Business & Technology Report
July 2025

Electric Industry Outlook Report

NRECA
America's Electric Cooperatives

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Executive Summary

This report by NRECA's Business & Technology Strategies (BTS) group seeks to provide a high-level summary of trends in the U.S electric industry using recent projections produced by the U.S. Department of Energy's (DOE) Energy Information Administration (EIA). Below are some high-level findings and others are highlighted in this report:

The U.S. generation mix is undergoing rapid evolution as coal's share of generation continues to decline, renewables continue to grow, and natural gas remains the primary fuel for dispatchable generation:

- Under the **EIA's Reference Case**, coal generation is projected to drop from 14% in 2026 to less than 1% by 2032. Natural gas remains relatively stable through 2030 before declining to 28% by 2034.
- Renewable generation is expected to grow from 30% in 2026 to 54% by 2035, largely due to solar and wind investments, and improving cost competitiveness.
- The **Alternative Electricity Case**, which assumes the rollback of Clean Air Act (CAA) Section 111 rules, shows slower coal phase-out and a slightly different renewable growth trajectory, demonstrating the impact of federal environmental policy on energy projections.

Electric cooperatives' current energy mix differs from national average:

- In 2023, co-ops derived 36% of retail energy from natural gas, 25% from coal, and 23% from renewables.
- Non-hydro renewables are expected to grow significantly, primarily through Power Purchase Agreements (PPAs) for wind and solar projects, but also from several co-op owned solar projects.
- Grant and loan funding from the U.S. Department of Agriculture's (USDA) Empowering Rural America (New ERA) program are also expected to drive further expansion of co-op renewable generation and energy storage portfolios in the coming years.
- Investments in new natural gas generation of various types continues to rise to meet growing demand for energy and capacity, and cooperatives are also investing in significant new battery energy storage projects to support intermittent generation and improve grid reliability.

Capacity retirements and additions:

- Coal and gas retirements will total tens of gigawatts by 2030. This includes ~2.7 GW of coal capacity at units wholly or partially owned by electric cooperatives (14% of the current co-op coal fleet).
- New national capacity additions, especially solar and battery storage, are set to break records. Over 63 GW of new capacity is planned for 2025 alone. Co-ops are expected to add 600 MW of gas and 275 MW of solar in 2025, with larger additions in subsequent years.

The successful commissioning of **Plant Vogtle Units 3 & 4** and growing interest in **small modular reactors (SMRs)** suggest renewed potential for nuclear energy, particularly among data center operators seeking round-the-clock power.

Demand for electricity is accelerating at rates not seen in decades, with EIA projecting total electric sales in 2035 to be nearly 16% higher than in 2024. This growth is being driven by:

- **Reindustrialization:** A surge in domestic manufacturing – including clean energy, semiconductors, and electric vehicle (EV) production – requires massive new electric loads.
- **Hyperscale Data Centers:** Artificial Intelligence (AI), cloud computing, and digital infrastructure are fueling a wave of large-scale data centers. These facilities can require up to 1 GW of continuous power and already account for 4.4% of total U.S. electricity consumption (2023). This part of the industry could grow to 6.7–12% by 2028.
- **Grid Infrastructure Lag:** While data centers can be built in 2–3 years, electric infrastructure (generation, transmission, and pipelines) typically takes much longer, creating a widening supply-demand gap.

Natural gas will remain critical to U.S. electricity:

- U.S. natural gas production has more than doubled since 2005, driven by the widespread adoption of hydraulic fracturing and horizontal drilling technologies.
- However, increasing **LNG exports**, limited **pipeline capacity**, and global market exposure are putting upward pressure on domestic prices.
- Natural gas is the largest electricity generation source for both the nation and electric cooperatives, and a critical contributor to grid stability.
- Higher gas prices contribute directly to rising **wholesale power costs**, which represent the majority of expenses for distribution co-ops.

These are just a few statistics from this report that will shape the future of the energy economy.

1: Electric Industry Outlook

Introduction

This report by NRECA's Business & Technology Strategies (BTS) group seeks to provide a high-level summary of trends in the U.S. electric industry using recent projections produced by the U.S. Department of Energy's (DOE) Energy Information Administration (EIA). The report supplements these projections with *Cooperative Focus* subsections specifically on electric cooperatives, as well as *Issue in Focus* sections on two major topics impacting the industry: the growth in large commercial and industrial loads that are projected to accelerate demand for electricity, and changes in the U.S. natural gas markets that will have a major impact on the electric industry. While these two issues are national in scope, they will have particular impacts on electric cooperatives and the consumer-members they serve. **Note that this report does not take into consideration changes to tax credits and other energy related policy included in the most recent legislation signed into law in July 2025.**

Methodology

Each year, the Department of Energy's Energy Information Administration prepares the *Annual Energy Outlook* (AEO), a report on U.S. energy system projections and analysis. The AEO is broken down into different modeled cases to look at different assumptions and projections on energy production, consumption, technology, and prices to serve as a resource. "AEO2025's projections reflect business-as-usual trends, given known technological and demographic trends and current laws and regulations, and so provides a policy-neutral Reference Case and an accompanying set of core side cases that can be used to analyze policy initiatives."[1]

In this report, we will be using the Reference Case which "assesses how the U.S. energy markets could operate under laws and regulations, current as of December 2024 and under historically observed technological growth assumptions," as well as the Alternative Electricity Case which "assumes the Clean Air Act (CAA) Section 111 rule implemented by the Environmental Protection Agency (EPA) in April 2024 to regulate carbon dioxide emissions from new gas-fired combustion turbines and existing coal, oil, and gas-fired steam generating units is not in place, and the affected generators are able to operate under rules existing prior to April 2024. In this case, existing coal-fired plants continue operating without requiring modifications to reduce emissions and generation from new natural gas-fired combined cycle units isn't constrained based on whether the plant has installed carbon capture equipment."[2] The AEO projects energy trends out to 2050, but this report will focus on trends over the next decade, 2025 to 2035.

For nearer-term historical data and projections, especially as it relates to natural gas, we will be using data from the most recent EIA *Short Term Energy Outlook* (*STEO*) published in July 2025, which includes historic data through April 2025 and projections through the end of 2026 available through a data browser. Other sources are used to supplement EIA on relevant topics.

[1] *Annual Energy Outlook 2025*, (EIA, April 15, 2025), https://www.eia.gov/outlooks/aeo/.

[2] *Annual Energy Outlook 2025*.

U.S. Generation Mix

The U.S. generation mix continues to evolve based on new load requirements, changing power supply technologies, and changes in federal and state policy. In **Figure 1**, EIA's Reference Case forecasts the change in the U.S. electric generation mix from utility-scale generators (1 megawatt or larger) over the coming decade. Of note, the amount of generation produced from coal declines steeply from 14% in 2026 to 8% in 2030 before falling to under 1% in 2032 and beyond, driven by the retirement of legacy generation and other factors. Natural gas generation supplies 37% of electricity in 2026 and its share remains mostly flat, declining somewhat to 34% in 2031 and then rising somewhat in 2032 to offset the decline in coal generation before falling slowly to 28% in 2034. Generation from renewable sources is forecasted to account for 30% of total generation in 2026, growing steadily across the entire period. However, this is due to projected accelerated growth in 2031, reaching 54% by 2035, driven primarily by growth in solar and wind capacity, as well as technological improvements for these technologies. Generation from nuclear and petroleum stays consistent throughout the modeled period.

Figure 1: U.S Generation Mix, AEO2025 Reference Case[3]

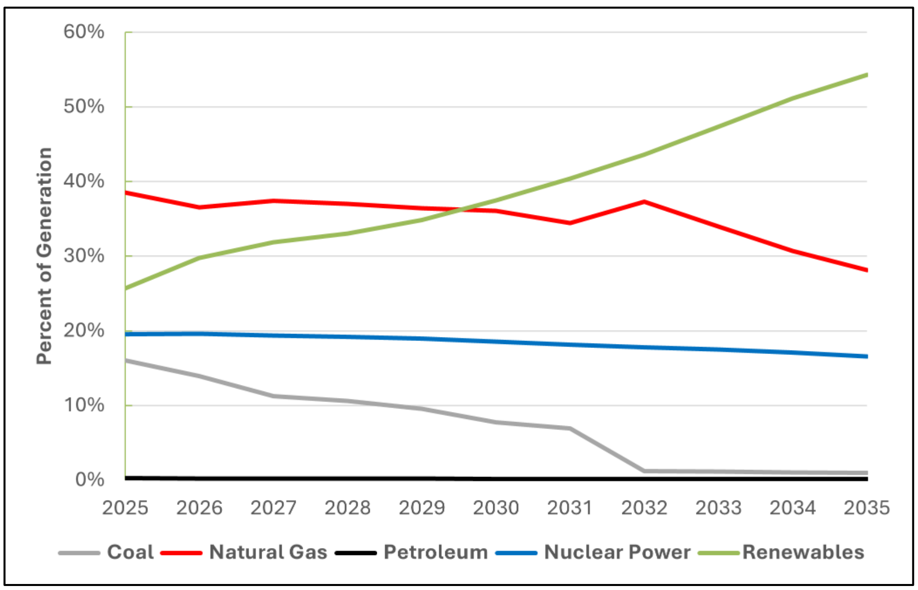
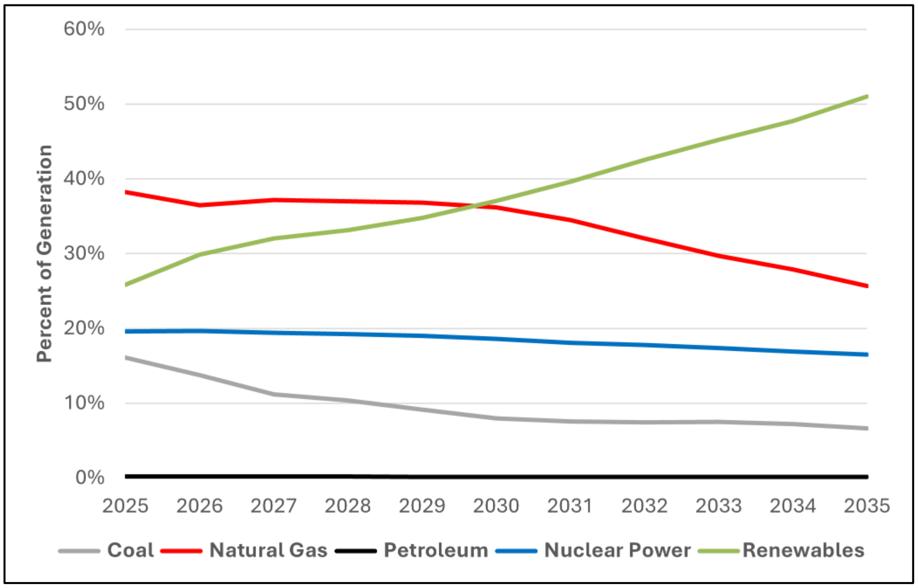


Figure 2 depicts EIA's forecast using the Alternative Electricity Case, which assumes that the CAA Section 111 rule is not implemented. In this case, generation from coal is forecasted to be at 14% of total generation in 2026, with its share declining slowly to 7% in 2035. The main difference in this case is that without the phase out of coal, natural gas generation is forecast at 36% of total U.S. generation in 2026, remaining flat until 2030, when it begins a gradual decline to 26% of total generation in 2035. Renewable generation is still forecasted at 30% of total generation and sees smaller gains through the early 2030's with renewable generation reaching 51% of total generation by 2035. Under the Alternate Electricity Case, generation from nuclear and petroleum sources do not see any significant changes to their forecast, with nuclear power's share of total generation forecast at 20% in 2026 dropping slightly

[3] *Annual Energy Outlook 2025*.

to 17% in 2035. Comparing the two modeled cases illustrates that policy changes can have an impact on the U.S. generation mix.

Figure 2: U.S. Generation Mix, AEO2025 Alternative Electricity Case[4]



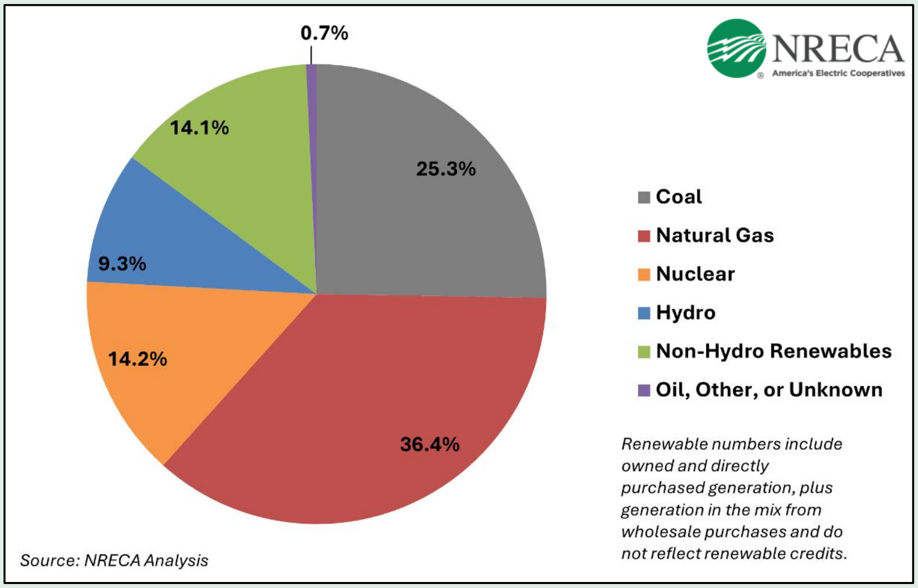
Cooperative Focus: Fuel Mix

Our most recent estimate of the national electric cooperative retail fuel mix for 2023 is shown in **Figure 3**. Compared to the 2023 U.S. generation mix, the electric cooperative retail fuel mix – which includes power generated at co-op owned plants and power purchases – had a higher share of coal generation at 25% (vs. 16%), and a bit lower generation from natural gas at 36% (vs. 43%) and nuclear at 14% (vs. 19%). The share of power from renewable resources in the co-op mix was slightly higher at 23% (vs. 21%), including a relatively higher share of hydropower, which is mostly purchased from federally owned dams. "Natural gas was the largest source of power for co-ops in 2023, rising by more than 4% to over 36%, its highest level ever. Natural gas and coal are often directly competing resources, so the decline in natural gas prices in 2023 also put pressure on coal generation more generally."[5] Based on NRECA's analysis, non-hydro renewables are expected to grow rapidly due to new and planned projects.

[4] *Annual Energy Outlook 2025*.

[5] Michael Leitman and Lauren Khair, "Natural Gas Reached a New High in the 2023 Electric Cooperative Fuel Mix" (NRECA, April 2025), https://www.cooperative.com/programs-services/bts/Documents/Advisories/Advisory-2023-Co-op-Fuel-Mix-Analysis-April-2025.pdf.

Figure 3: 2023 National Electric Cooperative Retail Fuel Mix (~ 503 million MWh)



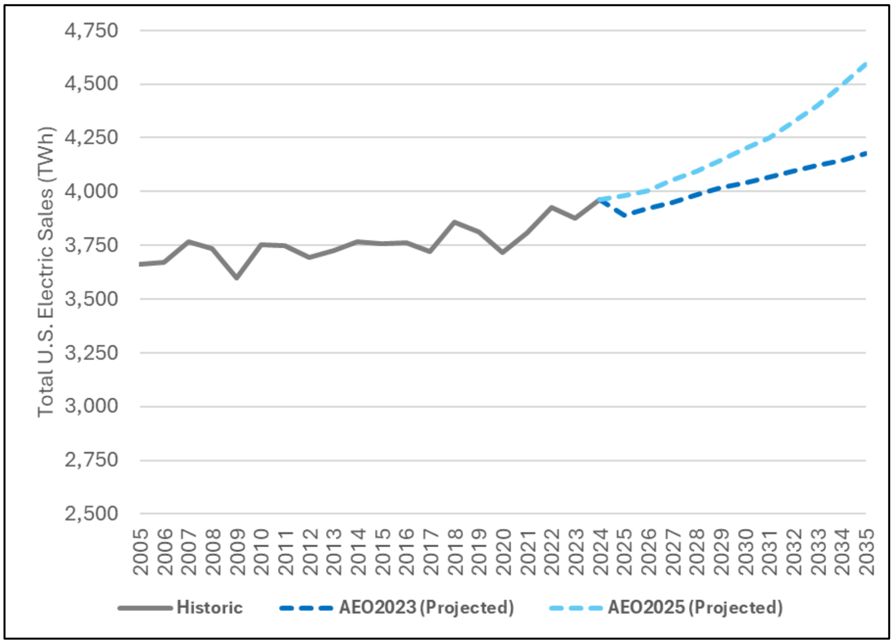
Explosion of New Demand

After nearly two decades of slow electric demand growth averaging ~1% per year, load forecasts have risen sharply in the last few years. **Figure 4** on the next page shows this historic period of relatively flat U.S. electricity sales and compares the *AEO2025* Reference Case projection to EIA's most recent prior Reference Case projection from its *AEO2023*[6] report. Highlighting the rapid shift in the electric sales growth picture, EIA now projects that electric sales in 2035 will be 15.9% higher than historic 2024 sales, nearly triple the 5.5% increase projected just two years ago.

With the increase in electrification, the proliferation of "hyperscale" data centers, new manufacturing, and other large consumers of electricity placing new demands on the bulk power grid, the overall level of demand growth is all but certain to accelerate, with concentrations of large previously unexpected growth in many parts of the country. This upsurge in demand is occurring at a challenging time for the U.S. electric grid. Traditional generation, especially coal, is rapidly retiring, while new generation of all types as well as the necessary transmission and natural gas pipelines to interconnect face delays due to local opposition, permitting delays, and supply chain issues. This report will provide a high-level overview of different drivers and challenges for large load growth in a subsequent section.

[6] EIA did not release an AEO in 2024 while it upgraded its National Energy Modeling System used for the analysis.

Figure 4: Total U.S. Electric Sales with EIA Projections through 2035[7]



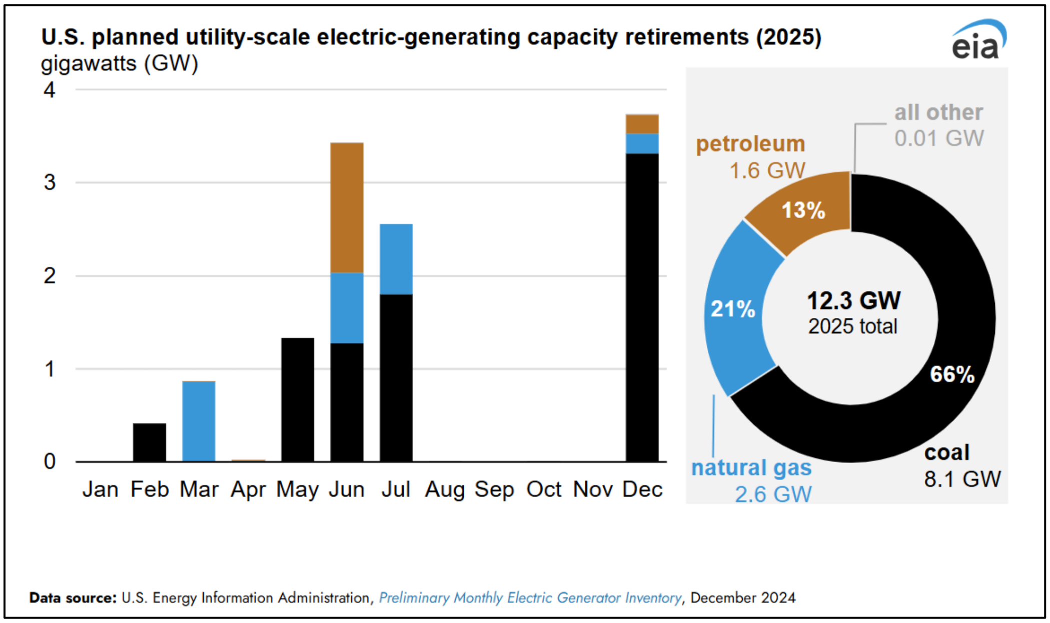
U.S. Electric Sector Retirements

According to EIA, "electricity generators plan to retire 12.3 gigawatts (GW) of capacity in 2025, a 65% increase in retirements compared with 2024. Last year, 7.5 GW was retired from the U.S. power grid, the least generation retired since 2011, according to data reported to us in our latest inventory of electric generators."[8] **Figure 5** shows planned 2025 retirements by month and fuel type. Due to the nature of EIA reporting, many of these planned retirements are slated for the end of 2025. An unusually high amount of petroleum-based generation is retiring in 2025 due to the scheduled retirement of two large plants, Herbert Wagner in Maryland and Allen in Tennessee.

[7] *Annual Energy Outlook 2025* and Annual Energy Outlook 2023, (EIA, March 16, 2023), https://www.eia.gov/outlooks/archive/aeo23/.

[8] "Planned Retirements of U.S. Coal-Fired Electric-Generating Capacity to Increase in 2025," (EIA *Today in Energy*, February 25, 2025), https://www.eia.gov/todayinenergy/detail.php?id=64604.

Figure 5: U.S. Planned Capacity Retirements by Fuel Type, 2025 by Month[9]

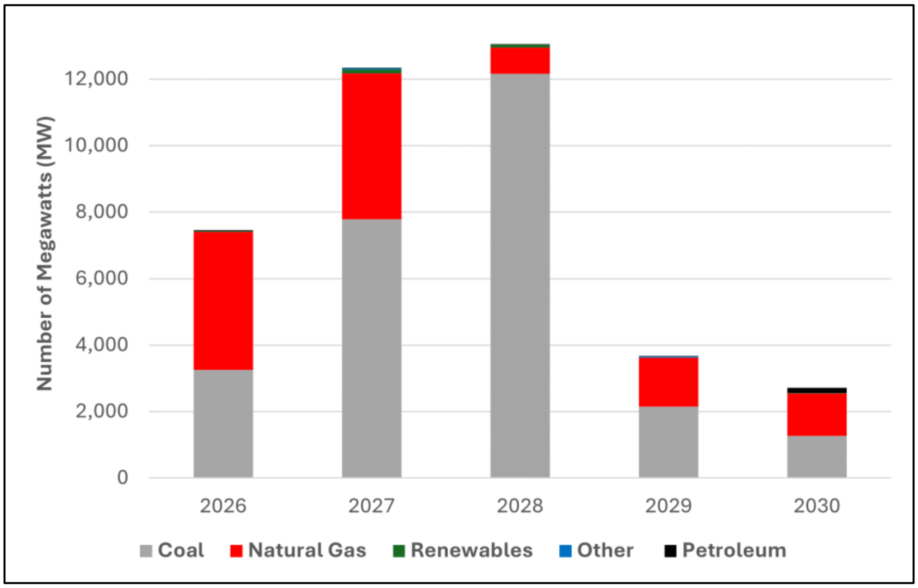


Looking out past 2025 at the other planned retirements reported to EIA on the EIA-860 Annual and the Preliminary Monthly Electric Generator Inventory, we can see significant retirements for coal and natural gas plants, shown in **Figure 6**. These retirements are reported to EIA directly by the plant operator and are subject to change.

- In 2026, natural gas leads retirements with over 4.1 GW scheduled, with coal retirements making up most of the other retirements at 3.2 GW.
- In 2027, over 7.7 GW of coal capacity is scheduled to retire, with 4.3 GW of natural gas retirements also planned.
- In 2028, over 12.1 GW of coal capacity is scheduled to retire, along with approximately 800 MW of natural gas capacity.
- Smaller amounts of generation are currently planned to retire between 2029 and 2030, including 3 GW of coal and 2.7 GW of natural gas generation.

[9] Image from "Planned Retirements of U.S. Coal-Fired Electric-Generating Capacity to Increase in 2025."

Figure 6: U.S. Planned Capacity Retirements by Fuel Type, 2026-2030[10]

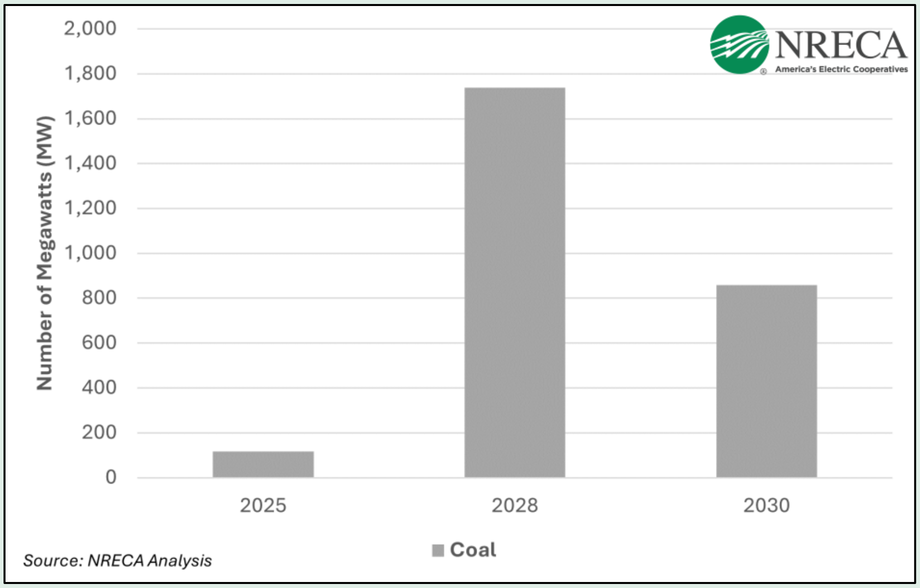


Cooperative Focus: Plant Retirements

Electric cooperatives are retiring generating units at a slower pace compared to the rest of the industry. **Figure 7** shows announced retirements of co-op owned generating capacity throughout the 2030 planning horizon, totaling approximately 2.7 GW, all of it at coal plants. In many cases, these are units where electric cooperatives are minority owners, and the closure decision is being made primarily by the investor-owned utility with majority ownership. This represents 14% of the capacity of the entire cooperative coal fleet that is currently operational. Cooperative owned coal units often have a higher capacity factor compared to others and are used to meet reliability and resilience requirements at their utilities and the wider markets in which they are located.

[10] *Annual Energy Outlook 2025*.

Figure 7: Co-op Planned Capacity Retirements, 2025-2030



U.S. Industry Capacity Additions

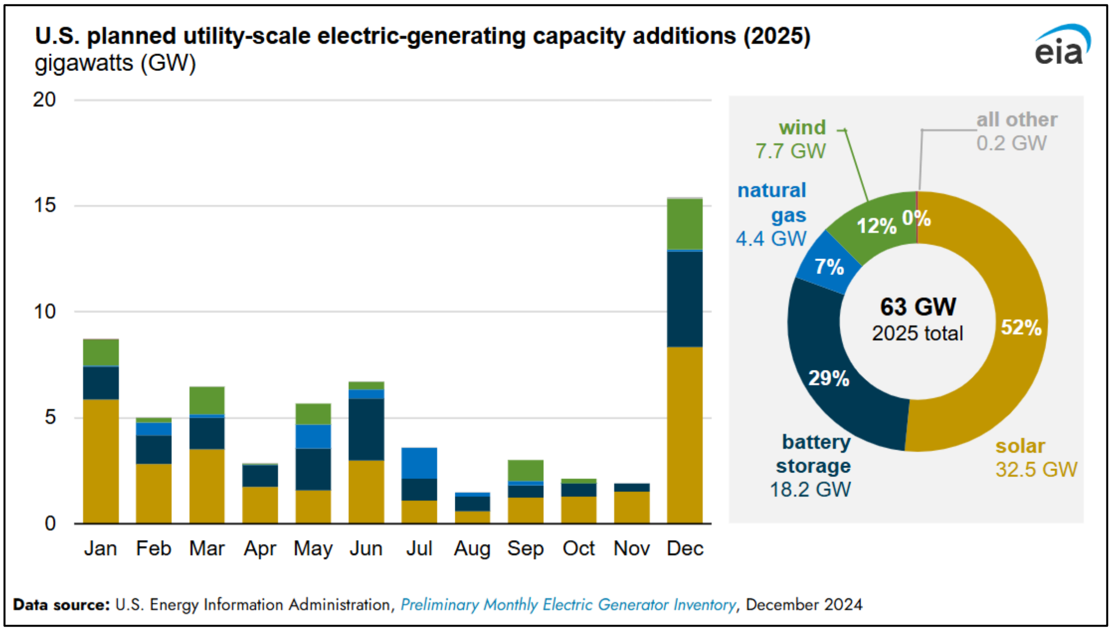
According to EIA's Preliminary Monthly Electric Generator Inventory, the new generating capacity additions in 2025 will surpass what was added in 2024 by over 30%.[11] As **Figure 8** illustrates, in 2025 there are over 63 GW of resources planned to be added to the grid. For a plant to be added to the EIA's database, the plant owners and operators report to EIA on the EIA-860M survey starting when they are within 12 months of commercial operation. Because of the nature of the reporting, many plant owners record the end of the year as the commercial operation date, which is why the majority of the additions are planned for December, though some of that capacity may come online earlier in the year.

Based on EIA's data, 2024 was a record year for solar installations, with over 30 GW of solar additions added to the grid. Another 32.5 GW of utility-scale solar capacity is planned to come online in 2025, with nearly half of this capacity in just two states, Texas (11.6 GW) and California (2.9 GW). As it pertains to wind, two large offshore plants are planned to come online this year on the East Coast totaling approximately 1.5 GW from just those two plants. Of note, there are 18.2 GW of new battery energy storage capacity planned for 2025, exceeding the record of 10.3 GW set in 2024. For natural gas additions, developers are adding 4.4 GW of gas with 50% of those plants built as simple cycle and another 36% of those plants built as combined cycle.[12]

[11] "Solar, Battery Storage to Lead New U.S. Generating Capacity Additions in 2025," (EIA's *Today in Energy*, February 24, 2025), https://www.eia.gov/todayinenergy/detail.php?id=64586.

[12] "Solar, Battery Storage to Lead New U.S. Generating Capacity Additions in 2025."

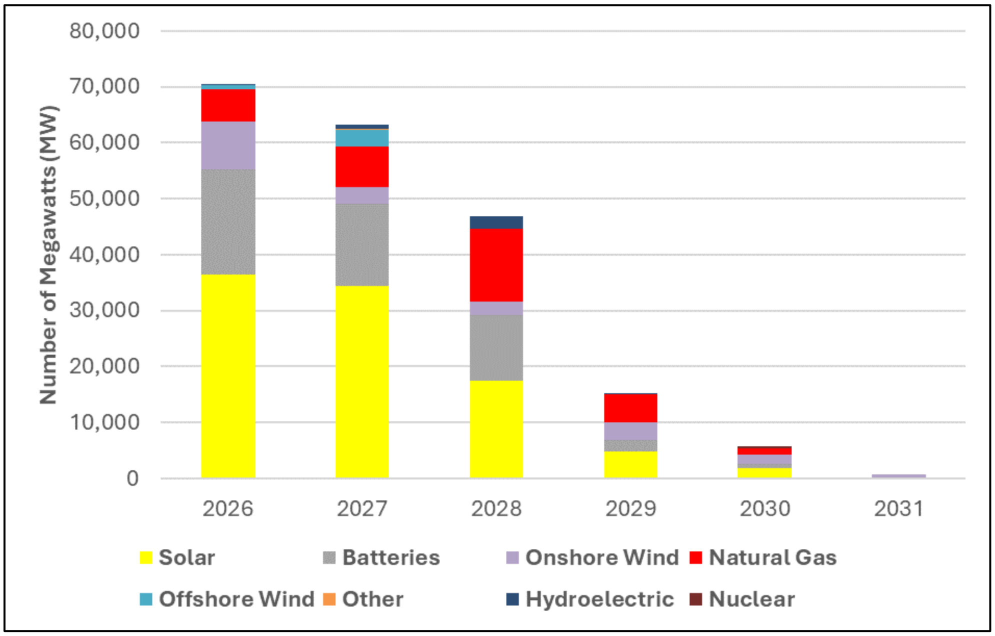
Figure 8: U.S. Planned Capacity Additions by Fuel Type, 2025 by Month[13]



Looking out past 2025, **Figure 9** shows that the amount of new capacity being added to the grid continues to grow steadily and surpasses what is announced to be added in 2025. In 2026, it is reported that over 70 GW of new resources will be added to the grid, with solar accounting for over half of the additions at 36 GW of capacity, batteries adding another 18 GW of capacity, natural gas adding 5.7 GW, and onshore wind making up the rest of the large additions at 8.3 GW of capacity. Solar additions continue to grow rapidly with over 50% of the additions projected in 2027 (34 GW) and more than 35% of total additions in 2028 (17 GW) before steadily decreasing in the later part of 2028. Battery capacity continues its strong growth, with approximately 18 GW in 2026, 14 GW in 2027, and another 11 GW in 2028. With the offshore wind units scheduled to become operational in 2025, more units get added in 2026 (~300MW) and in 2027 (3 GW) making the total capacity of offshore wind by the end of 2027 at potentially 4.5 GW. Onshore wind unit additions are reported as approximately 8 GW, 3 GW, and 2 GW from 2026 -2028. Natural gas additions continue steadily with approximately 5.7 GW in 2026, 7.3 GW in 2027, and 13.1 in 2028 respectively. It is expected that some of these units may be delayed and pushed out into later in the 2020's or early 2030's.

[13] Image from "Solar, Battery Storage to Lead New U.S. Generating Capacity Additions in 2025."

Figure 9: U.S. Planned Capacity Additions by Fuel Type, 2026-2031[14]

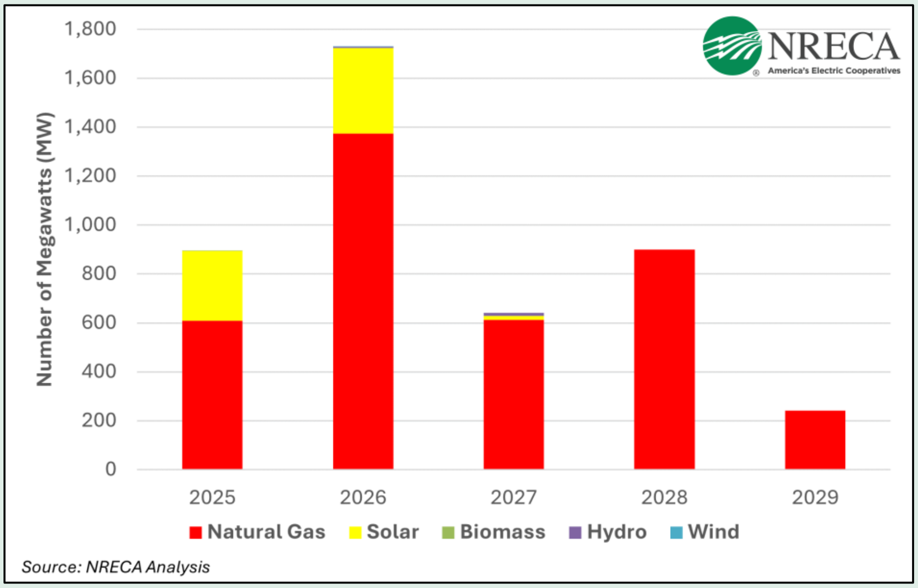


Cooperative Focus: Capacity Additions

In **Figure 10**, the capacity of announced cooperative owned generation projects is illustrated. Note that many cooperatives choose to procure a Power Purchase Agreement for resource additions – most commonly for renewable projects – which are not included here. In 2025, cooperatives are expected to bring over 600 MW of natural gas capacity online, with another 275 MW of solar being added as well. In 2026, cooperatives are expected to bring over 1.6 GW of resources online, including approximately 1.3 GW of natural gas and 350 MW of solar. Through 2029 the natural gas additions continue with 600 MW in 2027, 900 MW in 2028, and 241 MW in 2029. Battery energy storage capacity is not shown here, but our analysis shows that co-ops are planning to add roughly 1.5 gigawatts of new battery capacity over the next three years through a combination of owned and PPA projects. These numbers are expected to increase because, in most cases, they do not include new projects funded through the United States Department of Agriculture's (USDA's) Empowering Rural America (New ERA) grant program, which will bring online substantial new generation and battery storage at many cooperatives across the country.

[14] *Annual Energy Outlook 2025*.

Figure 10: Co-op-Owned Generation Planned Capacity Additions, 2025-2030

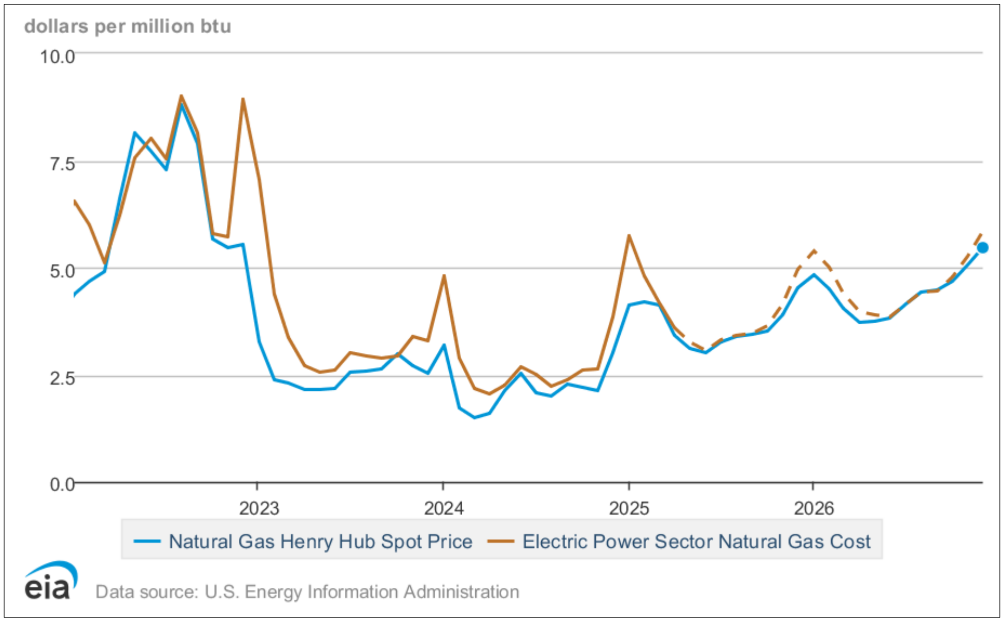


Natural Gas Prices

The price of natural gas is a critical metric for the electric industry, as natural gas plants have become the largest source of generation nationally over the last decade and price fluctuations can have significant impact on the amount and types of resources that provide power to the United States and, ultimately, the price paid for electricity by homes and businesses. **Figure 11** illustrates the historical natural gas price, both at the Henry Hub benchmark and as reported for electric power sector generators, and what these are forecast to be based on EIA's STEO.[15] After the global pandemic, it took a while for natural gas production and supply chains to ramp back up, which led to longer sustained Henry Hub price which reached a high of over $8.00 per million British thermal units (MMBtu) before falling dramatically in later half of 2023 to just a bit over $2.50 MMBtu. As the graphic illustrates, the Henry Hub price has been steadily increasing again through 2024 and the beginning of 2025. It is forecasted to continue to increase to over $5.00 MMBtu by the end of 2025 or beginning of 2026. This report provides a high-level overview of issues impacting natural gas supply, demand, and prices in a subsequent section.

[15] *Short-Term Energy Outlook (July 2025)*, (EIA, July 8, 2025), https://www.eia.gov/outlooks/steo/outlook.php#issues2025.

Figure 11: EIA Recent and Projected Natural Gas Prices[16]



The Future of Nuclear Energy

After years of stagnation, the nuclear industry has seen significant changes in the last few years with Plant Vogtle Units 3 and 4 in Georgia entering commercial operation in 2023 and 2024, respectively, marking the first new nuclear units to come online since the completion of Watts Bar Unit 2 in Tennessee in 2016, as illustrated in **Figure 12** below. While the completion of the Vogtle Units saw significant time and cost increases during their development, there is growing interest in using the lessons and experienced workforce from these two projects for additional large-scale nuclear units, especially considering the challenge of meeting rapidly accelerating demand driven by data centers and other large loads. This includes renewed interest in completing the construction of Units 3 and 4 at the VC Summer in South Carolina, a project that was cancelled in 2017 due to cost overruns and the bankruptcy of the prime contractor.[17]

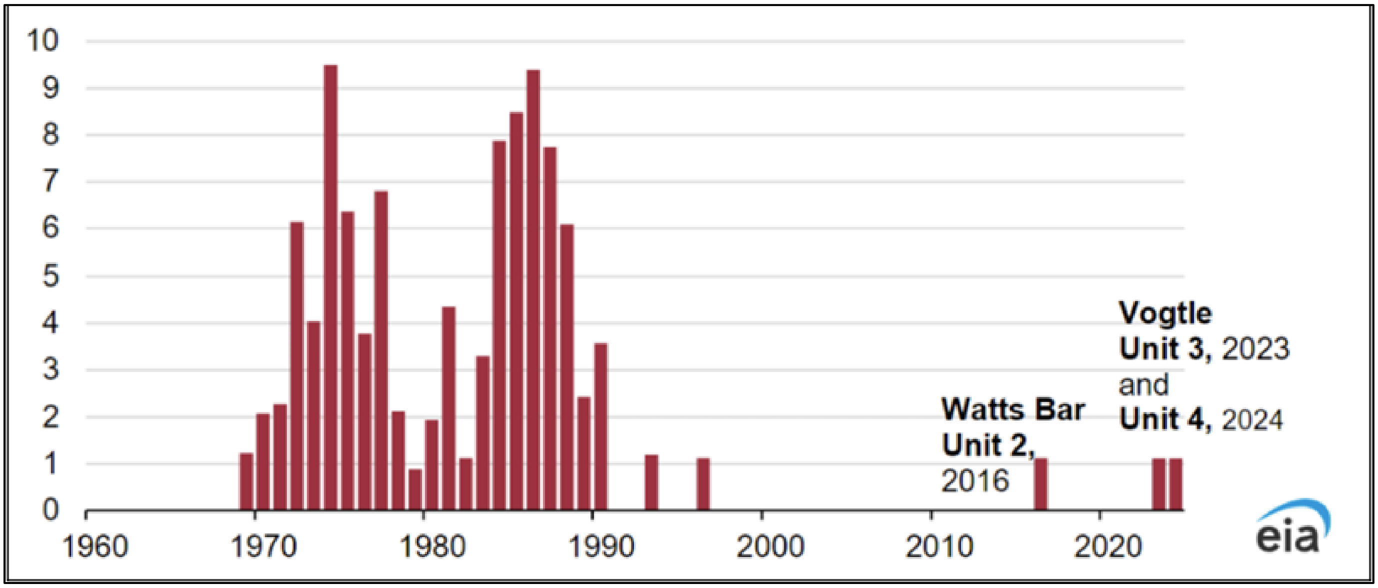
In addition, the increase of interest around small modular reactor (SMR) technology as a means of meeting increasing demand has made a nuclear renaissance a real possibility. There are several companies developing designs at various scales using a variety of traditional and advanced technologies. Only one SMR technology, NuScale, has made it through the Nuclear Regulatory Commission (NRC) regulatory process, with others set to follow. Currently, no SMR is in operation and the costs are expected to be very high – comparable to traditional large-scale nuclear plants on a per-MW basis – for first of their kind deployments. The premise of SMR technologies is that successful projects using smaller standardized designs will create economies of scale and production that will bring costs down

[16] Image from *Short-Term Energy Outlook Data Browser*, (EIA, July 8, 2025), https://www.eia.gov/outlooks/steo/data/browser/. The data in the browser is updated monthly, but STEO reports and data are archived at https://www.eia.gov/outlooks/steo/outlook.php.

[17] Rochas, Anna Flávia, "Plans to restart construction of VC Summer reactors gain traction," (Reuters, , July 4, 2025), https://www.reuters.com/business/energy/plans-restart-construction-vc-summer-reactors-gain-traction-2025-07-04/.

for subsequent units. The future of nuclear energy is one to watch and could add new opportunities for fuel diversity to the electric sector.[18]

Figure 12: U.S. Nuclear Capacity Additions by Year (in Gigawatts), 1960-2024[19]



Co-op Focus: Nuclear Ownership & PPAs

Rural electric cooperatives have a long history of supporting nuclear energy and using it to meet the power supply needs of rural Americans. While electric cooperatives do not own and operate any nuclear units outright, several G&T cooperatives own minority shares of nuclear units in several states for a total of nearly 3.4 GW of capacity, as shown in **Figure 13** on the next page. In addition, two G&Ts have recently added PPAs for nuclear generation totaling 161 MW, and two others have signed a PPA for the output of the 800 MW Palisades Nuclear Power Plant in Michigan, which would be the first restart of a previously retired nuclear plant in history.[20] There is interest in re-starting other recently retired nuclear plants to meet rising demand, including the 600 MW Duane Arnold Nuclear Plant in Iowa. This plant was retired by its majority owner, NextEra Energy, in 2020, but two G&T cooperatives retain a combined 30% minority ownership share of the plant.[21]

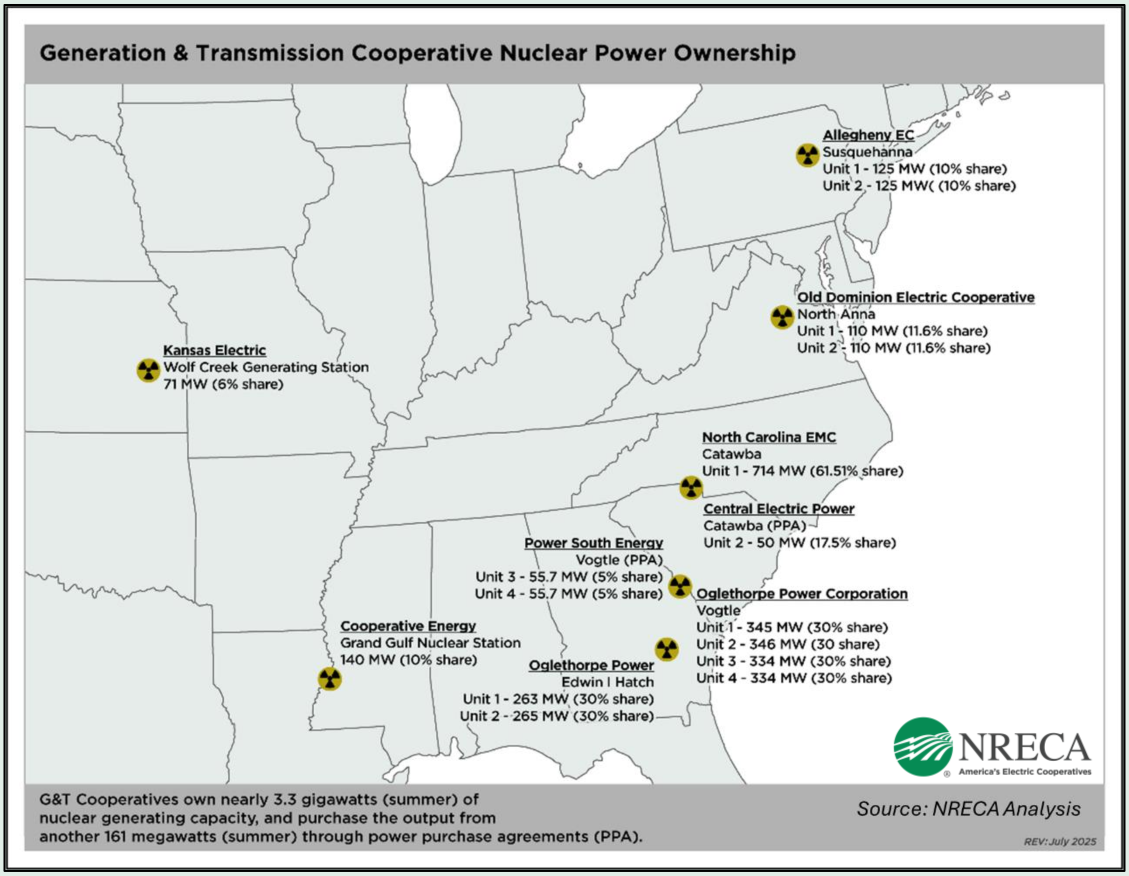
[18] For more information on the current state of nuclear power in the United States, see this recent Business & Technology Surveillance report published by NRECA. Matz, Michael, "The State of Nuclear Power 2025," (NRECA, June 2025), https://www.cooperative.com/topics/power-supply-wholesale-markets/Pages/The-State-of-Nuclear-Power-2025.aspx.

[19] Image from "Plant Vogtle Unit 4 begins commercial operation," (EIA *Today in Energy*, May 1, 2024), https://www.eia.gov/todayinenergy/detail.php?id=61963.

[20] Cash, Cathy, "G&T Focus: Wolverine and Hoosier Make History With Palisades Restart Project" (NRECA *Rural Electric Magazine*, January 13, 2025), https://www.cooperative.com/remagazine/articles/Pages/GT-Focus-Wolverine-and-Hoosier-Make-History-With-Palisades-Restart-Project.aspx.

[21] Matz, Michael, "The State of Nuclear Power 2025."

Figure 13: Electric Cooperative Nuclear Ownership and PPAs



2: Issue in Focus: Large Loads

Introduction

Faster load growth is being driven by continued electrification of end uses and transportation, and especially by the proliferation of large commercial and industrial loads, including fleet charging for medium- and heavy-duty commercial trucking, reindustrialization and onshoring of manufacturing, and the spread and increasing size of data centers. These loads are often highly concentrated, with fast ramp times that can put stress on local grids while also straining resource adequacy of regional wholesale markets and the wider bulk power system. This paper focuses on the latter two types, manufacturing and data centers.

Reindustrialization

In recent years, the United States has experienced momentum towards increasing domestic production and advancing the use of wind, solar, and other low-carbon energy sources. This reindustrialization of the U.S. economy is largely attributed to the supply chain disruptions during the COVID-19 pandemic, the Russia-Ukraine war, and the desire to increase domestic manufacturing in strategic sectors, including electric generation and storage technologies.[22] A white paper by the Electric Power Research Institute (EPRI) illustrated the potential exponential growth in large manufacturing loads across four key industries: clean energy, semiconductors and electronics, transportation and mobility, and heavy industry (see Figure 1).[23]

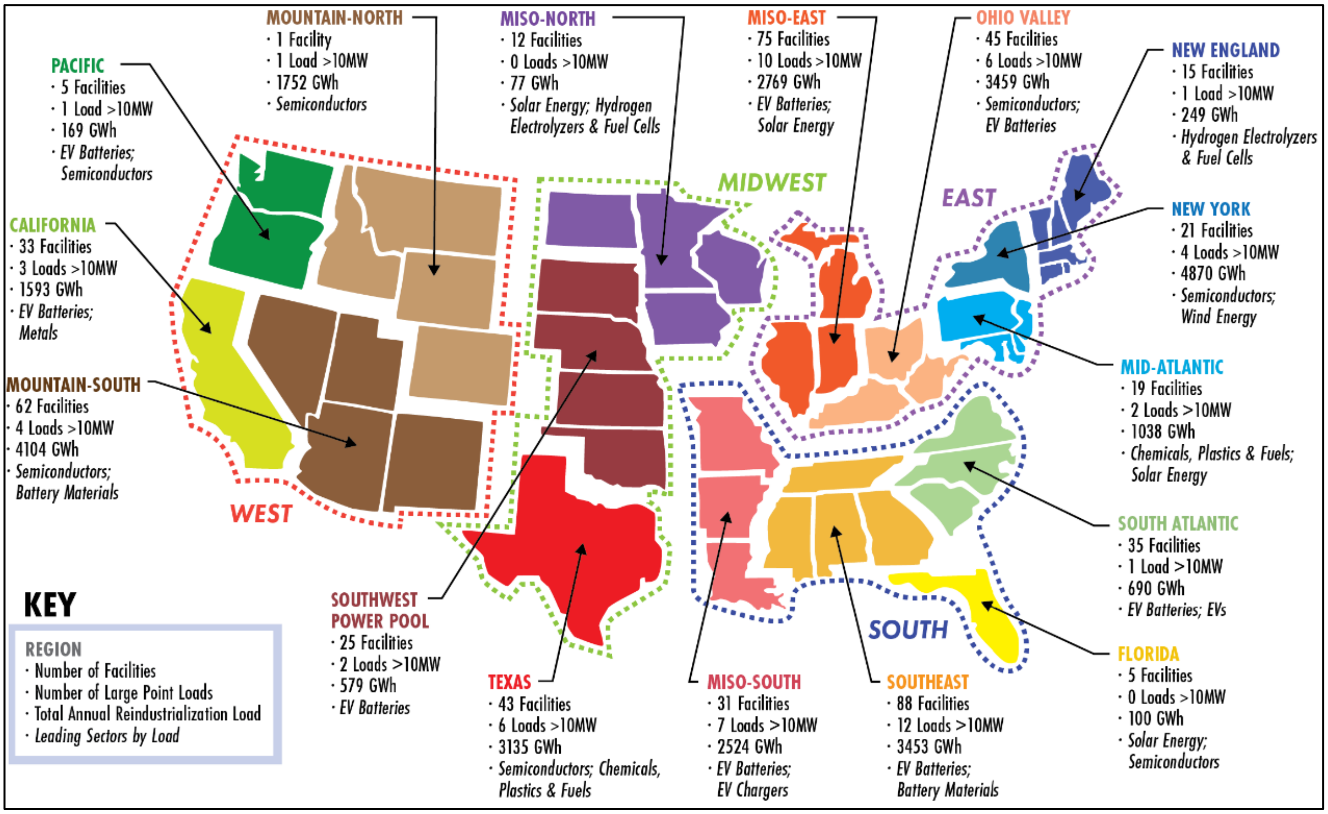
According to EPRI's findings displayed in **Figure 14** below, as of May 1, 2024, there were "524 new or expanded manufacturing facilities have been announced, initiated construction, or begun operation since January 1, 2021." If all these facilities are completed, they would create 30 terawatt-hours per year (TWh/yr) in additional electricity demand. The most demand comes from semiconductors and electronics facilities, while the clean energy sector – including solar, wind, energy storage, hydrogen technologies, and heat pumps – and the transportation sector – including electric vehicles, EV batteries, charging infrastructure, and related components – together make up more than 75% of new facility announcements and 45% of the projected new electricity load.[24]

[22] P. Patel, "Reindustrialization 2024: U.S. Load Growth Impacts." (EPRI, November 2024), https://www.epri.com/research/products/000000003002031350.

[23] "Reindustrialization, Decarbonization, and Prospects for Demand Growth" (EPRI, July 27, 2023), https://www.epri.com/research/products/000000003002027930.

[24] "Reindustrialization, Decarbonization, and Prospects for Demand Growth."

Figure 14: Expected Near-Term Industrial Load Growth by Region (Source: EPRI)[25]



The Proliferation of Data Centers

The large loads that have received the most attention, however, are data centers. Data centers are the cornerstone of the digital world, enabling everything from cloud services to machine learning—more commonly known as artificial intelligence. The rapid adoption of AI, rising industrial investments, cryptocurrency mining, and the ongoing expansion of digital infrastructure are fueling a global surge in data center development.[26] These facilities rank among the most energy-intensive building types, using 10 to 50 times more energy per square foot than a typical commercial office building.[27] According to a report produced by Lawrence Berkley National Laboratory (LBNL), data centers accounted for approximately 4.4% of the United States' total electricity usage in 2023. The report uses a "bottom-up" approach to estimating the amount of energy data centers use, which uses values from equipment and infrastructure characteristics for calculations. Using this bottom-up methodology, LBNL reports that data center electricity usage is projected to rise to between 6.7% (325 TWh) and 12% (580 TWh) of total usage by 2028.[28]

[25] P. Patel.

[26] A. Shehabi et al., "2024 United States Data Center Energy Usage Report," (Lawrence Berkeley National Laboratory, December 2024), https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf.

[27] "Data Centers and Servers," Energy.gov, accessed May 30, 2025, https://www.energy.gov/eere/buildings/data-centers-and-servers.

[28] Shehabi et al., "2024 United States Data Center Energy Usage Report."

Data Center Energy Consumption

Prior to the recent growth driven by increased cloud computing and more recently AI, data center electricity consumption stayed at a consistent 60 TWh per year. In 2018, U.S. data centers used 76 TWh, 1.9% of total U.S. electricity consumption. Usage rose rapidly after 2018, reaching 176 TWh in 2023, a 131.6% increase within five years, and accounting for 4.4% of total consumption. **Figure 15** below shows historical and projected data center electricity use from 2023 through 2028. Projections shown by LBNL range widely, from 6.7% to 12%, due to potential changes in data center equipment efficiencies, average operational power time, cooling system type and efficiencies, and future data center buildouts.[29]

Figure 15: Total U.S. Data Center Electricity Use from 2014 through 2028 *(Source: LBNL)*[30]

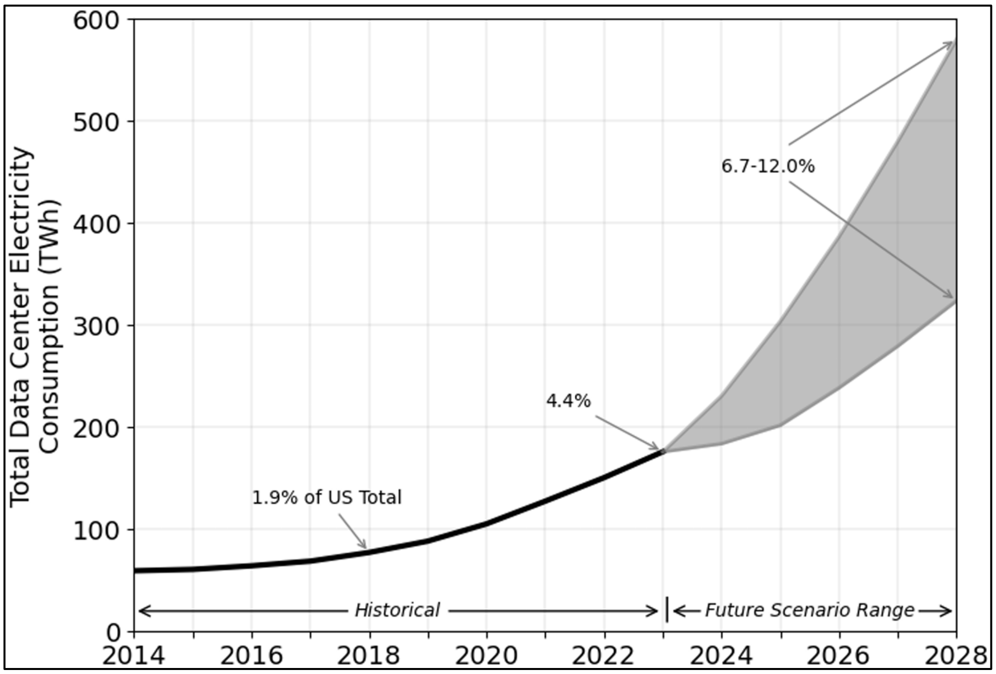


Figure 16 graphs the results of industry and financial analytics showing a dramatic increase in historical data center and energy use from 2020 through 2023/2024 (the solid lines), and various projections of growth through 2030 (dotted lines), which all show growth either continuing at the same accelerated rate or slowing somewhat but still significantly above pre-2020 historic growth rates. The International Energy Agency (IEA) (2024) gives a projected data center energy use in 2026 of ~260 TWh, while Boston Consulting Group's 2030 data center energy use estimates fall between ~335 TWh and ~391 TWh.

As for energy use trends, EPRI provides four scenarios:

- Low case: a gradual ~6 TWh/year increase, exhibiting a ~27% growth from 2023 to 2030;
- Medium case: an ~8.6 TWh/year increase, exhibiting a ~39% growth from 2023 to 2030;

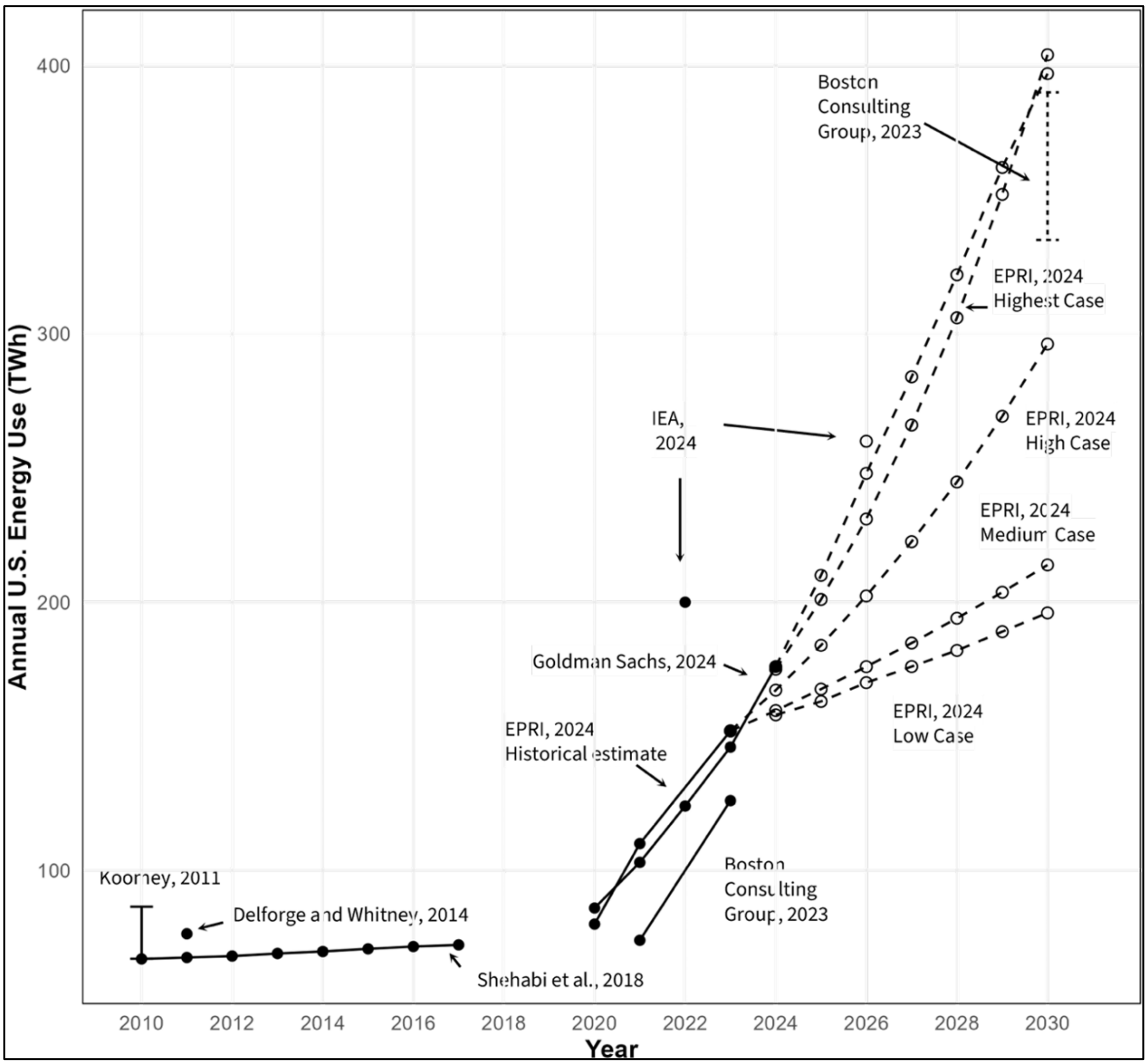
[29] Shehabi et al.

[30] Shehabi et al.

- High case: a steep ~20.3 TWh/year increase, exhibiting a ~92% growth from 2023 to 2030; and
- Highest case: a ~34.7 TWh/year increase, exhibiting a 156.7% growth from 2023 to 2030.

EPRI's Highest Case projection approximates the analysis from Goldman Sachs, which provides the most aggressive projection of ~404 TWh by 2030 – an approximately 38.2 TWh/year growth from 2024.

Figure 16: Academic and Industry Historical Estimates of U.S. Data Center Energy Use (Source: LBNL)[31]



[31] Shehabi et al.

Data Center Location

Data centers of various sizes and functions are scattered across the United States. According to the commercial real estate firm CBRE, data center construction has reached a record high, with a 69% year-over-year increase from 2023 to 2024.[32] For colocation[33] and hyperscale[34] data centers, preference for building locations depends on proximity to clients with the aim of reducing server response times (latency) and other factors such as proximity to population hubs, electricity and utility costs, and adequate network infrastructures.[35]

Another report from EPRI found that despite being located throughout the United States, hyperscale data center locations are not as diverse, with 15 states housing 80% of the national data center energy consumption (see **Figure 17**). Virginia, with its unparalleled network infrastructure, including two undersea cables to Europe, had the highest data center energy consumption in 2023, followed by Texas, known for its business-friendly environment and ample land availability, and California, recognized for its robust technological ecosystem.[36]

EPRI highlights several factors that support data center growth in leading states, including a business-friendly environment, available land, tax incentives, investments in renewable energy, low natural disaster risk, cost-effective operations, a skilled workforce, and strong fiber-optic infrastructure. This clustered growth also means that issues that arise from data center growth are concentrated in these areas, with increased stress on the grid posing a particular challenge in these regions. These clusters of high-density demand can lead to increased energy and property costs, the need for extensive new transmission infrastructure and generating capacity, as well as stress on local water systems from the significant increase in water demand for data center cooling and space conditioning needs.[37]

[32] "North America Data Center Trends H1 2024," (CBRE, August 19, 2024), https://www.cbre.com/insights/reports/north-america-data-center-trends-h1-2024.

[33] Multiple offsite computing customers rent space in these facilities for their servers and IT equipment rather than building smaller data centers of their own.

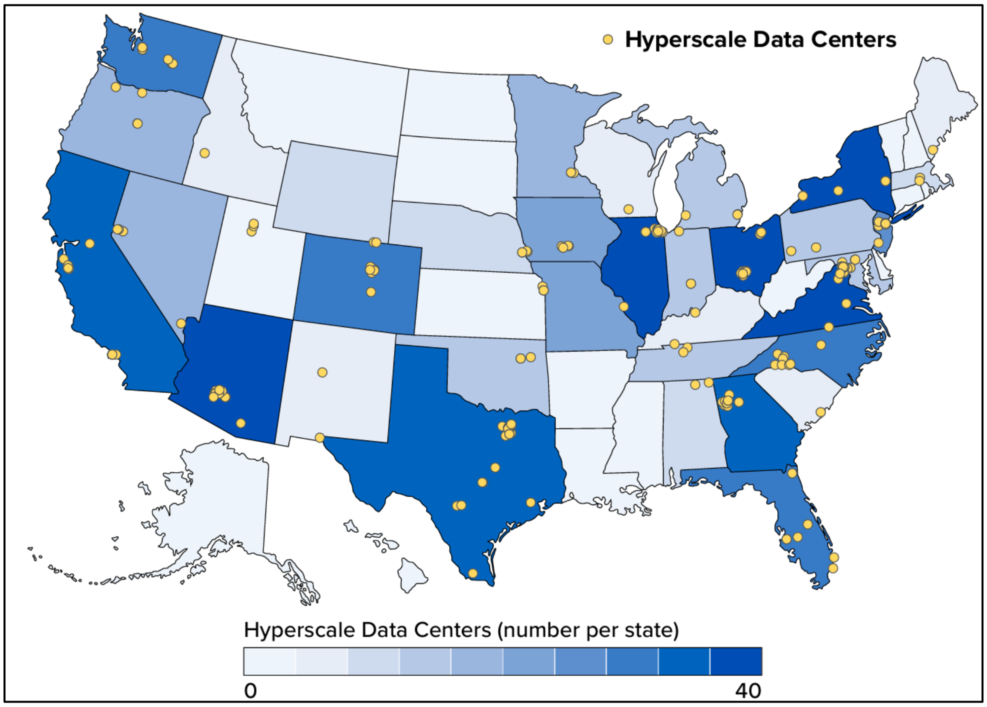
[34] Hyperscale data centers are large-scale facilities designed to support massive amounts of computing power, storage, and networking for the use by their owner, most commonly a large technology company.

[35] Shehabi et al., "2024 United States Data Center Energy Usage Report."

[36] "Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption" (EPRI, Inc., May 28, 2024), https://www.epri.com/research/products/3002028905.

[37] "Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption."

Figure 17: U.S. Hyperscale Data Center Distribution as of 2022 (Source: EPRI)[38]



The operation of a data center often requires massive amounts of water, largely used directly for cooling and space conditioning, and indirectly for generating electricity (e.g., hydropower). Although accurate data on water consumption is scarce, one recent report cites the example of The Dalles, a city of 16,000 along the Columbia River in northern Oregon. In 2021, data centers in the city consumed 335 million gallons of water, 29% of all water use in the city and raising concerns about water stress in an area that had experienced drought conditions in recent years.[39] Overall, it is estimated that billions of metric tons of water are being used for cooling annually.[40] Due to water challenges, some data centers owners have opted for air conditioning over water cooling in certain areas. While this can address water availability concerns, it also significantly increases the electricity demand from these facilities by approximately 10%.[41]

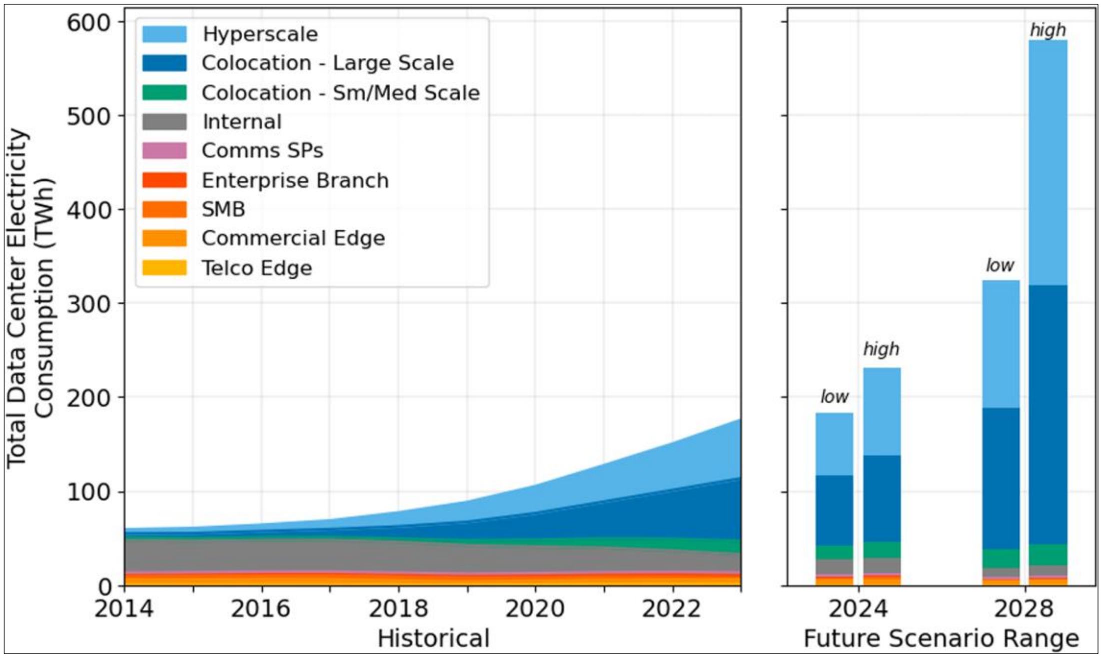
Big Data Center Players

Total data center energy consumption gradually increased over time but became more pronounced after 2018. As shown in **Figure 18**, this growth was largely driven by hyperscale data centers and large-scale colocation data centers, which more than offset the decline in internal data center (privately owned and operated facility) energy use. In 2023, hyperscale and colocation data centers accounted for ~70% of the

[38] Image from "Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption."
[39] Nuoa Lei et al., "The Water Use of Data Center Workloads: A Review and Assessment of Key Determinants," (*Resources, Conservation and Recycling* 219, June 2025): 108310, https://doi.org/10.1016/j.resconrec.2025.108310.
[40] Maeve Allsup, "Where Does the AI Boom Leave Data Center Cooling Strategies?," (*Latitude Media* (blog), March 13, 2024), https://www.latitudemedia.com/news/where-does-the-ai-boom-leave-googles-data-center-cooling-strategy/.
[41] Maeve Allsup, "Where Does the AI Boom Leave Data Center Cooling Strategies?," (*Latitude Media* (blog), March 13, 2024), https://www.latitudemedia.com/news/where-does-the-ai-boom-leave-googles-data-center-cooling-strategy/.

total data center energy use and are forecasted to contribute approximately 90% of data center energy use in both low and high cases for 2028.[42]

Figure 18: Total Data Center Electricity Use from 2014 through 2028 by Space Type (Source: LBNL)[43]



Major technology companies like Amazon, Google, and Microsoft own more than 50% of hyperscale data centers and are continuing to exhibit rapid growth.[44] In 2021, these three entities, along with Meta, consumed more than double the amount of energy for their cloud computing and digital services compared to 2017. Emerging services and technologies – such as streaming, cloud gaming, blockchain, artificial intelligence, machine learning, and virtual reality – are rapidly evolving and becoming more widely adopted, driving a surge in data center energy demand.[45]

Filling the Energy Demand Gap

The rapid expansion of data centers is set to potentially reshape the energy grid. New data centers often require a continuous power load ranging from 100 MW to as much as 1 GW,[46] with development timelines typically spanning two to three years from the start of construction to full operation. However, this timeline is misaligned with the pace of electric infrastructure upgrades, which can take significantly longer to plan, permit, and build. This growing disconnect presents a critical challenge for utilities and

[42] Shehabi et al., "2024 United States Data Center Energy Usage Report."
[43] Image from Shehabi et al.
[44] Shehabi et al.
[45] "Data Centres and Data Transmission Networks," (IEA, July 11, 2023), https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks.
[46] To put that in perspective, 1 MW is enough to power 750-1,000 homes, so 100 MW would be enough to power 75to 100 thousand homes, while 1 GW (equivalent to 1,000 MW) would be enough to power 750 thousand to 1 million homes. See this RE Magazine infographic for more information https://www.cooperative.com/remagazine/articles/pages/infographic-what-is-1-mw.aspx.

grid operators, especially in "data center hotbed" regions facing capacity constraints or lengthy interconnection queues.[47]

Much of the near-term demand will be met through solar, onshore wind, and battery energy storage projects which are already under or near construction. Ready-to-build, cost-effective energy projects offer the fastest way to address much of the anticipated increase in electricity demand, especially since supply chain issues have lengthened timeframes for acquiring equipment for increasing the capacity of traditional energy resources.[48]

Postponing the retirement of coal plants may offer limited short-term relief, but it falls short of addressing the scale of long-term demand growth. While advanced technologies like nuclear and geothermal hold considerable promise, they are unlikely to scale rapidly enough to meet near-term energy needs. As a result, new natural gas capacity is seen as an essential bridge.

However, a recent turbine procurement effort revealed that, without a pre-secured manufacturing slot, the earliest a new combined-cycle gas plant could realistically come online – assuming everything proceeds without delays – is the fourth quarter of 2029.[49] Compounding the issue, ongoing supply chain pressures are pushing up construction costs, with estimates for new combined-cycle gas turbine (CCGT) plants now exceeding $2,200/kW – an increase of nearly 40% compared to just a few years ago.[50]

To keep up with this demand, Amazon, Microsoft, Meta and Google stand out among the top corporate purchasers of renewable energy.[51] While these companies previously relied on power purchase agreements for intermittent wind and solar plants to meet net-energy usage with renewable energy, there has been a shift towards emerging technologies to ensure low- or reduced-carbon round-the-clock services.

Nuclear energy has seen increasing interest from hyperscale data center owners. Meta has also recently secured a 20-year deal with Constellation's Clinton Clean Energy Center, the owner of the decommissioned Three Mile Island nuclear power plant. This deal will restart the reactors to supply Meta's energy needs for their AI operations and computing.[52] There is also growing interest in advanced nuclear reactors, including SMRs, where these companies could use their significant balance sheets to drive early adoption of these technologies.

Geothermal energy is another attractive resource for powering data centers, offering non-intermittent electricity and faster deployment time compared nuclear. Meta and Google are among those that have

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[47] "Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption."

[48] Simon Flowers and Chris Seiple, "How Gas Could Displace Renewables in Meeting Surging US Data Centre Demand | Wood Mackenzie," (Wood Mackenzie, March 6, 2025), https://www.woodmac.com/blogs/the-edge/gas-could-displace-renewables-meeting-surging-us-data-centre-demand/.

[49] Flowers and Seiple.

[50] Flowers and Seiple.

[51] "Corporate Clean Power Buying Grew 12% to New Record in 2023, According to BloombergNEF," (*BloombergNEF* (blog), February 13, 2024), https://about.bnef.com/insights/finance/corporate-clean-power-buying-grew-12-to-new-record-in-2023-according-to-bloombergnef/.

[52] Matt Ott, "Meta Becomes the Latest Big Tech Company Turning to Nuclear Power for AI Needs," (The Associated Press, June 3, 2015), https://apnews.com/article/meta-facebook-constellation-energy-nuclear-ai-a2d5f60ee0ca9f44c183c58d1c05337c.

sought to take advantage of this clean energy resource. Both tech giants have partnered with startups to fuel their data centers with geothermal energy.[53] Google, for example, has entered a first-of-its-kind energy agreement with NV Energy called the Clean Transition Tariff (CTT). The CCT was signed into agreement in May 2025 and will enable Google to power its data centers in Nevada. Google agreed to pay a premium, covering the cost difference between the geothermal energy from Fervo Energy's 115-MW Corsac Station Enhanced Geothermal Project and the lower-cost energy mix NV Energy would typically deploy.[54,55]

Electric Cooperative Impacts

Electric cooperatives often serve territories including suburban and exurban areas near major metropolitan data center hubs or rural territories near favorable power supply and transmission resources (e.g., in the Pacific Northwest). Many of these co-ops are already impacted by the growth of hyperscale data centers and the challenges and opportunities they bring. But data center growth is a nationwide phenomenon, and areas outside of these hubs are still seeing interest from smaller data center players for use cases that do not need the proximity and low latency of the hyperscale data centers. These include co-location and enterprise data centers, as well as use cases like crypto mining that can present their own challenges. In many cases, these data centers may be more flexible than their larger peers when it comes to power supply and more amenable to load control and other grid reliability needs.

Data centers and other large loads are an issue facing co-ops nationwide, both in their communities and in the power supply and resource adequacy considerations. A recent NRECA report reviews the impact of data centers on co-ops and features case studies of how some co-ops are creating standardized, efficient processes for responding to data center requests and inquiries.[56]

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[53] Mrinalika Roy et al., "AI's Energy Hunger Fuels Geothermal Startups but Natgas Rivalry Clouds Future," (Reuters, December 19, 2024, sec. Artificial Intelligence), https://www.reuters.com/technology/artificial-intelligence/ais-energy-hunger-fuels-geothermal-startups-natgas-rivalry-clouds-future-2024-12-19/.

[54] Lisa Martine Jenkins, "The 'Clean Transition Tariff' Won Approval in Nevada. What's next for Fervo?," (*Latitude Media* (blog), May 15, 2025), https://www.latitudemedia.com/news/the-clean-transition-tariff-won-approval-in-nevada-whats-next-for-fervo/.

[55] Emma Penrod, "NV Energy Seeks New Tariff to Supply Google with 24/7 Power from Fervo Geothermal Plant," (Utility Dive, June 21, 2024), https://www.utilitydive.com/news/google-fervo-nv-energy-nevada-puc-clean-energy-tariff/719472/..

[56] Matz, Michael, "Serving Data Centers: Opportunities and Challenges for Electric Cooperatives," (NRECA, April 17, 2024), https://www.cooperative.com/topics/data-analytics/Pages/Serving-Data-Centers.aspx. Additional resources are under development and will be shared on a new "Large Loads and Data Centers" landing page on cooperative.com.

3: Issue in Focus: Natural Gas Supply, Demand and Price

Introduction

Over the last decade, natural gas has cemented its position as the largest source of electricity in the United States, driven by the increased deployment of large, highly efficient, combined cycle plants. Natural gas also serves as a crucial source of capacity to meet peak demand and, increasingly, to balance intermittent renewable generation on the grid, especially during expected (or unexpected) drops in production from wind and solar resources. Generation from natural gas plants first surpassed coal generation in the United States in 2016, and its share of U.S. electricity generation has continued to grow to over 40% as more coal capacity has been retired or converted to natural gas.[57] For electric cooperatives, this milestone came a bit later, with natural gas surpassing coal for the first time in the co-op retail power mix in 2020, and after falling behind coal again in 2021, it has been the largest source in 2022 and 2023 by a widening margin.[58]

The Natural Gas Supply Boom

The use of hydraulic fracturing (also known as fracking) and horizontal drilling technologies opened vast new reserves of economically recoverable natural gas in the United States over the last two decades. As show in **Figure 19**, total U.S. production of "dry"[59] natural gas has more than doubled from 49.5 billion cubic feet per day (Bcf/d) in 2005 to more than 103 Bcf/d in 2023 and 2024. This growth has been driven by production from non-traditional shale and tight gas wells enabled by these technologies, even as production from traditional onshore and offshore vertical gas wells has declined. Non-traditional production surpassed these traditional sources in 2013, and since 2020, have accounted for more than three-quarters of total production and exceeded 80% in 2023 and 2024.[60,61]

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[57] *Short-Term Energy Outlook Data Browser*. Where available, newer data from the *STEO Data Browser* is also used to supplement the other sources cited in this section.

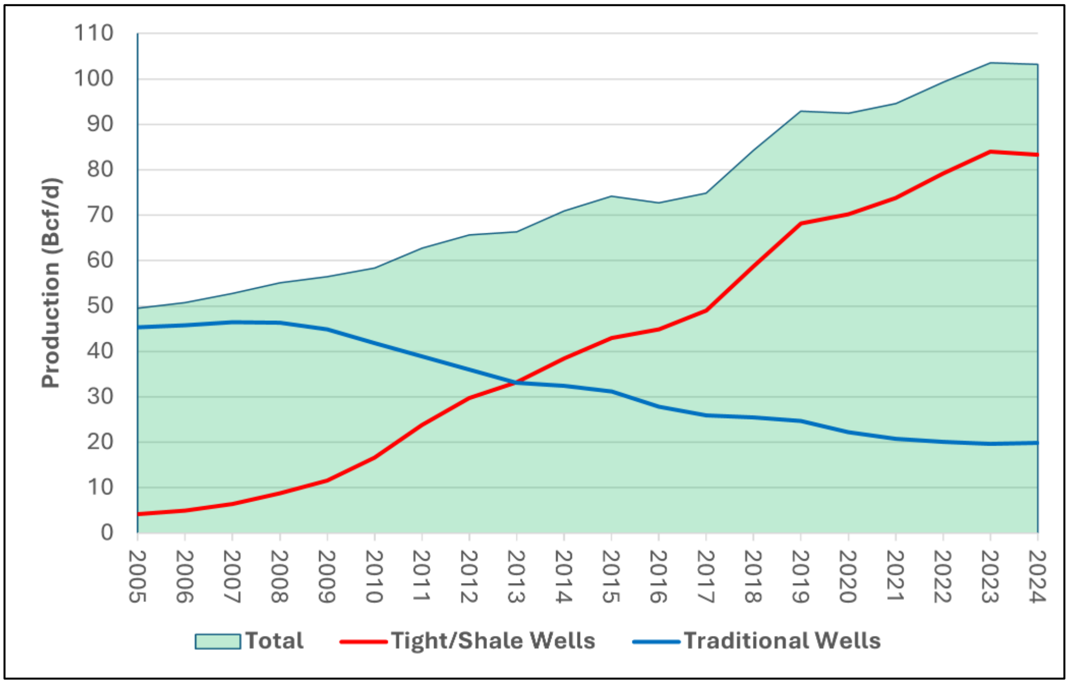
[58] For more information, see NRECA's annual Business & Technology Advisories analyzing the electric cooperative fuel mix , https://www.cooperative.com/topics/power-supply-wholesale-markets/Pages/Analysis-of-Electric-Cooperative-Retail-Fuel-Mix.aspx.

[59] Dry natural gas, also referred to as consumer-grade natural gas, is the type of gas that is distributed through pipelines for use in power plants and to provide space heating at homes and businesses, or for compression and liquification for export as liquified natural gas. Dry natural gas is made up of at least 85% methane. This is distinct from "wet" natural gas which contains some methane but also liquids like ethane, propane or butane which are separated through processing and used for other purposes.

[60] "U.S. Shale Natural Gas Production Has Declined So Far in 2024," (EIA *Today in Energy*, October 24, 2024), https://www.eia.gov/todayinenergy/detail.php?id=63506.

[61] *Short-Term Energy Outlook Data Browser*.

Figure 19: Annual Dry Natural Gas Production (2005-2024)[62]



These same technologies have also impacted oil production, and a growing share of U.S. natural gas production – around 37% in recent years – has been "associated" with oil production. **Figure 20** graphs this rapid growth in associated gas production since 2010, mostly from the Permian Basin, which stretches from western Texas into New Mexico. This is the largest oil production region in the U.S. and a source of more than two-thirds of associated gas production today. Since natural gas is a byproduct of oil production in these areas and oil producers get most of their profit from oil, this development has tied a significant share of U.S. natural gas production to volatile global oil markets rather than natural gas demand. At times, oil producers have resorted to negative pricing – paying customers to take away this gas – or even flaring on-site if no taker could be found – but increased liquified natural gas export capacity and increased pipeline capacity to reach terminals is making this gas more valuable.[63]

[62] *Short-Term Energy Outlook Data Browser*.

[63] "U.S. associated natural gas production increased nearly 8% in 2023," (EIA *Today in Energy*, November 13, 2024), https://www.eia.gov/todayinenergy/detail.php?id=63704.

Figure 20: The Permian Basin is the Largest Source of Associated Natural Gas Production[64]

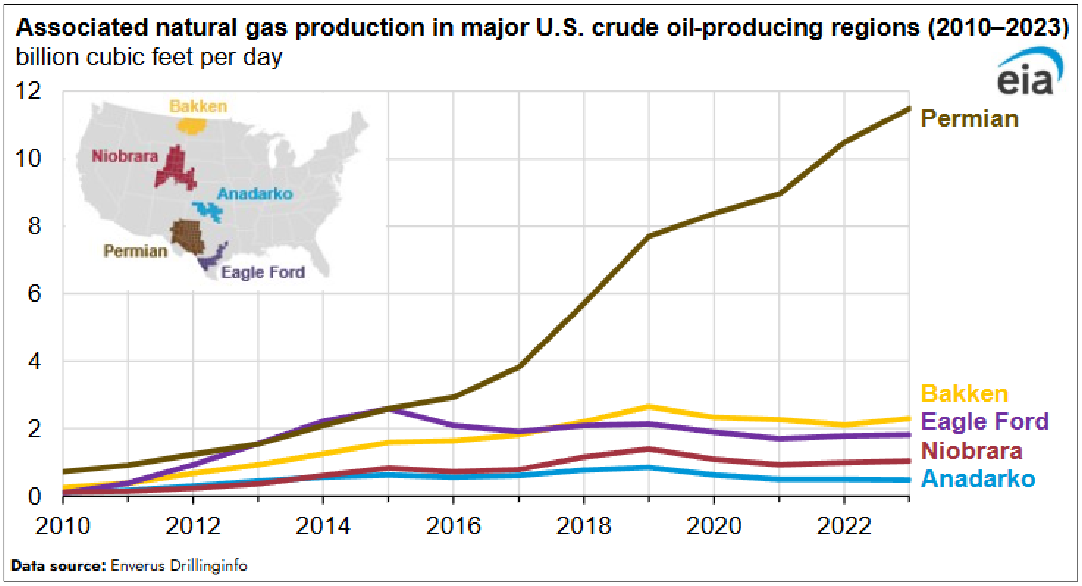


Figure 21 shows the impact of these changing natural gas supply dynamics from 2000 through 2024. The influx of new supply led to historically low natural gas prices from 2009-2020, with the annual averages for the benchmark Henry Hub spot price between $2.5 and $4 per MMBtu across the period, with prices relatively lower and less volatile after 2015. In 2020, natural gas prices sunk further due to a collapse in demand during the COVID-19 pandemic and associated mitigation efforts. Natural gas prices, which were already low heading into this period due to a mild winter, fell even further as the drop in demand drove prices even lower, reaching a decades-low $1.66/MMBtu in June 2020.[65]

When the economy reopened in 2021, natural gas demand exceeded expectations and supply growth was not fast enough to keep up, putting upward pressure on natural gas prices. In 2022, external events impacted natural gas supply, demand and prices. First, Winter Storm Uri in mid-February disrupted natural gas production and distribution, especially in Texas.[66] This was followed later in that month by the Russian invasion of Ukraine, which led to a huge surge in European demand for LNG [67] throughout the rest of the year to replace gas formerly imported from Russia, with prices spiking to over $8/MMBtu in May and nearly $9/MMBtu in August. A June 2022 fire at the Freeport LNG Terminal in south Texas reduced LNG export capacity temporarily, which did reduce upward pressure on domestic natural gas

[64] Image from "U.S. associated natural gas production increased nearly 8% in 2023." (EIA *Today in Energy*, November 13, 2024), https://www.eia.gov/todayinenergy/detail.php?id=63704.

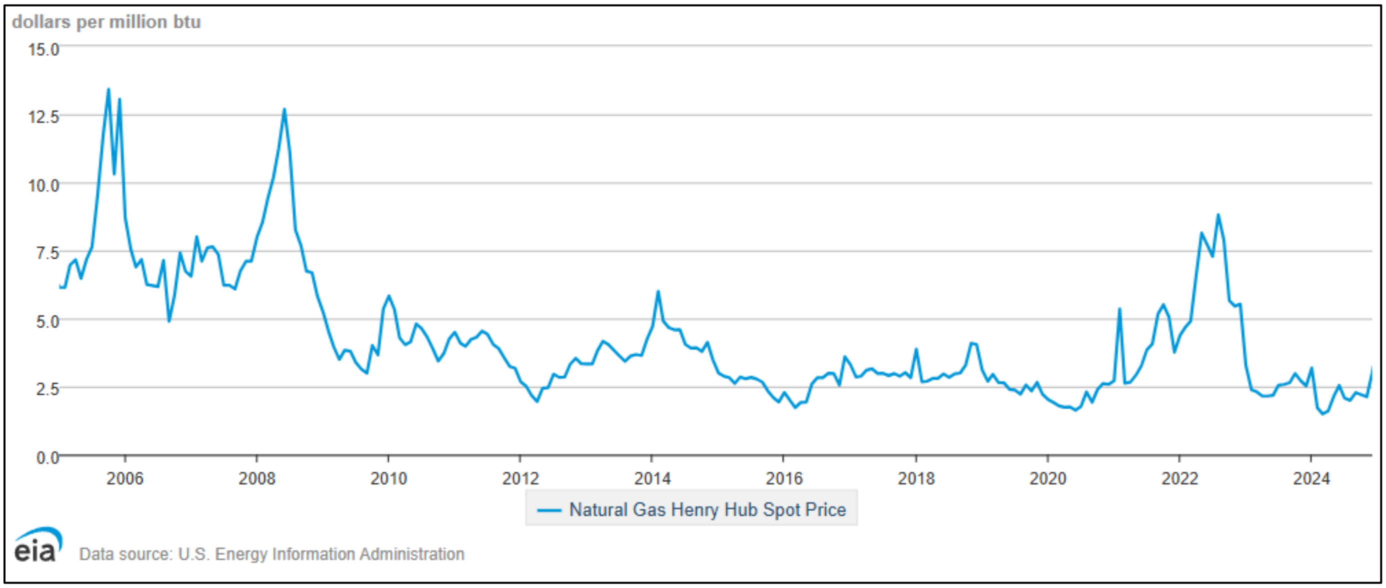
[65] *Short-Term Energy Outlook Data Browser*.

[66] "Winter storms have disrupted U.S. natural gas production." (EIA *Today in Energy*, March 13, 2024), https://www.eia.gov/todayinenergy/detail.php?id=61563.

[67] EIA Definition: "Liquefied natural gas (LNG) is natural gas that has been cooled to a liquid state (liquefied), to about -260° Fahrenheit, for shipping and storage. The volume of natural gas in a liquid state is about 600 times smaller than its volume in a gaseous state (in natural gas pipelines). The liquefaction process, developed in the 19th century, makes it possible to transport natural gas to places natural gas pipelines do not reach and to use natural gas as a transportation fuel." See https://www.eia.gov/energyexplained/natural-gas/liquefied-natural-gas.php.

prices.[68] Finally, a relatively mild winter in the United States and Europe allowed U.S. production to catch up to domestic and export demand, leading prices to return to the historically low levels seen in earlier years.[69]

Figure 21: Henry Hub Benchmark Natural Gas Spot Price, 2005-2024[70]



Abundant supply and low prices made natural gas much more attractive as fuel for electric generation, especially utilizing increasingly efficient combined cycle plants which can operate flexibly while providing intermediate or baseload power. The average capacity factor of these plants has risen from 40% in 2008 to the 55-60% range in most years since 2015.[71] Most natural gas generation comes from combined cycle plants, but capacity factors have also improved in natural gas steam plants (including converted coal), combustion turbines used for peak demand, and quick-start internal combustion plants balancing renewable energy. Average annual capacity factors for coal generation and various natural gas generation technologies are graphed in **Figure 22**. Natural gas and coal are competing resources in many U.S. wholesale markets, and the growth in natural gas generation has primarily been at the expense of coal generation, with many coal units shifting from baseload generation to more seasonal generation.[72]

[68] "U.S. Natural Gas Supply and Demand Balance Shifts amid Outage at Freeport LNG," (EIA *Today in Energy*, July 19, 2022), https://www.eia.gov/todayinenergy/detail.php?id=53079.

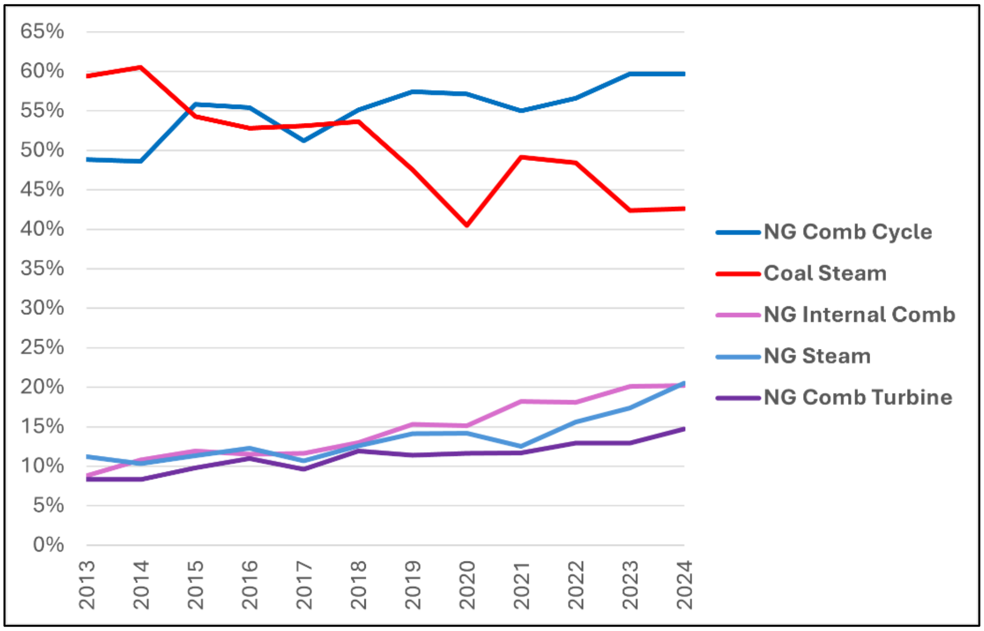
[69] "U.S. Natural Gas Prices Calmed after a Volatile 2022," (EIA *Today in Energy*, June 4, 2024), https://www.eia.gov/todayinenergy/detail.php?id=62203.

[70] Image from *Short-Term Energy Outlook Data Browser*.

[71] "Natural Gas Combined-Cycle Power Plants Increased Utilization with Improved Technology," (EIA *Today in Energy,* November 20, 2023), https://www.eia.gov/todayinenergy/detail.php?id=60984.

[72] EIA started reporting average capacity factors by technology with the 2013 data year. Capacity factor data for 2013-2023 is from *Electric Power Annual 2023*," (EIA, October 17, 2024), https://www.eia.gov/electricity/annual/. Preliminary capacity factor data for 2024 is from *Electric Power Monthly*, (EIA, June 25, 2025), https://www.eia.gov/electricity/monthly/index.php.

Figure 22: Annual Average Capacity Factor for Natural Gas and Coal Generators, 2013-2024[73]



In 2005, the electric power sector was the second largest user of natural gas, consuming 16.1 (Bcf/d) and accounting for nearly 27% of domestic consumption compared to 30% for the industrial sector. Electric sector usage first surpassed industrial in 2007, and then every year from 2009 onward, setting a record of 36.9 billion Bcf/d in 2024 when the sector accounted for nearly 41% of consumption, and this level of demand is projected to remain essentially flat through 2026.[74] This growth and near-term projection is charted in **Figure 23**. The emergence of electric generation as the largest consumer of natural gas in the United States has only increased the need for enhanced coordination between the electric and natural gas sectors. This is especially true during the winter months, when peak demand for electricity and natural gas – also used for space heating – often coincide, and severe weather creates additional operating challenges.[75]

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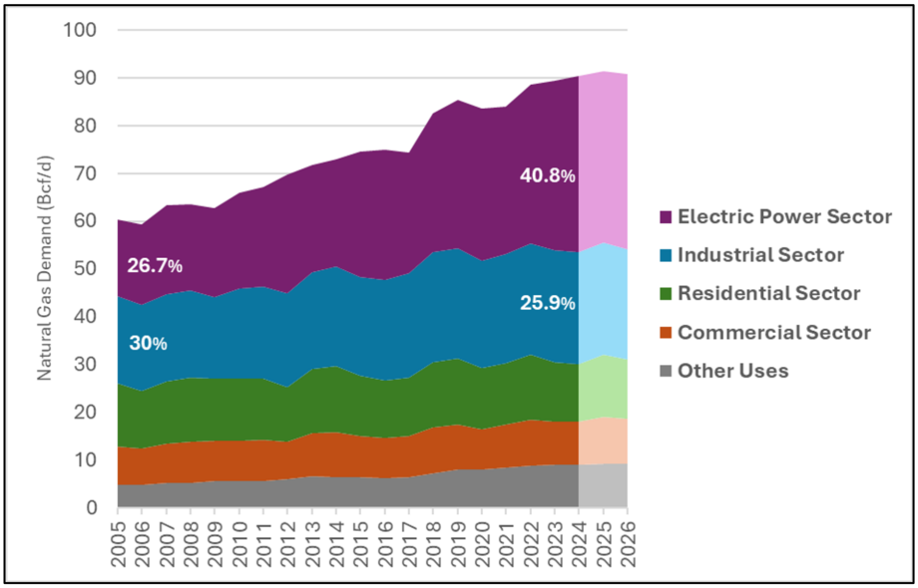
73 *Electric Power Annual 2023* and *Electric Power Monthly*.

74 *Short-Term Energy Outlook Data Browser*.

75 "Reliability Insights: The Interconnected Gas and Electric Systems," (NERC, March 2025), https://www.nerc.com/news/Reliability%20Insights/March%202025%20-%20NERC%20Reliability%20Insights.pdf.

Figure 23: U.S. Natural Gas Consumption by Sector, 2005-2026[76]



The Growth of Natural Gas Exports

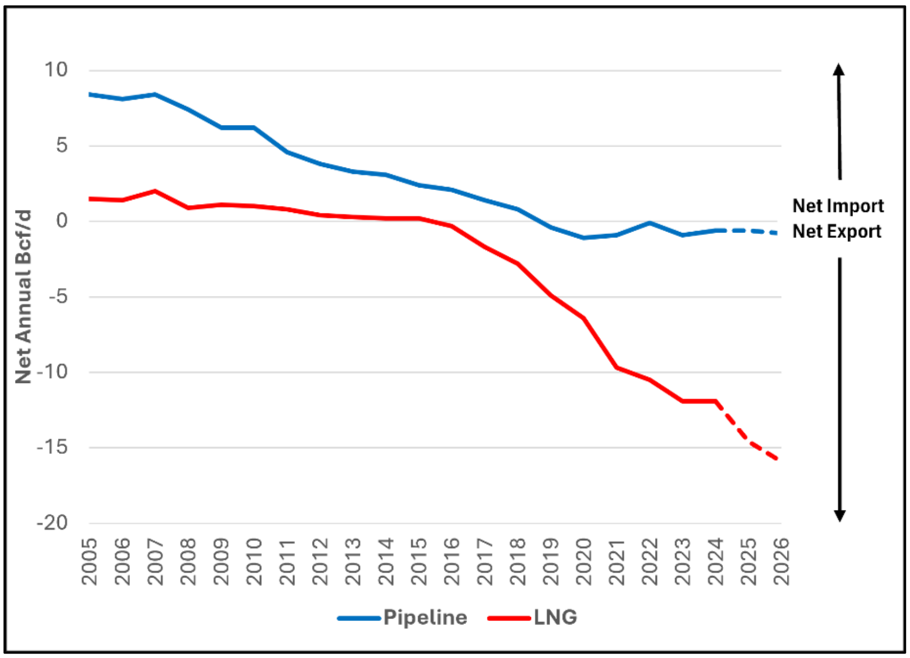
Prior to 2017, the United States was a net importer of natural gas, with net imports peaking at 10.4 Bcf/d in 2007, which was also the peak year for both net imports via pipeline (8.4 Bcf/d, primarily from Canada) and via LNG terminal (2 Bcf/d, with nearly 60% of imports from Trinidad and Tobago).[77,78] The growth in domestic production facilitated by non-traditional drilling technologies began to shift the natural gas trade, with the United States becoming a net exporter in 2017 and exports rising rapidly in the following years.[79]

As shown below in **Figure 24**, natural gas trade patterns for pipeline natural gas in North America were the first to be impacted. The United States' natural gas pipeline network is integrated with the neighboring networks of Canada and Mexico. From the 2007 import peak, imports steadily declined until the U.S. became a net-exporter of pipeline natural gas in 2019. Canada is a major natural gas producer and is still a net-exporter to the United States (about 2 Bcf/d in recent years), with most imports to the Pacific Northwest due to the existing natural gas pipeline network. Mexico, however, while a significant producer of natural gas has faced declining domestic production, while demand has increased driven primarily from increased generation from natural gas combined cycle plants. Mexico's imports via pipeline have increased rapidly since 2010, exceeding 2 Bcf/d since 2020 and offsetting Canadian exports, to give the United States a small export surplus through natural gas pipelines.[80,81]

[76] *Short-Term Energy Outlook Data Browser*.
[77] *Short-Term Energy Outlook Data Browser*.
[78] "U.S. Natural Gas Imports and Exports: 2007" (EIA, January 2009), https://www.eia.gov/naturalgas/importsexports/annual/archives/2009/ngimpexp07.pdf.
[79] "STEO Data Browser - 1. U.S. Energy Markets Summary."
[80] "U.S. Imports by Country" and "U.S. Exports by Country," (EIA, June 30, 2025), https://www.eia.gov/naturalgas/data.php.
[81] "Mexico's Reliance on U.S. Natural Gas to Grow Amid Rising Trade Tensions," (Fitch Ratings, February 20, 2025), https://www.fitchratings.com/research/corporate-finance/mexicos-reliance-on-us-natural-gas-to-grow-amid-rising-trade-tensions-20-02-2025.

The larger impact going forward is the shift of the United States from a net importer LNG in 2015 to the largest global exporter of LNG less than a decade later. LNG trades at a premium on the global market, which has driven the expansion of LNG export capacity, especially in Texas and Louisiana, to provide an outlet for associated gas from the Permian Basin. Exports have grown in step with LNG liquification capacity at export terminals, which increased from 1.2 Bcf/d in 2016 to 11.4 Bcf/d in 2013, with an additional 2.6 Bcf/d currently commissioning and expected to come online before the end of 2025. Beyond 2025, another 7.8 Bcf/d in export capacity is currently under construction and expected to come online between 2026 and 2029, and another 9 Bcf/d of capacity is proposed and undergoing review.[82] The significant increase in U.S. LNG exports to Europe since 2022 has accelerated this trend.

Figure 24: U.S. Net Natural Gas Trade, 2005-2026[83]

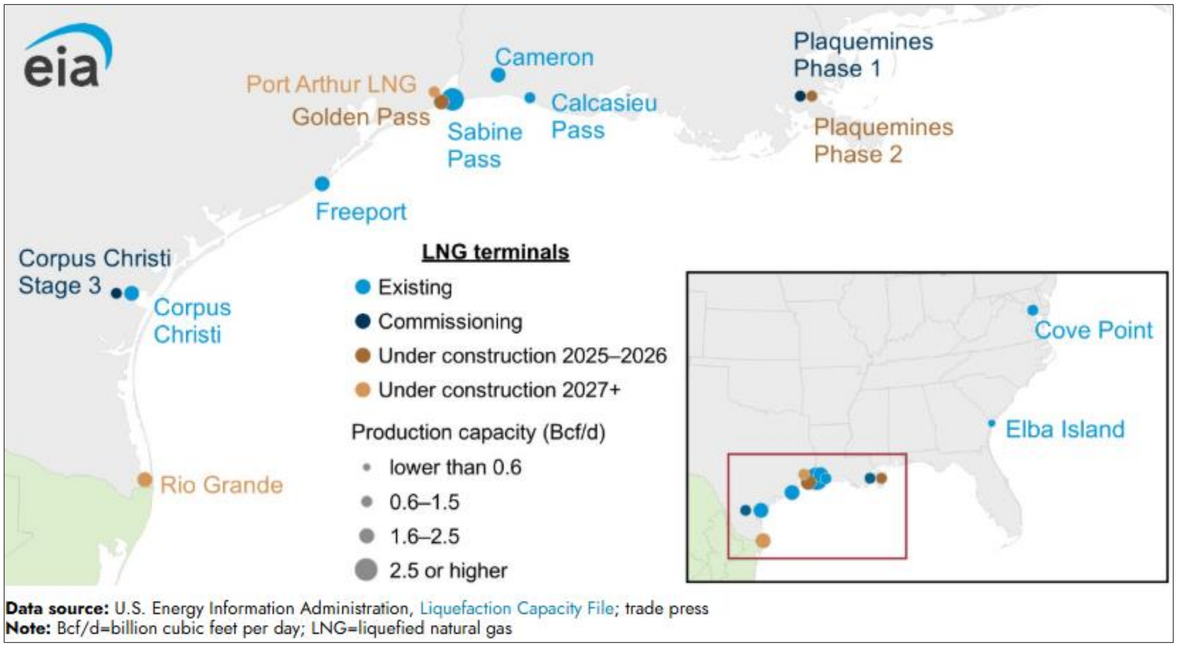


While European demand declined somewhat in 2024, this was balanced by increased U.S. exports to other parts of the world, leaving net exports essentially flat from 2023 to 2024 at just under 12 Bcf/d.[84] Net LNG exports are projected to increase by 4 Bcf/d to reach nearly 16 Bcf/d in 2026 as additional export capacity comes online in the United States, as well as increased LNG regasification import capacity in Europe. **Figure 25** shows LNG export terminals that are online, commissioning or under construction over the next few years.[85] Rising LNG exports increase the exposure of the domestic U.S. market to global prices, which has the benefit of incentivizing production to meet demand. This can have the benefit of reducing price volatility, like that seen in 2021-2022, but has the drawback of

[82] "U.S. Liquification Capacity Workbook (2Q2025),"(EIA, June 30, 2025), https://www.eia.gov/naturalgas/data.php#imports.
[83] *Short-Term Energy Outlook Data Browser*.
[84] "The United States Remained the World's Largest Liquefied Natural Gas Exporter in 2024," (EIA *Today in Energy*, March 27, 2025 https://www.eia.gov/todayinenergy/detail.php?id=64844.
[85] "How will the start-up timing of the new U.S. LNG export facilities affect our forecast?," (EIA *Today in Energy*, April 3, 2025), https://www.eia.gov/todayinenergy/detail.php?id=64884.

increasing domestic natural gas prices, especially when this growth of exports occurs rapidly as it has in recent years, while production takes time to catch up.

Figure 25: U.S. LNG Export Facilities, Existing and Under Construction[86]



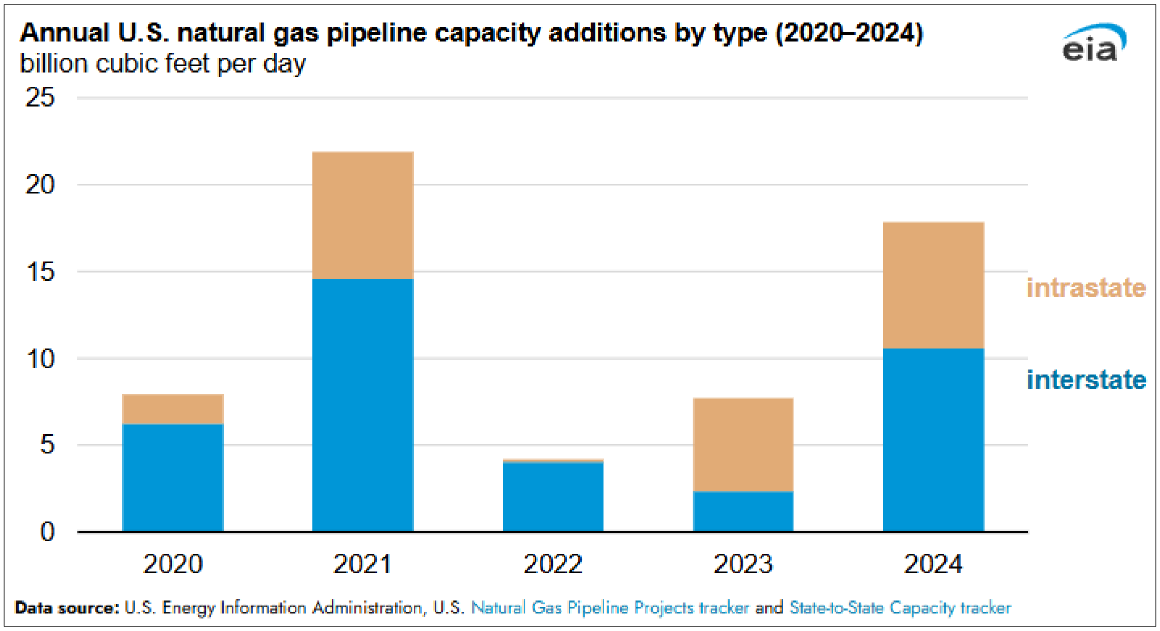
Pipeline Infrastructure

Natural gas is increasingly important for electricity generation, and surging demand, from electrification and the growth of large commercial and industrial users, especially data centers. The need for increased pipeline capacity to reliably fuel power plants even during winter when space heating demands increase has only become more important. Pipeline growth has not kept up with the increased need in recent years, and like many types of infrastructure pipelines face significant hurdles, including local opposition and permitting. Much of the pipeline infrastructure that has been built has been intrastate pipelines to serve LNG export terminals, which does not help from the standpoint of domestic supply reliability. **Figure 26** shows that pipeline growth slowed in 2022 and 2023, but picked up again in 2024, with more overall capacity and more interstate capacity added than the prior two years combined.[87]

[86] Image from "How will the start-up timing of the new U.S. LNG export facilities affect our forecast?"

[87] "Natural gas pipeline project completions increase takeaway capacity in producing regions," (EIA *Today in Energy*, March 17, 2025), https://www.eia.gov/todayinenergy/detail.php?id=64744#.

Figure 26: Annual U.S. Natural Gas Pipeline Capacity Additions by Type (2020-2024)[88]

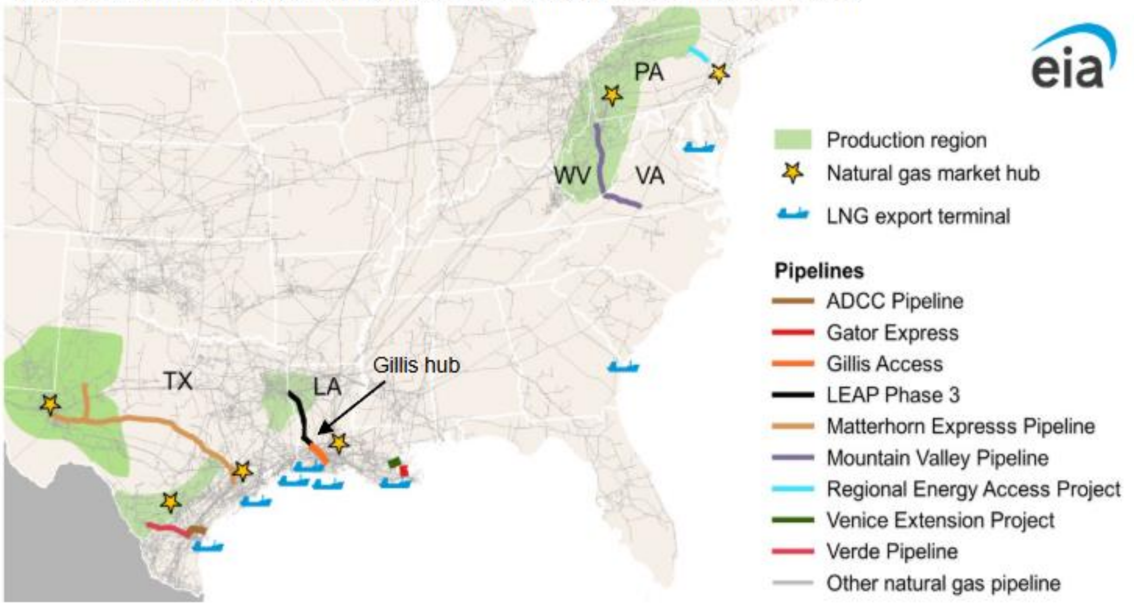


The increase in pipeline capacity in 2024 included several significant new projects, increasing takeaway capacity by approximately 6.5 Bcf/d from production areas in Texas, Louisiana, and Appalachia. Much of this new capacity was to connect natural gas production in Texas with LNG export terminals, but they also greatly increase the ability to bring this gas to demand-centers in the Mid-Atlantic and along the Gulf Coast, including power plant demand.[89] **Figure 27** maps some of these recent pipeline projects with associated productions regions and LNG export terminals.

[88] Image from "Natural gas pipeline project completions increase takeaway capacity in producing regions."
[89] "Natural gas pipeline project completions increase takeaway capacity in producing regions."

Figure 27: Recently Completed Natural Gas Projects[90]

Select natural gas pipeline projects and infrastructure (March 2024)



Data source: U.S. Energy Information Administration, U.S. Natural Gas Pipeline Projects tracker
Note: Map includes pipeline projects of more than 0.8 billion cubic feet per day (Bcf/d) of capacity completed in 2024 except the Louisiana Energy Access Project (LEAP) Phase 3, which added 0.2 Bcf/d in 2024 and increased operating capacity of the pipeline to 1.9 Bcf/d. LNG=liquefied natural gas

Natural Gas Price Projections, Power Costs, and Retail Electric Rates

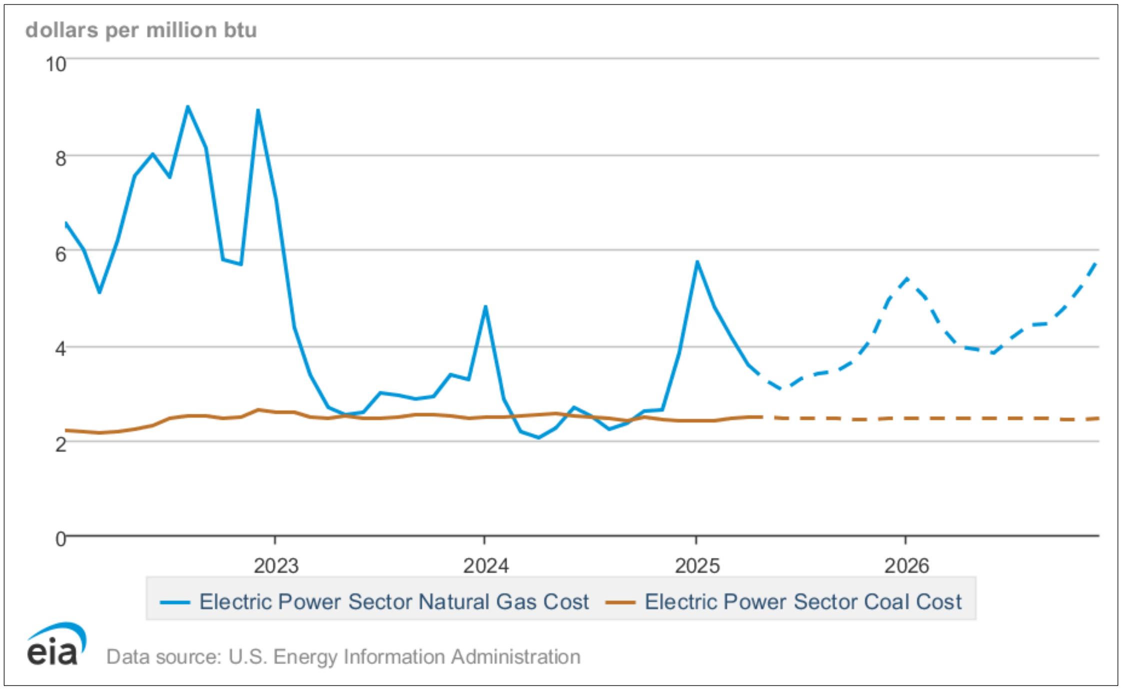
EIA projects that domestic dry natural gas production will grow by 3.2 Bcf/d by 2026, not fast enough to keep up with the growth in LNG exports over the same period.[91] Demand can be met by increasing withdrawals from natural gas storage facilities, but the imbalance between domestic demand and supply will put upward pressure on natural gas prices in the near term. The following graph shows the monthly electric power cost for the electric power sector from 2022 with projections through 2026. While prices are projected to remain significantly lower than 2022, with most months projected to be in the $4-6 per MMBtu range, they are nevertheless notably higher than prices in recent years. Higher prices and increased pipeline access to LNG export terminals incentivize increased production from higher-cost production areas, such as the Haynesville Shale Basin stretching from Louisiana into eastern Texas. This can help to meet increased demand, but will not be instantaneous, leading to higher prices in the coming years.[92]

Over the last decade, there was significant generation shifting from natural gas to coal during the winter, when natural gas prices increase due to increased demand for space heating, serving as a price hedge in the colder months. Coal prices are generally much less volatile than natural gas prices. **Figure 28** graphs

[90] Image from "Natural gas pipeline project completions increase takeaway capacity in producing regions."
[91] *Short-Term Energy Outlook Data Browser*.
[92] *Short-Term Energy Outlook Data Browser*.

the delivered price of natural gas and coal for electric generation.[93] Coal delivery challenges reduced gas-to-coal switching in 2021-2022, leading to record natural gas generation despite high natural gas prices. The ongoing retirement of coal plants is reducing the amount of natural gas to coal shifting that is possible during the winter in many parts of country, meaning that natural gas plants will continue to be dispatched even when natural gas prices rise, putting upward pressure on electricity prices.

Figure 28: Recent and Projected Power Generation Fuel Cost, 2022-2026[94]



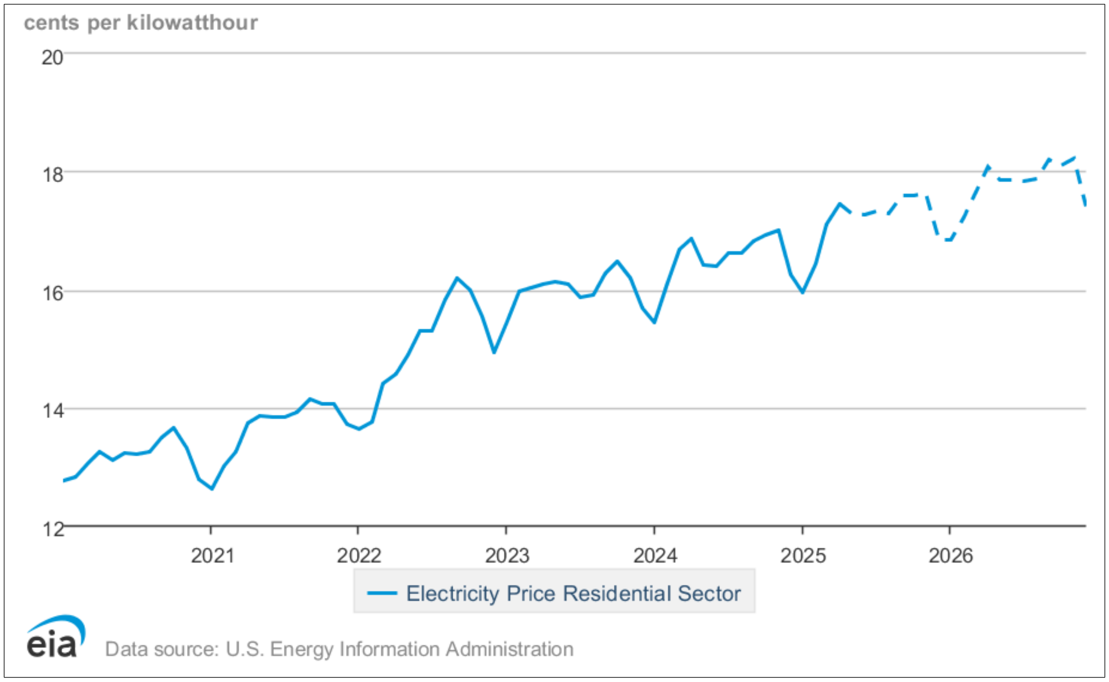
Given the increased reliance of the U.S. electric industry on natural gas generation and the reduced ability to fuel shift, high natural gas prices put upward pressure on wholesale power costs, and in turn drive up retail electricity rates. As can be seen in **Figure 29**, high natural gas prices in 2021 and 2022 contributed towards a notable increase in retail electricity rates. EIA already forecasts a continuing upward trend in rates due to the cost of grid upgrades to meet rising demand, so if natural gas prices increase more than expected, this will only exacerbate these expected rate impacts.[95] On average, wholesale power costs account for two-thirds or more of the total cost structure for distribution cooperatives, so this is a major challenge for maintaining affordability for consumer-members.

[93] Note that natural gas combined cycle plants are more efficient at converting fuel to electricity and generally have lower operating costs than coal plants, so natural gas prices do not have to be lower than coal on a MMBtu basis to make those plants more economic to dispatch.

[94] Image from *Short-Term Energy Outlook Data Browser*.

[95] *Short-Term Energy Outlook Data Browser*.

***Figure 29: Average U.S. Residential Electricity Rates*[96]**



While there are currently efforts by policymakers, markets and utilities to extend the life of existing coal plants, and where possible to re-open recently retired nuclear plants, at this time there are no large new plants of either type near construction. Natural gas will remain the fuel of choice for energy generation and grid balancing for reliability for the near future, unless a new technology like SMRs can help fill those roles while increasing fuel diversity.

[96] Image from *Short-Term Energy Outlook Data Browser*.

Conclusion

The U.S. electric industry is entering a decade defined by rapid transformation and uncertainty, bringing with it both opportunities and challenges. Electric cooperatives – many of which serve fast-growing or strategically positioned regions – are uniquely situated to both shape and be shaped by these changes. From rising demand due to reindustrialization and data center expansion, to fuel supply volatility and technology changes, and an evolving regulatory environment, the stakes are higher than ever.

While coal continues its decline and renewables scale rapidly, natural gas remains indispensable for system stability – yet its increasing exposure to global markets poses challenges for price predictability and long-term planning. At the same time, battery storage, nuclear innovation and emerging technologies like geothermal present potential long-term solutions for grid reliability and fuel diversity that need to be proven at scale.

Electric cooperatives are adapting with strategic investments in generation, battery storage, and energy resilience – often facilitated through federal programs like the USDA's New ERA initiative. However, constraints on transmission, permitting and interconnection must be addressed for the industry to keep pace with surging demand.

The decade ahead will test the agility, innovation and leadership of the cooperative community. With thoughtful planning and collaboration, electric cooperatives are well positioned not only to weather this transition, but to help lead the transformation of the U.S. electric sector – ensuring that they can continue to deliver safe, affordable, and reliable power for their members and the rural communities they serve.