to be a high hurdle to overcome at an estimated \$2.6 million to \$4 million per installed MW of capacity.

State and federal grants for research & development have supported microgrid deployment. Congress is scheduled to consider a clean energy bill that includes up to \$1.5 billion for microgrid R&D grants. About \$2 billion in planned microgrid spending for 2022 is being tracked, a doubling of planned spending for 2021.

DISTRIBUTED GENERATION OUTLOOK

Over the last several years, distributed energy resources (DER) have become a more important element of the power generation business. As a category, DER includes a wide range of assets in smaller-scale settings, typically less than 10 MW in size. Types of DER include: small combined heat and power (CHP) units; wind; solar; battery storage; flywheel; biomass; waste-to-energy incinerators; small hydropower; fuel cells; reciprocating internal combustion engines (RICE); and generation that is part of a microgrid.

DER also includes onsite power generation located at industrial or institutional sites such as colleges, universities, chemical processing plants, refineries, medical centers, military bases, manufacturing plants, and more.

More than 29 GW of DER generation currently under development across the country is being tracked, with an additional 1.4 GW of generation in the early planning stage, with possible deployment by 2022-2023. The regions with the largest planned spend on DER are the Southwest, Northeast, and Rocky Mountains.

Orders 828 and 842 from the Federal Energy Regulatory Commission (FERC) determined that DERs deserve to be compensated if they provide generation or frequency support. Utility generation owners continue to have some concerns about FERC Order 842.

In September 2020, FERC issued Order 2222, which expanded the definition of DER to include rooftop solar, electric vehicle charging system (EVC), and other micro-generation sources when coupled together. FERC followed that order with 2222-A, issued in March 2021, which removed other barriers to aggregated DERs in wholesale markets.

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LOOKING AHEAD

It is unclear whether full decarbonization of the U.S. electricity business can be achieved by 2035. But in the current business climate, decarbonization doubters have largely gone underground. Those advocating cleaner and greener power are driving the narrative. ■



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