

U.S. POWER INDUSTRY OUTLOOK 2024

Renewables continue to rock the new-build electric generation market, but gas-rich Texas, and some locals, are pushing back.

BY BRITT BURT AND BROCK RAMEY



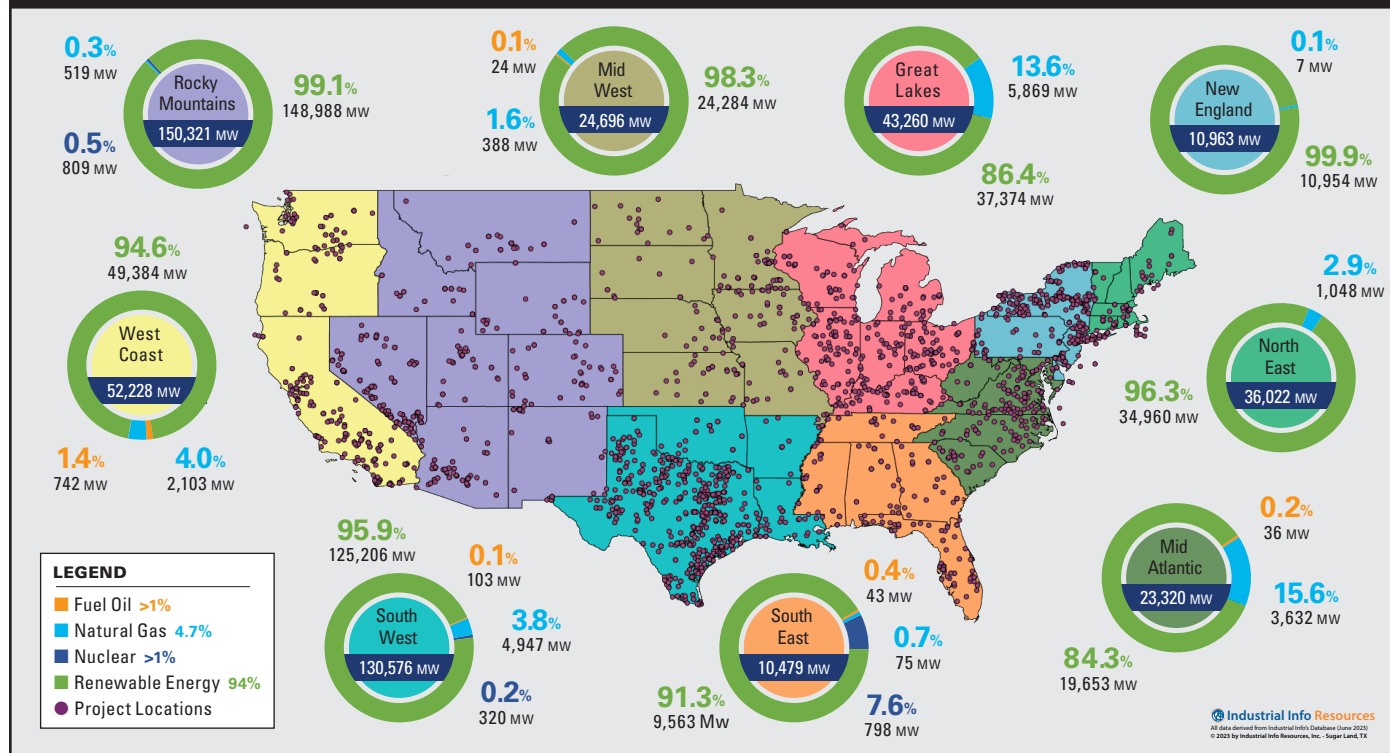
The U.S. Environmental Protection Agency (EPA) drafted a third set of greenhouse gas regulations using an explicit congressional delegation of authority, but litigation is still expected. Although climate change has led to more weather extremes, decarbonization of the U.S. power sector remains a “two steps forward, one step back” exercise.

As the United States prepares to enter the third year of the Biden administration, with its priority to decarbonize the electric generation market, the challenges to decarbonization are so significant as to call to mind the Tennyson poem, “The Charge of the Light Brigade,” which chronicled the

ill-fated attack launched by lightly armed British cavalry troops against better-armed Russian artillery forces during the Crimean War. As recounted by Tennyson, the British troops suffered a beating at the hands of the more numerous and better-equipped Russians:

*Cannon to right of them,
Cannon to left of them,
Cannon in front of them
Volleyed and thundered;
Stormed at with shot and shell,
Boldly they rode and well,
Into the jaws of Death,
Into the mouth of hell
Rode the six hundred.*

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



A seasoned dealmaker with 36 years of inside-the-Beltway experience as a U.S. senator, Joe Biden as President has notched impressive legislative victories to decarbonize the U.S. power industry. The Infrastructure Investment and Jobs Act, enacted in late 2021, and the 2022 Inflation Reduction Act, with \$369 billion in federal support for renewable energy, will go a long way to reducing CO₂ emissions from the power sector.

In May 2023, the EPA issued its third set of draft regulations to reduce CO₂ emissions from current and future power plants.

All significant accomplishments. But permanent? One wonders, given the forces that stand in opposition:

- Congressional Republicans, furious about House Speaker Kevin McCarthy's 11th-hour debt ceiling deal this past spring, are determined to claw back federal spending on renewable energy, among other items, under the rallying cry of fiscal austerity.

- Coal-rich states such as Montana, Wyoming, West Virginia, Kentucky, and Utah have enacted various measures to impede the closure or sale of coal-fired generators in their states, prop up in-state coal mines, and preserve the flow of tax revenues into state coffers.
- In the closing hours of the 2023 Texas state legislative calendar, lawmakers approved, and Governor Greg Abbott signed into law, a bill creating a \$10 billion fund to support the construction of new gas-fired generation, as well as the modernization of existing gas-fired generators. Republican-elected officials and fossil-fuel interests staunchly oppose the EPA's May 2023 draft Clean Air Act rule designed to limit CO₂ emissions from power plants. Legal challenges are sure to come, perhaps even before the rule is finalized, and yet another trip to the U.S. Supreme Court appears likely.

- If such a legal challenge does make its way to the highest court in the land, the composition of the court seems unfavorable to those who seek to decarbonize the power sector. In 2022, the justices ruled 6-3 against an EPA effort to cut carbon emissions. Shortly after that decision, Congress closed the regulatory loophole that gave the justices such pause. Will the third time be the charm for this rule, or will the court find yet another reason to intervene?

These and other challenges to decarbonization emerged during 2023 and are expected to continue unfolding in 2024 and beyond to shape the U.S. new-build power business. The industry has an outlook that extends for decades, but small changes in the near term can lead to dramatically different outcomes in the long term.

That said, renewable energy continues to dominate the outlook for U.S. new-build power-generation projects scheduled to begin construction over the 2024-2028 period.

ENERGY TRANSITION

The transition to lower-emitting generation fuels has been underway for several years, but the 2022 Inflation Reduction Act's direction of \$369 billion of federal funds into renewable energy is expected to significantly strengthen a years-long trend of heightened investment in new non-emitting electric generation.

According to data tracked by Industrial Info Resources, 94% of all new-build power generation projects scheduled to begin construction in the United States between January 2024 and December 2028 will be for renewable energy (see the **MAP** and **FIGURE 1**).

That spending is expected to extend the rush to renewables, but what's different about the 2024-2028 period is the dramatic increase in the projected volume of new-build construction: Developers plan to build about 482 GW of new generation over the 2024-2028 period, up 22% from last year and at least double the amount of any five-year period in the last 14 years (**FIGURE 2**).

By and large, electric utilities have found that their customers like and prefer renewable energy, provided it is cost-competitive with electricity produced from other fuels.

The COVID-19 pandemic, now apparently receding into the rear-view mirror, turned much of the discussion about the

energy transition into a rueful recognition of the importance of supply chains. In 2023, electric utilities were forced to defer, or rebid, planned renewable energy additions, citing rising component prices and delayed delivery dates. Evergy, an electric utility serving customers in Missouri and Kansas, caught some negative publicity from members of the environmental community in mid-2023 after it went public with a revised schedule and mix of generating options that included building new gas-fired generation, per requirements of its grid operator, and keeping some operating coal generators open past their planned retirement dates. Other utilities have had to rejigger their clean-energy plans, some more publicly than others.

Ultimately, state utility regulatory commissions, along with grid operators, have the whip hand in deciding what gets built where and when. We expect that the shifting economics of generating electricity will force several public utility commissions (PUCs) to revisit decisions made in earlier integrated resource plan (IRP) dockets.

Texas already has decided: Going forward, natural gas will play a bigger role in the state's electricity future. Lone Star State politicians were quick to blame—incorrectly, as it turned out—renewable energy for the rolling blackouts and multiple catastrophes triggered by Winter Storm Uri in early 2021. More objective analysis found that frozen natural gas lines and poorly winterized thermal power plants bore a more significant share of responsibility for that event.

Never letting the facts get in the way of a good story, Texas politicians and the state's grid operator, ERCOT, have been advocating for an increase in dispatchable, i.e., gas-fired, generation to ensure the lights stay on during weather extremes. The state has weathered some white-knuckled summer peaks in recent years, so the call for more dispatchable generation wasn't all home-state hoopla.

In mid-2023, Republican Texas Governor Greg Abbott signed into law a bill to create a \$10 billion fund to support

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

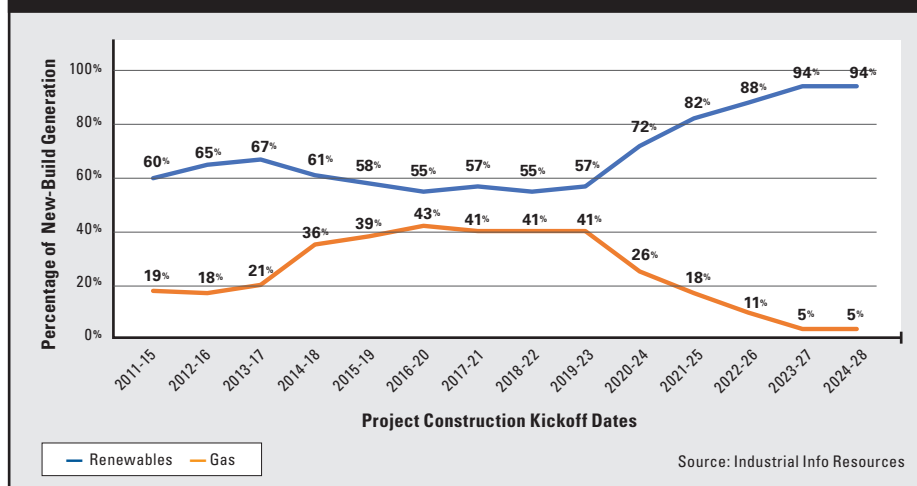
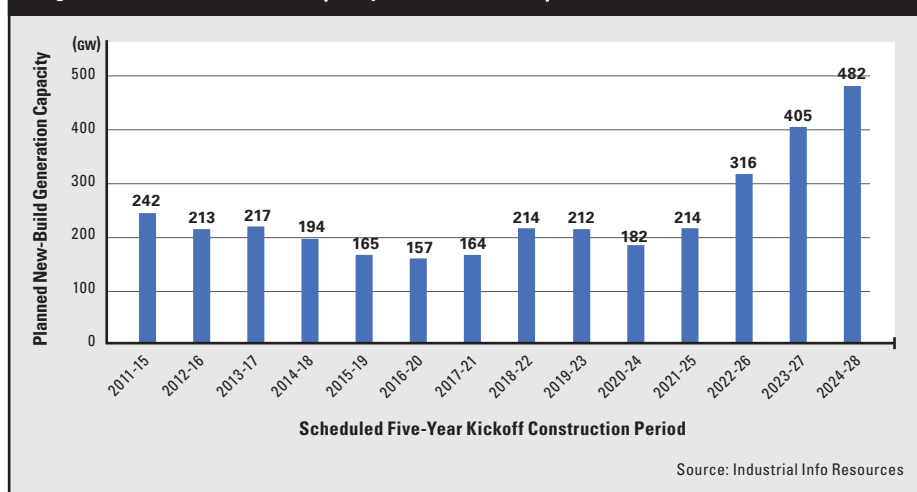


Figure 2: Planned New-Build Capacity Additions Shoot Up



building new-build gas-fired generation and modernizing existing gas power plants.

Republican-led energy-producing states like Texas, Montana, and Wyoming, among others, effectively are working in partnership with U.S. Senator Joe Manchin (D-WVa), chairman of the powerful Energy and Natural Resources Committee, to preserve the role of fossil fuels in the nation's electricity supply.

Natural gas is expected to hold a strong share of the electric fuels market for the near term, accounting for approximately 41% of electricity generated in 2023 and 40% in 2024, according to the July 2023 *Short-Term Energy Outlook* produced by the U.S. Energy Information Administration (EIA). Coal's market share is expected to continue weakening in the near term, sinking from 20% in 2022 to an estimated 15% in 2023, before rising slightly to 16% in 2024. Nuclear's share of the electric generating mix is expected to hold steady at about 19% over the 2022-2024 period, while solar and wind are expected to continue gaining market share.

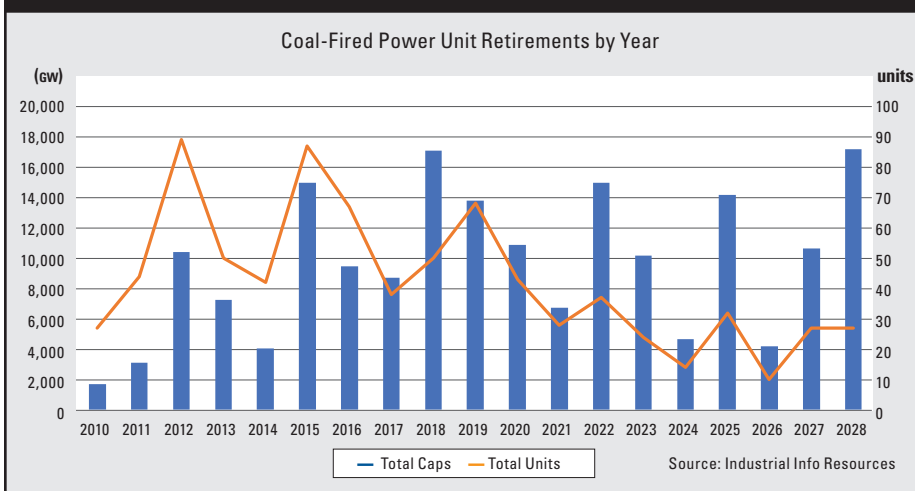
COAL OUTLOOK

New-build coal-fired generation has been a rounding error in recent years, and the 2024-2028 period is no exception. "Early retirement" continues to be the watchword for existing coal-fired generation, with nary a new-build project in sight.

About 133 GW of coal-fired capacity has been retired since 2010, and over the 2024-2028 period, Industrial Info Resources (IIR) expects another 51 GW of coal generation to be retired (**FIGURE 3**).

But there are about 146 in-plant capital projects, worth an estimated \$16.5 billion, that are scheduled to kick off at coal-fired power plants across the United States over the next five years. This broad category of projects includes automation; carbon capture, utilization, and storage (CCUS); debottlenecking; decommissioning and demolition (D&D); efficiency upgrades; environmental remediation; life extensions; upgrades; and uprates.

Figure 3: Coal-Fired Unit Retirements: Historical and Projected



The states with the largest dollar value of in-plant capital projects are Wyoming (five projects valued at about \$2.7 billion); Illinois (eight projects worth approximately \$2.4 billion); Texas (19 projects valued at \$2.2 billion); and New Mexico (one project worth about \$1.3 billion).

The \$16.5 billion of planned in-plant capital projects includes CCUS projects. A sharply increased federal tax credit of as much as \$85 per ton of CO₂ removed has led companies to schedule billions of dollars of CCUS projects to be constructed at coal-fired power plants over the next five years. We are tracking six CCUS projects, valued at \$7.4 billion, that are scheduled to be built at stations in Illinois, Texas, Wyoming (which has three projects), and New Mexico over the next five years. These projects are expected to be vying for expanded federal tax credits under section 45Q of the federal tax code.

Also included in that \$16.5 billion sum are approximately 58 coal combustion residuals (CCR) remediation projects that are scheduled to begin construction by the end of 2028. The total investment value (TIV) of these projects is about \$3.6 billion. The states with the greatest dollar value of projects for remediating CCR, also known as coal ash ponds, are Montana, Texas, Indiana, and Missouri.

Coal power plant decommissioning and dismantling (D&D) projects also are included in that \$16.5 billion in-plant capital sum. The value of these D&D projects is about \$2.3 billion. The states with the largest dollar value of D&D projects include Ohio, Michigan, Indiana, Texas, and South Carolina.

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 leveled out at about 41,000, down more than 75% over the last two generations, according to the St. Louis Federal Reserve Bank (**FIGURE 4**). And the amount of coal burned to generate electricity, after briefly surging in 2021 and 2022 as utilities restocked their fuel-depleted piles, is expected to fall in 2023 and 2024 (**FIGURE 5**).

King Coal's woes are a result of many factors—regulatory, legislative, economic, and technological—but another significant contributor is the rise of so-called "responsible" investing, where bankers and investment managers at pension funds, mutual funds, and other sources of public and private capital use environmental, social, and governance (ESG) metrics to identify companies in which they want to invest—and those they don't. Institutional investors with more than \$120 trillion of assets under management have adopted the U.N. Principles of Responsible Investing (PRI),

Figure 4: Coal Mining Employment Flattens

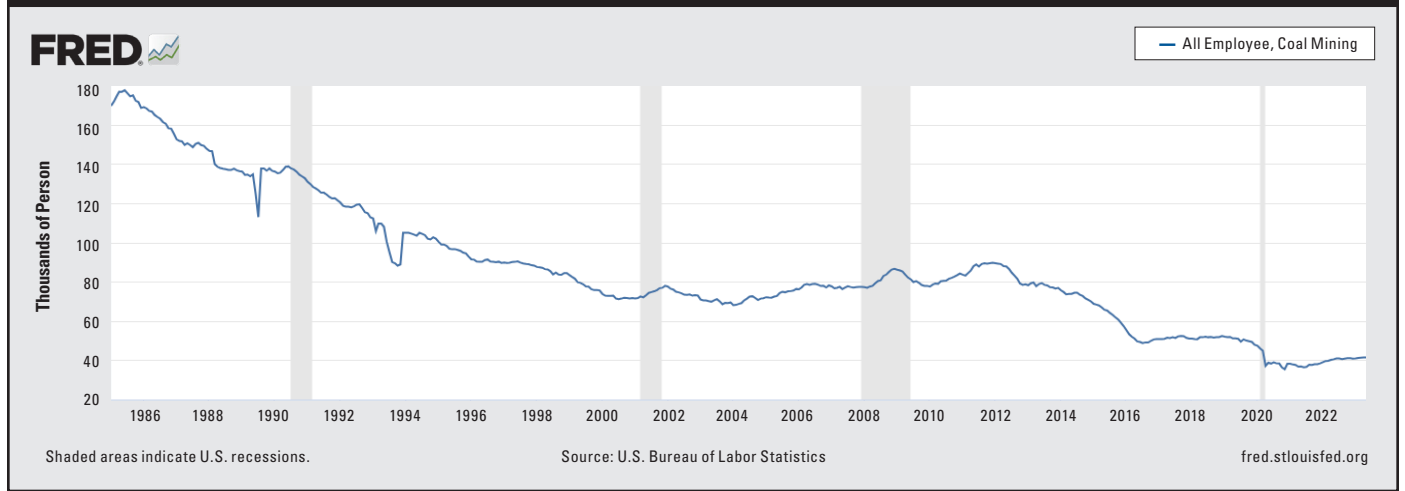


Figure 5: Coal Use at Electric Generators Expected to Decrease in 2023, 2024

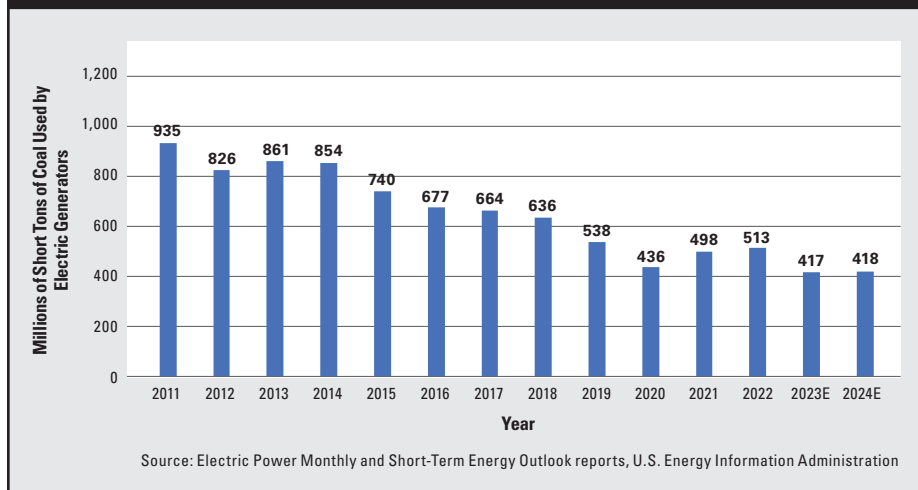
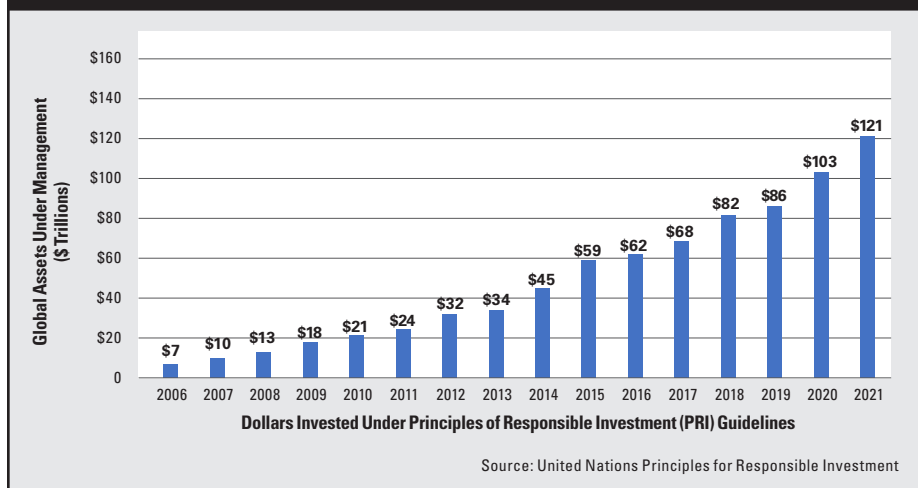


Figure 6: Surge in Cumulative Investments in “Responsible” Companies and Funds



which don't permit investing in or lending to companies in the coal business (FIGURE 6).

Because each trend spawns a counter-trend, there has been some recent push-back against ESG, or “responsible” investing: 18 states have enacted or proposed legislation restricting the state from doing business with companies that use ESG investing criteria, arguing that those criteria mask a political agenda.

During 2023, coal generators in a variety of states, including Michigan, Utah, Pennsylvania, Tennessee, West Virginia, and Texas, either were closed or announced premature retirement decisions. Asset owners claimed a variety of reasons for the decisions, but, broadly speaking, there were two reasons: 1) renewable generation, even allowing for its recent price increases, is still more economical than operating existing coal plants; and 2) state and federal environmental regulations and laws made it uneconomical to continue operating those plants.

A countervailing trend to coal unit retirements is the delay in planned retirements due to delays in interconnecting renewables to the grid, supply chain bottlenecks, and permitting delays. In the face of rising electric demand and continued uncertainties surrounding new-build projects, an operating power plant—even

one that burns coal—is worth more than projects that remain on the drawing board.

NATURAL GAS OUTLOOK

Natural gas generation is feeling the fossil-fuel “splatter” effect that has hobbled coal-fired generation. Even though natural gas only emits about half the CO₂ as coal when burned for generation, gas-fired generation still contributes to global climate change.

After a decade when developers made a “dash to gas,” that bloom is off the rose. Only about 4.7% of all new-build generation scheduled to begin construction over the next five years will use gas as a fuel. By contrast, as shown in **FIGURE 1**, five years ago that percentage was 41%. A decade ago, that percentage was a still respectable 36%.

Gas’ share of the electric fuel market should rise over the next five years, as Texas begins disbursing its \$10 billion to support dispatchable generation.

But for now, the new-build gas market remains a shadow of its former self.

The regions with the largest share of planned new-build gas generation are the Mid-Atlantic (15.6%) and the Great Lakes (13.6%). At the other end of the spectrum, the regions that plan to build the least amount of gas generation over the 2024-2028 period are New England (0.1%), the Rocky Mountains (0.3%), the Southeast (0.7%), and the Midwest (1.6%). All told, IIR expects about 19 GW of new-build gas generation to be built over the next five years.

By contrast, about \$19.1 billion of new-build natural gas-fired generation projects that were scheduled to kick off during 2024-2028 have been canceled or placed on hold, according to IIR’s data. The states with the greatest dollar value of project delays or cancellations are Texas (nine projects valued at \$6.6 billion), Michigan (six projects valued at \$ 2.5 billion), West Virginia (two projects valued at \$1.4 billion), and Florida (six projects valued at \$1.1 billion).

As large as these numbers are, they pale in comparison with the prior five-year period (2019-2023) when developers

anceled or placed on hold 224 proposed new-build natural gas-fired projects valued at \$80 billion. For that period, the greatest dollar value of cancellations and project delays were Texas (41 projects valued at \$18.2 billion), Pennsylvania (25 projects valued at \$7.7 billion), Virginia (seven projects valued at \$4.9 billion), Ohio (eight projects valued at \$4.5 billion), and New Jersey (seven projects valued at \$4 billion).

The wave of proposed gas plant cancellations and deferments doesn’t reflect the sharp political divide between blue and red states. Deep-red states like Texas, Florida, Indiana, and Ohio are among the leaders in gas-fired project cancellations or deferments, alongside deep-blue states like California, New Jersey, New York, and Pennsylvania.

Whatever the drivers—remember Tip O’Neill’s famous quip that all politics is local—the dash to gas has slowed dramatically. What could revive it? Widespread generation-related power outages. Perhaps Texas had solid reasons—beyond supporting the home team—to create a \$10 billion fund to build or modernize gas-fired generation.

As the United States sweltered under an unrelenting heat dome during the summer of 2023, fingers were crossed that power plants that were being run hard and long would hold up.

Developers who canceled or placed proposed gas-fired power projects on hold cited the shifting economics of electricity generation, driven by technology advances and regulatory or legislative mandates to build non-emitting generation. For example, New York’s plan to fight climate change envisions 70% of all electricity coming from non-emitting generation. California’s renewable portfolio standard (RPS) requires 60% of electricity to come from renewables by 2030 and 100% by 2045.

The Golden State recently reported that RPS-eligible resources accounted for more than 37% of electricity delivered to customers in 2021.

But there are signs that the Golden State may be rethinking its stance on gas, at least

FLOWDY

Flow & Dynamic

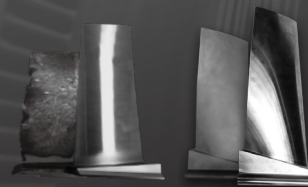


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for the near term. In a mid-year 2023 article, “California just can’t kick its coastal gas plant addiction,” the Los Angeles Times wrote:

“Three natural gas-fired power plants in Huntington Beach, Long Beach and Oxnard were supposed to shut down in 2020, under a regulation designed to protect marine life. But (in 2020) officials voted to let the polluting generators keep churning out power another three years, just a few weeks after California experienced its first rolling blackouts since the early-2000s energy crisis. Now regulators are gearing up to approve another three-year extension, which would allow the plants to run through 2026. It’s only the latest illustration of the difficult balancing act California faces in its quest to phase out planet-warming fossil fuels and show the rest of the world that addressing the climate crisis is possible.”

The hand of environmental regulators in the state was forced after several summers of wildfires and power outages led to unpopular public safety power shutoffs (PSPS), where investor-owned utilities were given permission to preemptively shut off power in certain areas under red-flag conditions: high heat, low humidity, and high winds. Those conditions, coupled with failing utility equipment, have sparked extremely destructive wildfires in recent years. But even the PSPS could not stop rolling blackouts in certain areas during the blazing hot summer of 2022.

The state’s environmental regulators, forced to choose between people without power during broiling summers or fish that could be harmed by warmer water from gas-fired power plants, opted for people over fish.

The decision also was shaped by the state’s deepening “duck curve,” in which there is a surplus of renewable power during off-peak periods, like mid-day during the summers, and a shortfall during summer afternoons. Dispatchable gas-fired generation to the rescue! At least, for the short term.

California has not greenlighted a new-build gas power plant. Instead, it is trying to get a few more years of service out of the gas-powered generators on the coast, until battery energy storage becomes large enough, reliable enough, and economically viable so that it can replace gas generation. Gradually, gas generation will fade in California.

But gas is proposed as the fuel to power several large planned CCUS projects in the Golden State. Overall, gas will be used in about 4% of new-build generation constructed in the western United States over the next five years; by contrast, developers plan to build far more renewable generation—about 49 GW worth—in that region over that timeframe.

Gassier regions include the Great Lakes, where about 6 GW of new-build gas generation is slated to start turning dirt over the next five years. Developers also plan to begin construction of about 5 GW of gas generation in the Southwest during 2024-2028. In the Mid-Atlantic, about 3.6 GW of new gas generation is expected to begin construction over the next five years.

Electric asset owners have paid more volatile prices in recent years when compared with the quieter period of 2015-2020 when prices averaged a little more than \$3 per million British thermal units (MMBtu) (FIGURE 7). But Winter Storm Uri in early 2021, and Russia’s invasion of Ukraine in

early 2022, briefly brought gas price volatility back with a vengeance, according to the EIA. Market forces of supply and demand have since reasserted control, driving prices back down to pre-Uri levels.

Electric generators are expected to pay an average of between \$3 and \$4 per MMBtu during 2023 and 2024, the agency predicted. Longer term, the EIA expects gas use for electric generation to fall about one-third, from approximately 12 trillion cubic feet (Tcf) in 2022 to less than 8 Tcf by 2030, though the agency’s Annual Energy Outlook acknowledged there could be a high level of variance under alternate scenarios (FIGURE 8). Demand for gas among electric generators will fall as renewables capture market share.

In mid-2023, as heatwaves broiled large sections of the United States, grid operators and the North American Electric Reliability Corp. (NERC) warned, once again, that the U.S. electric supply was one banana peel away from a catastrophic crash. Judging from the surge in announced new-build generation plans in recent years (FIGURE 2), developers and utilities have taken notice, though only 5% of new-build generation over the 2024-2028 period is expected to be fired by natural gas (FIGURE 1).

RENEWABLES OUTLOOK

King Coal ruled the electric kingdom for most of the 20th century. Gas was great—for

Figure 7: Gas Prices Paid by Electric Generators since 2002

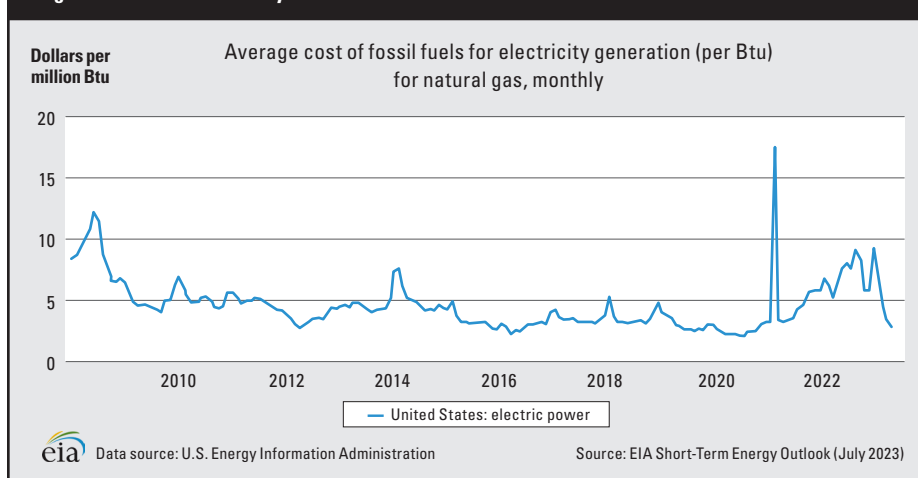
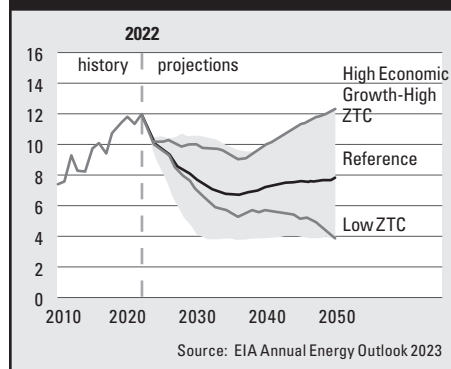


Figure 8: Gas Demand From Electric Generators Projected to Decline Through 2030



a decade or two. Now, we are several years into a period where renewables rock.

According to data tracked by IIR, about 460 GW of new-build renewable generation is scheduled to begin construction over the next five years, roughly 94% of all new generation.

Our traditional caveat applies here. IIR doesn't believe all this planned new generation will begin construction according to this schedule. This is particularly true for renewable generation, which has become more competitive over the years but still has some reliance on state and federal tax credits and incentives.

Our power plant database continues to show a high level of dynamism for planned renewable generation: Each day, new projects are added to our database while others are deferred or canceled. In our experience, as much as half of all planned renewable generation projects eventually are canceled or placed on hold—nearly double the rate for proposed gas-fired generation.

No matter how the future unfolds, this is what we know today: Renewables are expected to account for approximately 94% of all planned new-build generation projects in the United States over the next five years.

By region, the areas with the greatest planned reliance on new-build renewable energy are New England (99.9% of all scheduled new-build construction), the

Rocky Mountains (99.1%), the Midwest (98.3%), and the Northeast (96.3%). The least green regions, the Great Lakes and the Mid-Atlantic, still show renewable energy projects accounting for more than 80% of planned new-build power projects over the 2024-2028 period.

By type of generation, solar continues to be the leader: Approximately 45% of all new-build renewable generation built over the next five years is expected to be solar, continuing a yearslong trend where power from the sun is rising, while wind power is slowing (**FIGURE 9**).

Battery energy storage systems (BESS) continue to make sharp gains in new-build construction kickoffs: Those systems are expected to account for nearly 20% of all new-build renewable generation over the 2024-2028 period, up from 17% last year and virtually nothing in the prior years.

This extraordinarily green future may not fully come to pass if Congressional Republicans are successful in clawing back some of the estimated \$369 billion in investments designed to slash CO₂ emissions from the power sector.

Another potential headwind blowing against renewable generation is the yearslong interconnection queue, driven in part by the sheer number of proposed projects. Significant delays in connecting new generation have taken place at most RTOs and ISOs, including PJM, MISO, SPP, and even ERCOT. In PJM, some projects

have been delayed at least 24 months because they were unable to secure an interconnection agreement.

Like other sectors of the power industry, renewable developers and utilities are still working to remove supply-chain bottlenecks that have caused project costs to rise and in-service dates to be pushed back. Some sectors have fared better than others, but supply-chain delays have led to shortages of panels, inverters, and transformers.

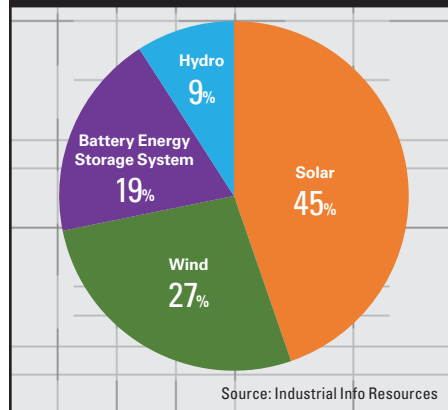
Supply-chain snafus also are threatening plans to build wind turbines offshore. President Biden aims to have 30 GW of offshore wind operating by 2030, but the U.S. Department of Energy's most recent estimate is that only 7 GW will be spinning by 2029. In addition to a global shortfall of underwater cables and inverters, these proposed projects face opposition from commercial fishermen and environmental activists worried about the impact offshore wind could have on their livelihoods and the underwater ecosystem, most notably whales and dolphins.

For all the forces driving the renewable generation buildout and the construction of new BESS, resource competition and prices have emerged as significant headwinds. Electric vehicles (EVs), BESS projects, and renewable energy generators all use, to some degree, the same minerals: lithium, nickel, cobalt, manganese, and graphite. Also, EVs use much more copper than their internal combustion counterparts. Demand for EVs, BESS, and renewable generation has surged, putting upward price pressure on the minerals.

There remains a pitched debate over whether the projected supply of these clean energy minerals will be sufficient to meet projected demand, and at what price.

The International Energy Agency (IEA) released a midyear 2023 report, *Critical Minerals Market Review 2023*, with an anxious undertone. "At a pivotal moment for clean-energy transitions worldwide, we are encouraged by the rapid growth in the market for critical minerals, which are crucial for the world to achieve its energy

Figure 9: Solar Owns a Strong Plurality of the New-Build Renewable Market



and climate goals,” said IEA Executive Director Fatih Birol. “Even so, major challenges remain. Much more needs to be done to ensure supply chains for critical minerals are secure and sustainable.”

NUCLEAR OUTLOOK

The first unit addition to the Alvin W. Vogtle Nuclear Power Station was brought online on July 31, 2023, billions of dollars over budget and years late. Unit 4 is expected to begin commercial operations at the end of 2023 or the start of 2024. And thus, will end the much ballyhooed “Nuclear Renaissance,” perhaps better titled “Nuclear Renaissance Part 1,” as hopes are rising about its sequel: small modular reactors (SMRs).

Presently, IIR is tracking about 2 GW of new-build nuclear that is scheduled to begin construction over the next five years.

This includes:

- 809 MW in the Rocky Mountains, split between the Utah Associated Municipal Power Systems (UAMPS) at the Idaho National Laboratory and TerraPower’s Natrium project at the Kemmerer brownfield site in Wyoming
- 798 MW in the Southeast at the Oak Ridge Clinch River brownfield site
- 320 MW in the Southwest, the Seadrift project is scheduled to be built at a Dow Chemical site in Calhoun County, TX

Overall, new-build nuclear is expected to account for less than 1% of all new generation over the next five years.

Given the last 50 years of performance by the nuclear industry, with any type of reactor design and cooling systems, we have our doubts the industry can clear even that low bar.

In 2020, the UAMPS project secured a \$1.355 billion grant from the U.S. Department of Energy to build up to 12 SMRs at 60 MW each. At the end of 2022, it reduced the number of units and increased the size of each SMR so that the net result was about 462 MW, down from the 720 MW originally envisioned.

One reason for the reduced scope:

NuScale, the developer, in early 2023 said the target price for power from those SMRs had jumped 53%, to about \$89 per MWh, up from an earlier estimate of \$58 per MWh.

Construction of the project is scheduled to begin in early 2025, and the units are expected to be operational by 2030.

Stay tuned.

MICROGRIDS OUTLOOK

The microgrid sector of the power industry continues to grow as the push for decarbonization, resiliency, and distributed energy resources moves forward.

Over the last couple of years, federal legislation, such as the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, as well as state-level regulations and the reliability-related conclusions of cities, military bases, commercial customers, and industrial concerns, have combined to expand the prospects for microgrid installations.

Moving into 2024, IIR expects spending in this sector to continue to climb, with more than \$500 million in projects scheduled to begin construction that year alone. We expect that number will grow as we move deeper into the 2024-2028 period.

Industrial energy producers are feeling the push to install microgrids through either site-specific unit additions or through third-party agreements for microgrids to be installed onsite by a third-party owner-operator. One of the drivers in the industrial manufacturing sector is a renewed federal government push for all federal and military sites to have a microgrid installed by 2030.

Historically, most microgrids were powered by diesel or natural gas, but a growing percentage of deployments are planned to be powered by renewable generation, coupled with some form of energy storage.

ENERGY STORAGE OUTLOOK

There are about 9,565 MW of energy storage systems operating in mid-2023, a sharp surge over 2021 and 2020 numbers, according to the

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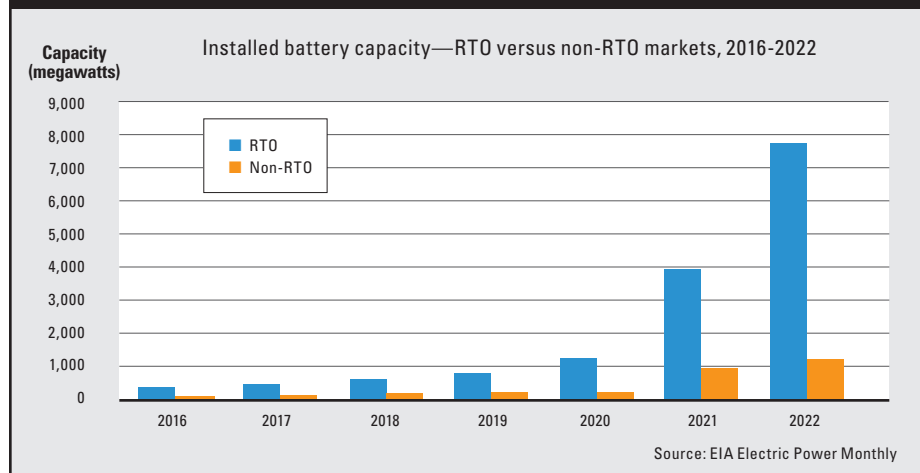
High-Temperature Roof Pipe Seal



Series 5 Mechanical Pipe Seal



Severe Service Access Door

Figure 10: Regional Transmission Organization (RTO) and Non-RTO Installations

EIA. Most of those systems, about 9,003 MW worth, are batteries. Nearly all batteries have been installed at a regional transmission organization (RTO) (**FIGURE 10**). Other types of storage systems are flywheel, compressed air, or concentrating solar power.

Going forward, IIR is tracking about 296 BESS projects that are scheduled to begin construction over the 2024-2028 period. The value of these projects is about \$68 billion.

The states expected to see the greatest deployment of BESS over the next five years, by dollar value, are Texas (107 planned projects worth about \$23.4 billion), Nevada (23 projects worth approximately \$16 billion), California (31 projects valued at roughly \$8.6 billion), and New York (53 projects worth about \$7.8 billion).

As with all projections, IIR does not expect every planned BESS project to be built according to its current timeframe. Energy storage is an extremely dynamic sector of the electricity business, and its future depends on various factors, not least the interconnection queue for renewable energy projects in RTOs and ISOs. Most of these planned BESS projects are tied to renewable generators, whether solar or wind.

Widespread blackouts resulting from unscheduled outages at power plants, an ever-present concern during recent summers, could boost plans to build BESS

projects. States with aggressive renewable portfolio standards are another driver.

While most BESS projects to date have been lithium-ion, other battery chemistries are being deployed, slowly, as safety concerns around lithium-ion batteries mount.

INDUSTRIAL ENERGY PRODUCTION OUTLOOK

Looking at the industrial energy production (IEP) outlook for 2024, IIR sees an increase of about \$4 billion in project spending when compared with 2022. The industrial sectors with the greatest interest in IEP include oil and gas, metals and minerals, pulp and paper, and industrial manufacturing.

Unit additions, equipment replacements, electrical upgrades, and plant expansions are the leading reasons for new-build deployments. However, maintenance spending continues to be part of the spending picture.

IEP spending by industrial manufacturers is focused on educational and medical facilities. The push toward decarbonization is leading metals and minerals firms, as well as oil and gas producers, to increase their use of renewable energy and natural gas-fired generation additions.

Equipment rebuilds, revamps, and replacements are the leading spending drivers for the pulp and paper sector in 2024.

IIR projects that spending on IEP by

industrial firms will remain strong for several years, especially with new initiatives, grants, legislation, and regulations pushing for carbon neutrality, infrastructure hardening, and improved electric resiliency. Corporate sustainability pledges are another driver for IEP using renewables.

LOOKING AHEAD

Could President Biden and his decarbonization goals suffer the same fate as the 600 British light infantrymen under the leadership of Lord Cardigan during the Crimean War—overwhelmed by opponents with greater numbers?

The proverbial cannons in Tennyson's poem are evident: congressional Republicans who are hostile to his goals; a federal judiciary stockpiled with conservatives skeptical of presidential overreach; a conservative super-majority in the Supreme Court; and energy-state elected officials eager to protect their legacy fossil-fuel extraction and combustion businesses.

And that's even before we consider the 2024 election, where one-third of incumbent senators (mostly Democrats), all 435 members of the House, and the presidency itself will be up for grabs. The chattering class has doubted Biden for years, and he has tepid support from the electorate, according to 2023 public opinion polls. But as president, Biden has pulled several rabbits out of hats.

Although Vegas oddsmakers favor Biden over Trump and DeSantis in the presidential race, the only poll that matters will be held on Nov. 5, 2024. ■



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