

U.S. POWER INDUSTRY OUTLOOK 2025

Presidential elections are typically important for the power industry, but few in recent memory stack up to the potential consequences of the 2024 election.

BY BRITT BURT AND BROCK RAMEY

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This spring, near the end of a momentous term, the U.S. Supreme Court overturned a four-decade-old bedrock regulatory precedent that granted deference to subject-matter experts at regulatory agencies.

In deciding *Ohio v. E.P.A.*, the high court upended the process by which future, and potentially past, regulations would be determined for energy, the environment, vehicle safety, and food and drug safety—indeed the broader economy. The overturned case was one of the most-cited cases in federal regulatory law: *Chevron U.S.A., Inc. v. Natural Resources Defense Council*.

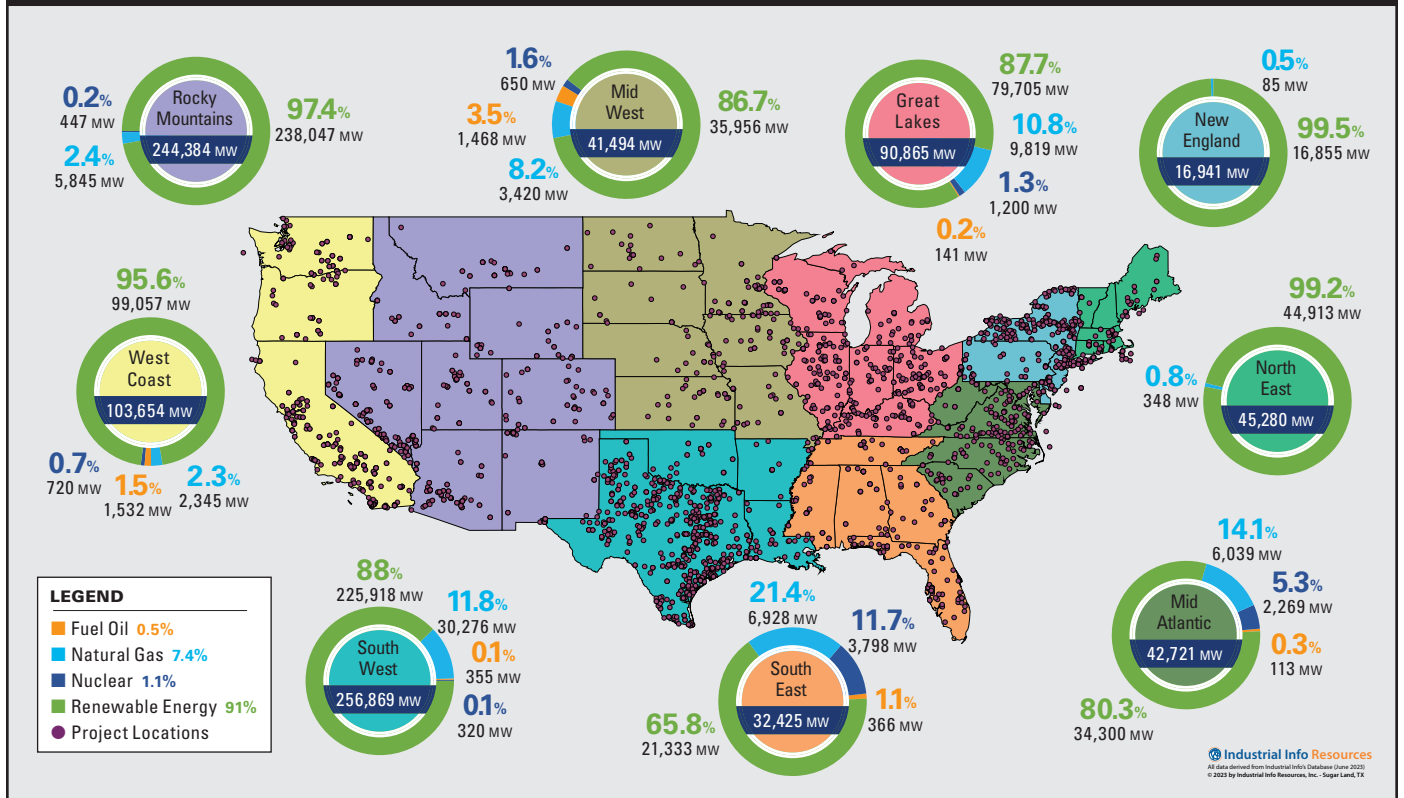
Well before the high court's July 1 ruling, Republican presidential candidate Donald Trump had repeatedly vowed to reverse, block, or at least defund many if not most of President Joe Biden's energy and environmental initiatives. The

Republican National Committee platform, adopted in July, included planks calling for the abolition of the electric vehicle (EV) "mandate," cutting burdensome regulations, and "making America the dominant energy producer in the world, by far."

Then, over the summer, as Biden's support fell apart, he bowed out of the race and endorsed Vice President Kamala Harris as the candidate to succeed him, creating a completely different electoral dynamic for November.

The results of the November elections—for the presidency, one-third of the Senate, and all 435 members of the House of Representatives—will likely have an outsize impact on companies that own and operate electrical generation assets in the United States as well as those who build or service those generators.

U.S. Power Generation Capacity: Under Development with Construction Kick-off Scheduled During 2024 - 2028



Industrial Info Resources
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However the elections conclude, events in the months preceding them should give pause to those who thought the United States was on a one-way trip to a carbon-free electric future:

The U.S. Supreme Court ruling in *Ohio v. E.P.A.* overturned a 40-year-old precedent in which experts in regulatory agencies were granted deference in crafting regulations when Congressional intent was ambiguous or unclear.

- FirstEnergy became the latest electric utility to delay the planned retirement of coal-fired generators, joining PacifiCorp, WEC Energy Group, Alliant Energy, Dominion, Santee Cooper, Omaha Public Power District, and Evergy. The list may grow longer as utilities grapple with the soaring electric demand growth coming from data centers, particularly those powered by artificial intelligence (AI).
- Google, Microsoft, and other tech companies disclosed that they no longer were on a net-zero trajectory, as the

energy consumption of their data centers effectively erased years of their use of renewable electricity.

- Power plant CO₂ emissions grew in the developing world more than offsetting reductions in developed economies.
- In a highly unusual move, the Supreme Court stayed the EPA's "Good Neighbor Rule" on air emissions, even as it was still being litigated by the lower courts.
- 2023 went down in the record books as the hottest in recorded history, and 2024 appeared on track to break that record. Extreme weather events—fueled, experts say, by global warming—are becoming more extreme, more frequent, more destructive, and more expensive.
- The Texas grid operator Electric Reliability Council of Texas (ERCOT) estimated there was a 12% probability of rolling blackouts this summer, as dramatically faster electric demand growth coupled with a shortfall of dispatchable generation caused the

agency to question its own ability to provide reliable electricity to Texans.

- Biden's EPA finalized a suite of Clean Air Act regulations, sure to be challenged by Republicans, sharply lowering emission standards from existing coal-fired power plants as well as future gas-fired generators. A separate rule, covering emissions from existing gas-fired generators, is expected later this year. That, too, is expected to draw legal challenge.
- Another executive-level agency, the Council on Environmental Quality, finalized changes to reform, update, and streamline the environmental review process in the National Environmental Policy Act (NEPA), another foundational piece of federal environmental regulation. Again, this final rule is almost certain to be challenged by GOP attorneys general and other parties, regardless of how power is apportioned in Washington, D.C., in 2025.

Throughout the spring, Biden's regulatory agencies worked to finalize rules on a wide variety of energy and environmental issues in the hope they could withstand challenge under the Congressional Review Act (CRA), a GOP-enacted measure that allows Congress to overturn any executive-agency regulation that was finalized within 60 legislative days of a presidential election. A majority vote in both houses is all that is needed to repeal any regulation enacted in the 11th hour of an outgoing presidential administration.

The key is legislative days, not calendar days. Congress was not in session for large chunks of June, July, and August, which moved the 60-day "lookback" date to as early as May 20, according to the Congress watchers at Arnold & Porter.

George Washington University's Regulatory Studies Center reported that federal agencies published 66 significant final rules in April, covering all manner of issues, higher than any month since the Reagan administration.

So yes, it was a busy run-up to the November elections. And no matter what the outcome of the 2024 election, it looks like 2025 will be a busy one for the U.S. new-build power industry.

In the United States, about 71 renewable energy projects were completed through July, and another 200 were scheduled to begin construction during the remainder of 2024, according to data tracked by Industrial Info Resources.

ENERGY TRANSITION

On taking office in 2021, President Biden confirmed his goal of cutting CO₂ emissions to zero for the power sector by 2035 as a first step to decarbonizing the entire U.S. economy by 2050.

For the domestic new-build power generation industry, the rush to renewables was well underway years before Biden placed his hand on the Bible on Jan. 20, 2021. That trend continued during 2024. In the United States, about 71 renewable energy projects were completed through July, and another 200 were scheduled to begin construction during the remainder of 2024, according to data tracked by Industrial Info Resources (IIR). The value of those completed projects is about

\$11.6 billion while the value of the second-half projects is nearly \$53 billion.

Looking forward to projects beginning construction during 2025 - 2029, IIR data shows only a slight slowdown in the rush to renewables: Approximately 91% of all power projects beginning construction during that time will be renewable, down slightly from earlier trends (see MAP and FIGURE 1).

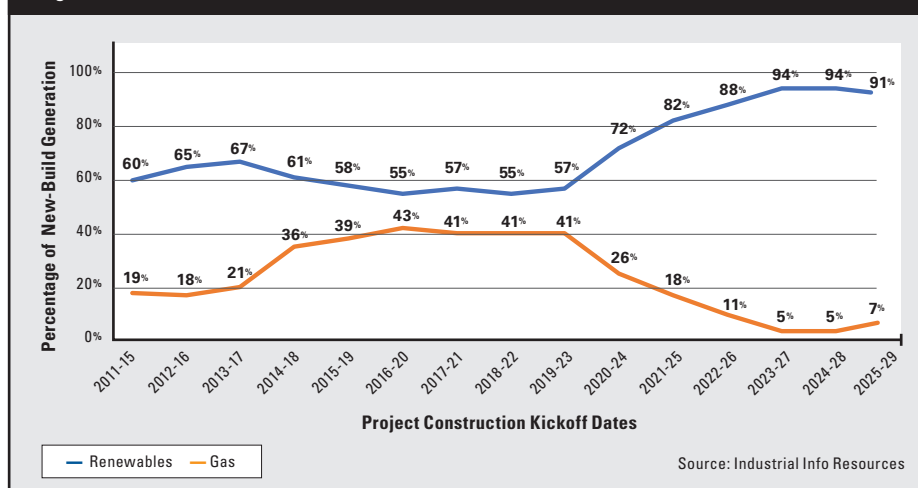
The 2022 Inflation Reduction Act's commitment of \$369 billion in federal funds to new-build renewable energy significantly strengthened the longstanding trend of heightened investment in new non-emitting electric generation.

That longstanding trend has been buttressed not only by federal money but also by the growing competitiveness of renewable electric generation and state lawmakers' and regulators' pronounced preference for non-emitting generation.

An adjacent Biden policy initiative, to spur the sales of electric cars and trucks, may also significantly impact new-build generation. At press time, the EV initiative appeared to be falling short of initial estimates, but results vary from state to state. California is still expecting a jolt to electric demand from electric transportation, but other states seem to be scaling back expectations.

Electric car and truck sales are on track to number roughly one million units in 2024, down from 2023's sales of 1.6 million units. The slower-than-expected uptake

Figure 1: Planned New-Build Generation, Renewables vs. Gas



TURBOMACHINERY MARKET INTELLIGENCE

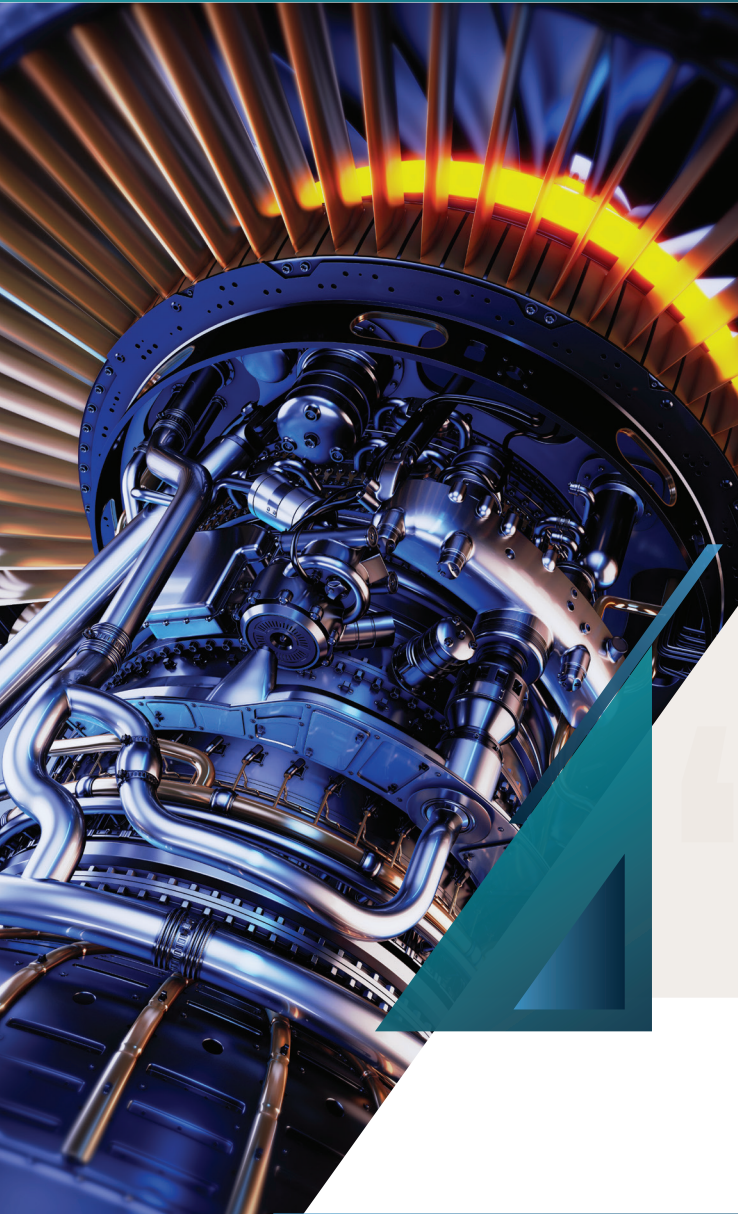
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- Which plant owners/operators are presenting the biggest spending potential?
- What are the key drivers shaping the current and future industrial market?

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caused the administration to revise its timeline for new, stricter new vehicle tailpipe emissions.

Previously rosy projections of EV sales had caused many electric utilities to boost their planned capital expenditures (CAPEX) to cover bulking up their electric distribution system so that it would not be overly stressed when clusters of EV owners came home from work and recharged their vehicles at the same time.

Like many other assumptions about the power industry, the slow uptake of EVs is causing some utilities to rethink their planned higher CAPEX spending to strengthen and expand their distribution networks.

But offsetting this trend is the sharp growth in demand from data centers, particularly those equipped with AI. Several utilities with data center clusters in their service areas, such as Dominion, Georgia Power, American Electric Power, and Public Service Electric & Gas, have been forced to increase their projection of electric demand growth, and thus CAPEX to build new generation.

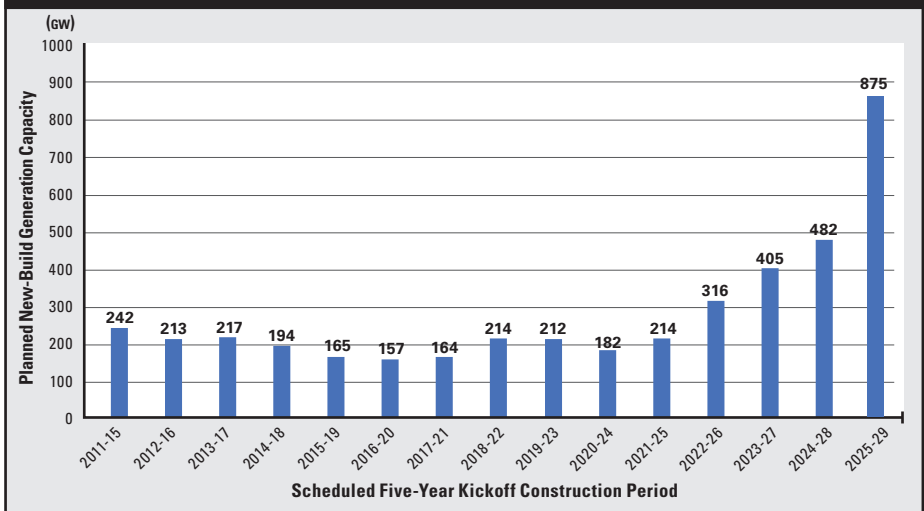
Some, but not all, of this new generation is slated to burn natural gas, but because many data center owners have signed sustainability commitments, IIR expects a good bit of this new generation will be renewables plus storage.

This year, electric reliability organizations, such as the North American Electric Reliability Corp. (NERC) and ERCOT, sounded alarms about whether electric generation will be sufficient to meet rising peak demand. Those concerns no doubt played into plans to dramatically increase new-generation construction projects in the United States.

Developers have sharply increased their planned construction kickoffs for all forms of generation for 2025 - 2029, according to data tracked by IIR. In analyzing prior five-year kickoff plans, data we tracked showed developers planned to begin construction of about 200 GW of new generation in the United States over successive five-year periods starting in 2011 (FIGURE 2).

Figure 2: Plans to Build New Electric Generating Capacity Skyrockets

Source: Industrial Info Resources

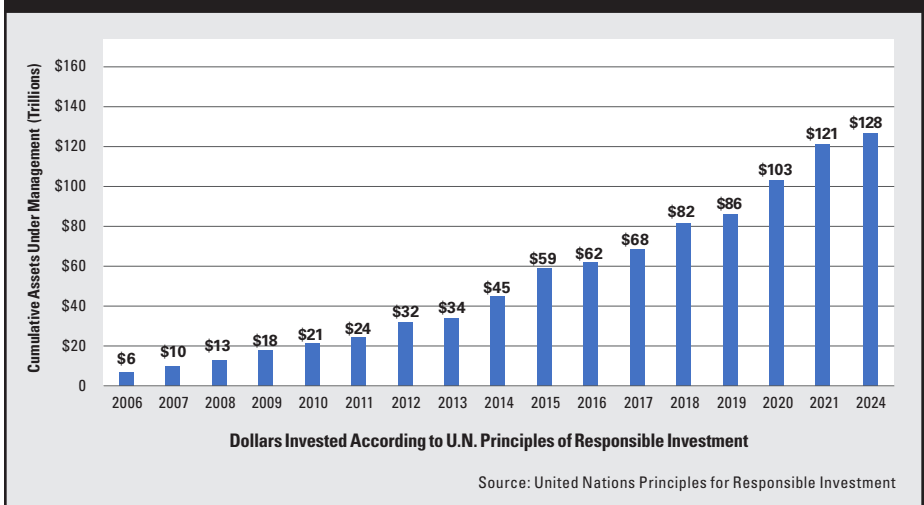


But in recent years, those plans have sharply accelerated. In IIR's most recent analysis of U.S. planned generation construction starts, covering 2025 - 2029, about 875 GW of new-build generation is scheduled to begin turning dirt, roughly four times the prior five-year period. This data includes all types of electric generation.

IIR does not expect all these planned generation projects will begin construction as slated. Many will be deferred, and some will be canceled outright. However, tracking power plant development suggests that many new projects will be added over the next five years.

Another factor influencing types of new-build generation construction is the continued influence of "sustainable" investing among institutional investors, pension funds, and other types of financial asset managers. A growing number of asset managers have pledged to abide by the U.N. Principles for Responsible Investment (PRI), which rules out investing in new coal generators and frowns on new-build gas generation. Through March 31 of this year, organizations that managed over \$128 trillion in funds have signed onto the UN PRI, continuing a yearslong rise (FIGURE 3).

Figure 3: Surge in Cumulative Investments in "Responsible" Companies and Funds



COAL OUTLOOK

In mid-2024, when FirstEnergy CEO Brian Tierney told the *Financial Times* the multistate utility holding company was abandoning the planned 2030 phaseout of coal-fired generation, he observed, “Some people think we were bad people for doing that. I think... we’re just honest.”

FirstEnergy operates 10 electric distribution companies that provide electricity to six million customers in five states in the Midwest and Mid-Atlantic regions. It also operates two coal-fired power stations in West Virginia with about 3,082 MW of combined generating capacity.

FirstEnergy’s operating utilities operate in the PJM Interconnection, a power market that includes northern Virginia, the world’s largest data center hub. Electricity demand in the PJM region is one of the fastest growing in the country, the *Financial Times* reported, with the operator this year more than tripling its growth forecast for the next decade.

“When we were looking at emissions reduction, it was based on running our coal-fired power plants less at the end of the decade,” Tierney said. “We don’t see a pathway for that now.”

He cited exceptionally strong electric demand growth, driven by existing and planned data centers in the Old Dominion state and elsewhere.

“The things that are bumping up against each other are people’s growing demand and desire for reliability, what’s affordable for most customers, and then what’s sustainable. It’s easier to make two of those three things congruent with one another. It’s harder to get all three solved at the same time,” Tierney told the *Financial Times*.

Tierney’s not the only utility chief struggling to balance the energy trilemma: reliability, affordability, and sustainability. But forced to make a choice, it appears he is willing to sacrifice sustainability to deliver reliability and affordability.

Those who lead electric utilities hold electric reliability as a foundational,

non-negotiable element of their mission. It’s the reason electric utilities exist. Everything else—safety, affordability, economic development, and, more recently, sustainability—comes after reliability. To meet soaring electric demand, they will use any and all resources at their disposal, starting with the most economical ones first.

As the cost of renewables has fallen steadily in recent years, utilities have embraced wind and solar. The hundreds of billions of dollars in federal support for renewables contained in the 2022 Inflation Reduction Act didn’t hurt, but the embrace of wind and solar was well underway before that law was passed.

Even as they embraced intermittent, non-emitting generation like wind and solar, some utility leaders did so grudgingly, mindful that the wind doesn’t always blow, and the sun doesn’t always shine. But regulators supported renewables, and what regulators want, they usually get.

One other trend we noticed this year: More asset owners were deferring the planned closure of coal-fired generators. At the start of 2024, IIR tracked nearly 5 GW of planned retirements for U.S. coal-fired generators, but by midyear, that slipped to about 3 GW. It may fall faster in the last months of the year.

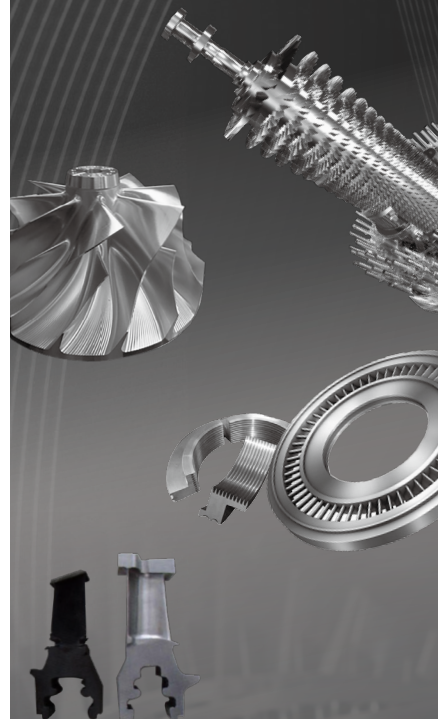
We expect the decision to close, or defer closing, coal-fired generation may lead to questions from regulators, lawmakers, and consumer groups. If that comes to pass, we expect utility leaders to say, in effect, “Increased CO₂ emissions were preferable to rolling blackouts.”

Since 2010, over 150 GW of U.S. coal-fired generation has been retired, forced by tightening environmental regulations, increasingly competitive natural gas prices, and the declining cost of renewables. Looking out over the next five years, IIR is tracking the planned closure of about 56 GW of coal generation (**FIGURE 4**).

But those numbers are not set in stone. In fact, as we have seen in 2024, they are subject to change.

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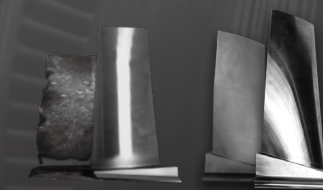


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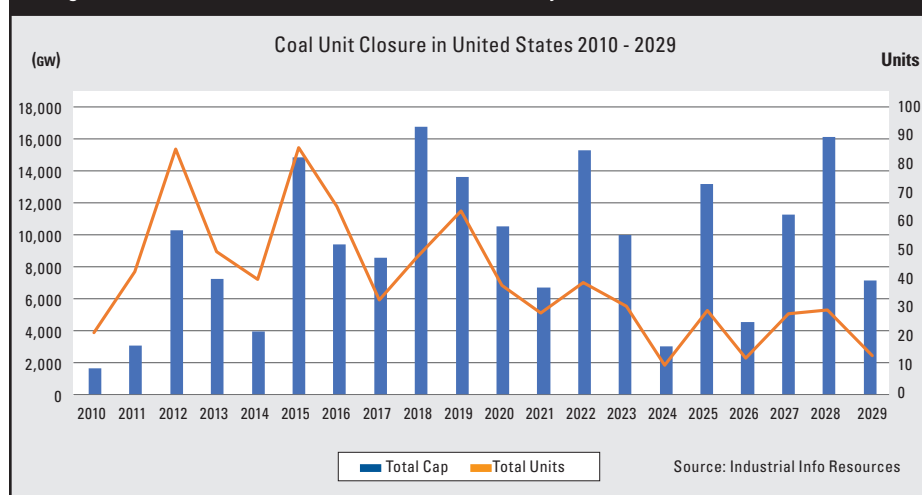
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Figure 4: Coal-fired Unit Retirements, Historical and Projected



We don't see any new-build coal generation projects kicking off over the next five years. That would extend a years-long trend. But we are seeing a surge in planned in-plant capital outlays, much of it for environmental upgrades, as asset owners seek to coax every megawatt-hour of generation out of existing coal-fired power plants. Right now, IIR is tracking about \$25 billion of active in-plant capital projects, more than 50% higher than we were tracking a year ago.

In-plant capital outlays are a broad category of projects that include automation; carbon capture, utilization, and

storage (CCUS); debottlenecking; decommissioning and demolition (D&D); efficiency upgrades; environmental remediation; life extensions; upgrades; and uprates.

Plant closures as well as in-plant capital outlays could shift dramatically over the 2025 - 2029 period depending on the results of the November elections. All other things being equal (meaning there are no catastrophic blackouts due to insufficient generation), if Democrats keep the White House and Senate, and retake the House, we expect to see an acceleration of coal plant retirements. The election of Donald

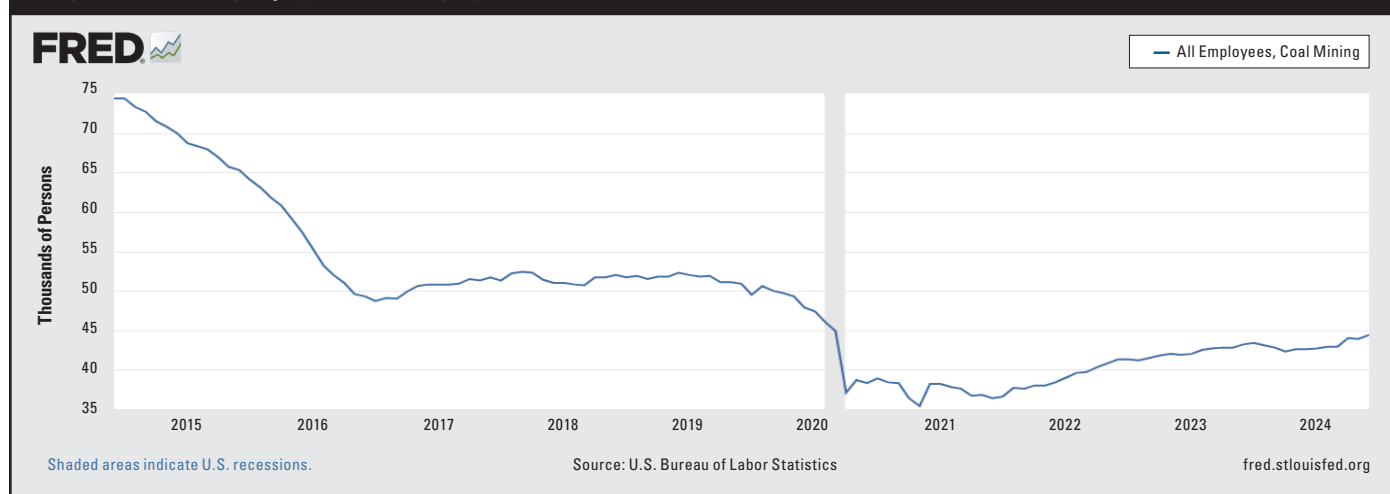
Trump, or a Republican trifecta, likely means a slowdown in coal plant closures.

The grim outlook for coal-fired generation in the United States mirrors the outlook for coal mining. The number of people engaged in coal mining has increased slightly since 2020 to about 45,000, but that number is down from peak mine employment of nearly 180,000 in the latter years of the second Reagan administration, according to the St. Louis Federal Reserve Bank (FIGURE 5).

The amount of thermal coal burned to generate electricity—after briefly rising in 2021 and 2022 as utilities restocked their fuel-depleted piles—fell in 2023 and the first half of 2024 (FIGURE 6). The U.S. Energy Information Agency projected the use of thermal coal to generate electricity will decline for the full year 2024 and 2025.

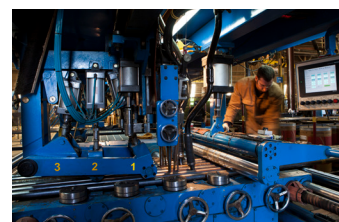
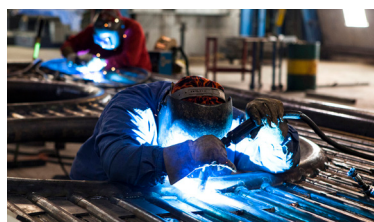
As coal use and coal mining have declined throughout Democratic and Republican administrations over two generations, it seems reasonable to project further reductions will take place post-2025. Automation and corporate consolidation are major factors affecting coal-mining employment. In the power sector, the abundance of inexpensive natural gas, coupled with higher-efficiency generation and tighter environmental regulation, has powered the dash to gas for new-build generation for over a decade.

Figure 5: Coal Mining Employment Rises Slightly





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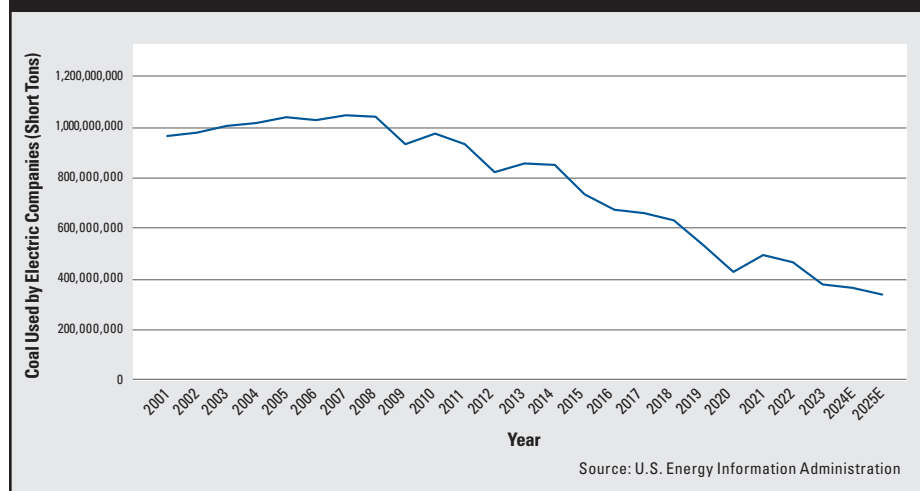
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Figure 6: Coal Use at Electric Generators Expected to Continue Falling



NATURAL GAS OUTLOOK

Last year, 2023, may go down as an inflection point in the fortunes of new-build gas-fired generation. After falling steadily from 41% of all new-build generation over 2019 - 2023 to 5% for 2024 - 2028, developers planned to build many more new gas-fired power plants over the 2025 - 2029 period: approximately 65,000 MW or 7% of all new-build generation.

The regions turning most sharply to new-build gas-fired generation over the next five years are the Southeast (where 21% of all new-build generation will be gas-fired), Mid-Atlantic (14%), and Great Lakes (11%).

In recent years, the Mid-Atlantic and Great Lakes regions have had the greatest preference for new-build gas generation. This year, they are joined by the Southeast, where plans to build new gas-fired generation have soared from less than 1% from 2024 - 2028 to about 21% for 2025 - 2029. IIR defines the Southeast region as Florida, Georgia, Alabama, Mississippi, and Tennessee.

And, in the Southwest, developers tripled earlier plans to build gas generation, rising to 12% for 2025 - 2029 compared to 3.8% for 2024 - 2028. IIR defines the Southwest region as Texas, Oklahoma, Arkansas, and Louisiana. Switching from percentages to raw numbers, the

Southwest, anchored by Texas, plans to build far more gas-fired generation during 2025 - 2029, slightly over 30,000 MW than the Southeast at about 7,000 MW.

IIR is tracking developers' plans to build eight billion-dollar-plus gas-burning generators in the Southwestern region over the next five years. By contrast, only four billion-dollar-plus mega plants are scheduled to begin construction in the Southeast over that timeframe.

Developers plan to install CCUS at some of those big-ticket planned gas plants.

The resurgence of new-built gas generators in the nation's largest gas-producing state has been aided by Texas' \$10 billion state fund, created in 2023 to support the construction or refurbishing of dispatchable (mostly gas-fired) generation. In less than a year, about 125 companies have reportedly applied for approximately \$39 billion in grants and low-cost loans from the Texas Energy Fund to construct a proposed 55,800 MW of new natural gas-generating capacity.

It's anyone's guess whether Texas lawmakers will add more money to the Texas Energy Fund to capture developer enthusiasm for gas-fired generation. Much may depend on whether the lights, and air conditioners, go out this summer. The Texas legislature only operates in

odd-numbered years; it is scheduled to reconvene on Jan. 14, 2025.

Texas lawmakers, regulators, and grid managers have urged developers to build new dispatchable generation for years. Ultimately, the availability of billions in state funding, coupled with the skyrocketing demand created by AI-equipped data centers, convinced developers the time was right.

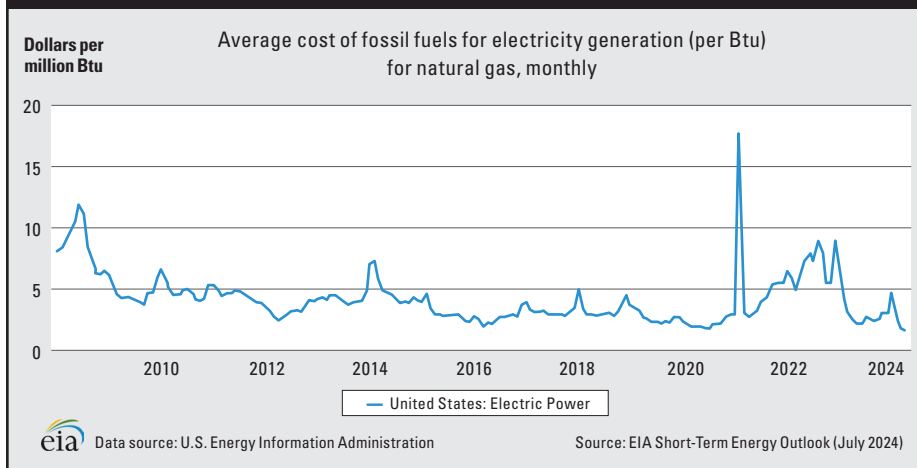
Although everything's bigger in Texas, the Southwestern region's embrace of new-build gas-fired generation is also driven by industrial activity in neighboring Louisiana, where developers have been busily constructing LNG export terminals as well as petrochemical plants and other industrial facilities that are reliant on natural gas.

This mini-trend to revive new-build natural gas generation will likely be decried by environmental organizations and others who want to keep gas "in the ground." But state utility regulators, whether appointed or elected, can't afford to let the lights go out. When in doubt, given the penalties for getting it wrong, the incentive is to build.

Therefore, while developers and regulators have been circumspect about new gas generation, generally preferring to comment narrowly rather than globally, we expect to see new-build gas generation rise throughout the next five years—particularly if electric demand comes close to overwhelming electric supply, leading to blackouts.

Any move to boost the construction of new-build gas-fired generation in the United States will be helped by fuel's low cost, widespread abundance, and relative price stability. Though gas prices for electric generation briefly shot up in early 2021, driven by the bitter cold, they quickly returned to normal, only to have that brief period of normalcy upended by Russia's invasion of Ukraine in early 2022. Shortly thereafter, market forces of supply and demand displaced panic, causing prices to fall as new supply continued to outstrip new demand (FIGURE 7).

Figure 7: Gas Prices Paid by Electric Generators Since 2008



With the prospect of brighter days ahead, natural gas power developers may soon echo then-president Gerald Ford, who after pardoning disgraced President Richard Nixon proclaimed, “Our long national nightmare is over.”

RENEWABLES OUTLOOK

Whether or not natural gas storms back into the new-build power generation market, renewable energy developers are expected to continue dominating the market for the foreseeable future: From

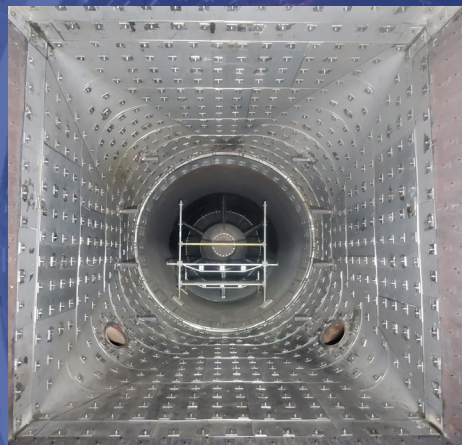
2025 – 2029, more than nine in 10 planned megawatts of new-generating capacity will be solar, wind, or other non-emitting resources.

Although nuclear is a non-emitting resource, IIR does not include it in its tally of renewable generation.

On a percentage basis, the regions with the greatest appetite for renewables in their planned construction kickoffs for 2025 - 2029 include New England and the Northeast (tied with 99% of all planned generation), followed by the Rocky Mountain states (97%), and West Coast (96%).

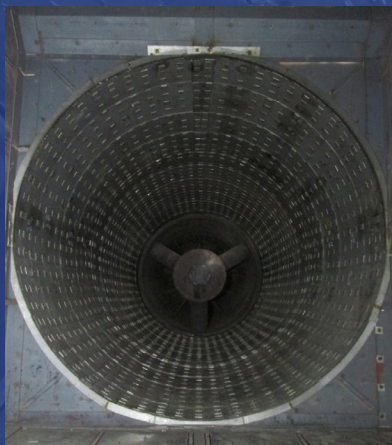
But on a raw-numbers level, the amount of renewable generation to be built in the Southwest region dwarfs all other regions. The Southwest has about 226 GW of renewable generation slated to begin construction over the next five years, roughly 88% of all planned new-build power plant construction activity in that region.

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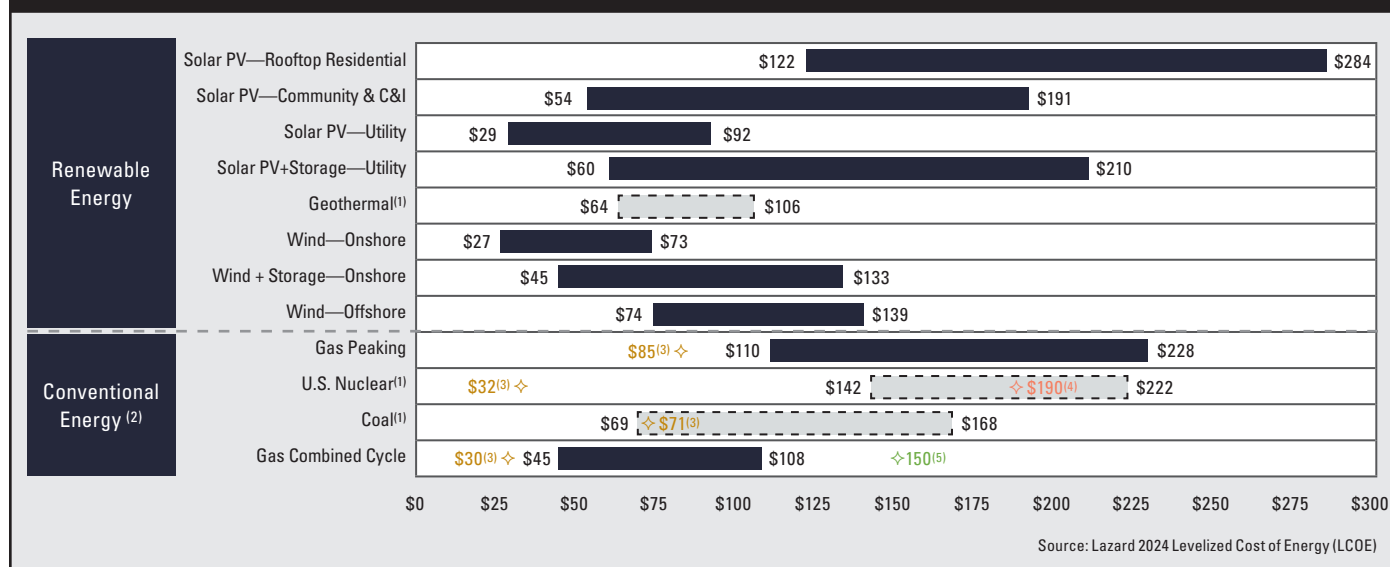
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Figure 8: Renewables Remain Competitive with Conventional Generation



The regions with the lowest percentage of renewables in their new-build portfolio include the Southeast (66% of all new-build projects), the Mid-Atlantic (80%), the Midwest (87%), and the Great Lakes (88%). So even in the lowest green regions, developers have plans to build a lot of non-emitting generation over the next five years.

Overall, developers plan to begin turning dirt on slightly over 796 GW of U.S. renewable generation over the next five years, significantly higher than earlier years.

Again, it bears mentioning that IIR does not expect all these announced projects will be constructed according to their original timelines. This is particularly true for renewable generation, which has a higher rate of delays and cancellations compared to gas-fired generation. Still, the size of the renewable electric pipeline is notable. As interest rates come down, more projects may be deemed economically viable.

Lazard’s 17th annual Levelized Cost of Energy study, released in summer 2024, showed utility-scale solar and wind being lower-cost resources, on average, than conventional generation, even when excluding the effect of federal renewable tax credits (FIGURE 8). This continues a lengthy trend.

The numbers get more bunched together when storage is added to solar or wind. Even then, onshore wind and storage generally pencils out to a lower cost per megawatt-hour than gas-fired combined-cycle generation.

A large and growing proportion of planned renewable generation includes some form of energy storage, which boosts the construction cost. Right now, over 170 proposed renewable-generation projects include an energy storage component. Five years ago, storage projects were attached to less than three dozen renewable electric-generation projects. Today, stand-alone renewable generation is giving way to combined generation + storage.

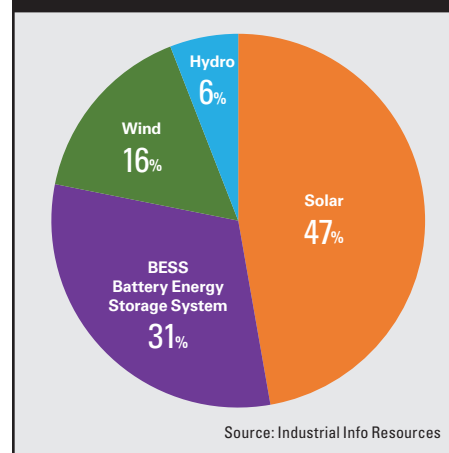
Something else that has changed in the renewable energy world: Offshore wind generation continues to blossom, with about two dozen projects under development, with the combined asset value (TIV) of those projects exceeding \$55 billion. Several put steel in the water in 2023 and 2024, and we expect that will continue, even accelerate over the next five years. That is unless Donald Trump is elected president.

According to project-development data tracked by IIR, solar is keeping its lead in the new-build renewable market share,

with about 47% of all new-build project kickoffs during the 2025 - 2029 period, followed by battery energy storage systems (BESS; 31%), wind (16%), and hydro (6%) (FIGURE 9).

The states with the largest dollar value of solar projects scheduled to begin construction during this timeframe are Texas, Nevada, and Arizona. The states with the biggest dollar value of wind-power projects scheduled to begin construction over the next five years are Texas, Illinois, Iowa, Wyoming, and North Dakota.

Figure 9: U.S. Renewable Energy Project Kickoffs, 2025 - 2029



Renewable power development has been particularly hamstrung in recent years by yearslong interconnection queues in organized wholesale markets. Steps taken in 2024 by the Federal Energy Regulatory Commission (Order 1920) and the U.S. Department of Energy (National Transmission Corridors) could expedite the construction of transmission lines to carry green kilowatts to load centers, but that's unlikely to happen in the near future. There are too many entrenched interests eager for litigation to be optimistic that a tangle that took decades to develop can be sorted out quickly.

NUCLEAR OUTLOOK

During a few weeks in 2024, the “old” nuclear renaissance wrapped up and one of the technologies that could spur a “new” nuclear renaissance began to take shape.

Unit 4 of the Alvin W. Vogtle Nuclear Power Station began commercial operations in April 2024. Unit 3 began operating commercially in July 2023.

Principal owner Georgia Power Company will likely spend lots of time in prudence hearings before Georgia utility regulators as it seeks to recover the costs of, and make a profit on, the 2,228 MW of new nuclear capacity represented by units 3 and 4. The utility has already taken hefty asset write-offs and absorbed incremental financial penalties.

The all-in costs to build the two nuclear units hovers around \$35 billion, less a multibillion-dollar payment from Hitachi after Westinghouse bailed on the project in 2017. Years late in coming online, and with a ghastly price tag, Vogtle units 3 and 4 brought the curtain down on the much-hyped circa 2010 version of the “nuclear renaissance.”

As the curtain was coming down on the Vogtle project, another curtain began a slow potential rise. In June 2024, the owners and off-takers of a next-generation nuclear project, Natrium, began preliminary site development activities on the project in Wyoming.

That 345-MW sodium-cooled nuclear project, backed by Microsoft founder Bill Gates' extraordinarily deep pockets, originally was scheduled to begin operating in 2028. Shortly after that in-service date was announced, Russia—the world's only supplier of high-assay, low-enriched uranium (HALEU) fuel for the project—invaded Ukraine, and the fuel contract was scuttled. A replacement HALEU supply chain is trying to be assembled in the United States. Stay tuned.

The Natrium project has been selected to receive up to \$2 billion in federal grants,

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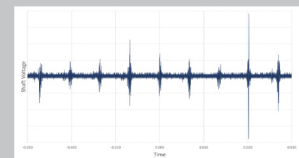
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which need to be matched by the owner, TerraPower.

Meanwhile, there were mixed results for another nuclear technology—small modular reactors (SMRs). The Utah Associated Municipal Power Systems (UAMPS) canceled plans to build up to a dozen 50-MW NuScale reactors near the Idaho National Laboratory in late 2023 after several years of development. Rising cost was the reason given.

But over a dozen SMR projects remain in development, with construction kickoff dates scattered through the late 2020s and early 2030s. The power companies investigating SMRs include the Tennessee Valley Authority, Duke Energy, Dominion Energy, Nebraska Public Power District, and Energy Northwest. In addition, one non-utility, X-Energy LLC, is developing an SMR for potential construction at a Dow Chemical facility site in Texas.

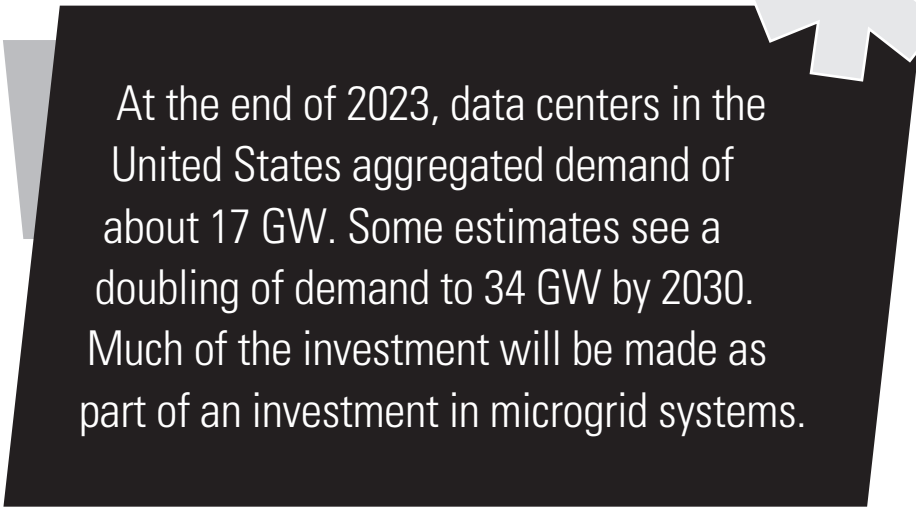
Rising electric demand, coupled with increasing concerns about global warming, has sustained the development of next-generation nuclear technologies for more than a decade. So far, no nuclear breakthroughs have been discovered, though several brave pioneers continue efforts to unlock non-emitting generation from the atom.

MICROGRIDS OUTLOOK

For the past several years, and for the foreseeable future, microgrids have been and will continue to attract robust investment in the energy sector.

Microgrid systems often include distributed energy resources, many of them renewable, to help support grid stability. In most cases, these systems have been deployed outside the traditional power sector to support industrial sectors, such as food and beverage processors, mining sites, metal-processing plants, and other heavy industrial manufacturing sectors.

The booming data center sector oftentimes includes a microgrid system to



At the end of 2023, data centers in the United States aggregated demand of about 17 GW. Some estimates see a doubling of demand to 34 GW by 2030. Much of the investment will be made as part of an investment in microgrid systems.

ensure highly reliable power. Other types of business customers, such as educational centers, healthcare providers, transportation systems, remote communities, and other institutional businesses, are installing or investigating microgrid systems.

As the United States moves closer to decarbonization, microgrids will play an important role, partly to store electricity generated by renewable generators that is not immediately needed. By some estimates, microgrids are expected to grow 19 - 20% per year through the end of the decade.

On a global basis, the microgrid market, currently about \$40 billion, could grow to over \$200 billion by 2033. In the United States, the microgrid market is closer to \$5 billion and is expected to grow at about 10% per year through 2032. As with other sectors of the industry, there are challenges, the greatest of which remains a kinked supply chain.

INDUSTRIAL ENERGY PRODUCTION OUTLOOK

IIR continues to track healthy spending in this sector of the power industry. Industrial energy production (IEP) is on the rise in today's environment, whether to meet a carbon-neutral requirement or meet increasing onsite power needs.

The growth of data centers is one of the keys driving project activity in this area. Data centers in most cases draw grid power for their day-to-day operation; however, investment for onsite backup power generation, as well as installation of renewable energy technology, is becoming more common in this sector.

At the end of 2023, data centers in the United States aggregated demand of about 17 GW. Some estimates see a doubling of demand to 34 GW by 2030. Much of the investment will be made as part of an investment in microgrid systems.

Beyond data centers, a growing slice of the U.S. economy requires highly reliable (99.999% availability) electric supply, as power-sensitive equipment moves from manufacturers to healthcare facilities, retail outlets, law-enforcement installations, educational institutions, and military bases.

We see increased spending for IEP in a wide range of sectors, including food and beverage companies to firms extracting minerals, manufacturing metals, and processing pulp and paper. Increasingly, companies opt for renewable energy to meet their net-zero requirements.

But these IEP owners also face project development challenges: supply-chain issues, development costs, labor supply, and tight timeframes.



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Climate experts predict a greater number of increasingly extreme weather events over the next five years. Skyrocketing electric demand, fueled in part by AI-equipped data centers, is the Power industry's new "X factor."

BESS OUTLOOK

BESS deployment is expected to grow 10% in 2024 compared to 2023. Further growth is expected for 2025. Large incentives are driving this activity, such as those contained in the 2021 Infrastructure Investment and Jobs Act and the 2022 Inflation Reduction Act.

The latter law expanded the production tax credits to include stand-alone and co-located battery energy storage constructed on existing renewable energy sites. This, coupled with several state clean-energy programs and the push to reduce carbon emissions, is propelling the BESS buildout.

Another driver is the rising demand for grid resilience and support. This is done in several ways, such as having battery assets constructed at existing substations, built as stand-alone battery storage facilities, integrated into microgrids, and installed on industrial sites as backup power systems.

BESSs have a lot of positive drivers within the power sector. But they also face constraints, including supply-chain issues: The metals that go into lithium-ion batteries are not yet available in abundance, and there are numerous competing uses for those metals, including batteries for EVs, smartphone technology, and various other digital devices. Another constraint is the interconnection to the grid and delays that all power-generation projects face. Another limiting factor is the limited duration of the batteries, which is about 4 MW/h.

Are there challenges to the BESS market? Yes, but new technologies with longer storage durations are being developed, such as the air-iron or air-zinc systems and the Redox system. Are these systems ready for full utilization? Not yet. Typically, we see smaller projects utilizing these technologies as test beds to help further development.

LOOKING AHEAD

The 2025 - 2029 period is expected to be extraordinarily choppy for the new-build U.S. power industry and those who service generators. On its own, the political dimension of the power industry's Rubik's Cube—who will occupy the White House, which party will hold a majority in the House and Senate, and the size of those majorities—is enough to keep scenario planners busy throughout the remainder of 2024. Filling out that Rubik's Cube are economic growth, interest rates, consumer sentiment, new technologies, and federal and state laws and regulations.

Don't forget about extreme weather events, at both hot and cold ends of the spectrum, which have scrambled power planners' assumptions in recent years. Climate experts predict a greater number of increasingly extreme weather events over the next five years. Skyrocketing electric demand, fueled in part by AI-equipped data centers, is the Power industry's new "X factor." Exogenous events, such as Russia's invasion of Ukraine in 2022, and to a lesser degree the Israel-Hamas conflict, could wreak havoc on the power industry's fuel markets.

Various American patriots were said to have uttered, "Eternal vigilance is the price of freedom." The same might be said of operating in the U.S. new-build power sector in the second half of the 2020s. ■



Britt Burt is Senior Vice President of Global Power Industry Research for Industrial Info Resources (IIR), an industrial market intelligence firm headquartered in Sugar Land, TX. IIR has six offices in North America and 12 international offices.



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Can you please provide a brief description of your company, Optimistic Plus?

Gladly. Optimistic Plus is a Portuguese company specializing in high-tech rotary equipment. We produce centrifugal compressors (API and non API), fans, blowers, and special process packages, and we also do the packaging for reciprocating and screw compressors. Our products are made in the central region of Portugal where we operate a factory of 7000sqm with more than 70 employees. Our equipment can serve distinct industries, from oil and gas to petrochemicals, LGN, construction, metals, mining, power generation, hydrogen and others. We take pride in our products, and we have been certified by independent entities for our quality and excellence.

How do you see the rotary equipment manufacturing market evolving in the upcoming years?

I anticipate significant market evolution in 2025, driven by several key trends and factors. First, there is strong demand from major industries, which continues to grow. This is particularly evident in the rapid industrialization of developing nations and emerging markets. Additionally, ongoing technological advancements will play a crucial role. For example, the integration of digital technologies like IoT, machine learning, and AI will greatly improve the predictive maintenance and performance of rotary machinery. Alongside this, the rise of 3D printing is enabling more customized solutions for rotary equipment, further boosting demand. Finally, the current geopolitical landscape is creating supply chain disruptions, slowing the pace of decarbonization. As a result, oil and gas will remain essential, ensuring continued demand for rotary equipment.

What are Optimistic Plus goals for 2025?

To consolidate and grow. In sales and number of collaborators,

our workforce, without whom we wouldn't be able to succeed. We also want to expand our business to other regions of the globe with Africa and South America being prominent continents in our list. In 2024 we've done a lot of traveling and participated in huge events, such as Gastech and ADIPEC, where we met a lot of interesting potential partners and collaborators with whom we want to do business with a focus on growth. For next year, we have a very busy schedule in terms of events and conferences we'll be attending. We'll have a stand in Gastech 2025 and ADIPEC 2025. We also plan to attend other events such as, "India Energy Week", "Egypt Energy Week", and "Global Energy Show" in Canada, amongst others. Very exciting times ahead!



How is Optimistic Plus facing the energy transition and how is the company contributing to lower emissions?

Well, as I explained before, due to the current state of international geopolitics, I do not think the energy transition will happen as quickly as everyone wanted. Because, first and foremost, it continues to be crucial to secure energy for everyone, and oil and gas will continue to be pivotal for this. However, we want to support the transition to a greener and safer environment for future generations to flourish. And on that, our technical department has been developing compressors to be adaptable to the future hydrogen supply chain.



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