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QUANTIFYING POWER DEMAND FROM ARTIFICIAL INTELLIGENCE

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Summary:

- U.S. electricity consumption is forecasted to grow up to 25 percent by 2030, with over half of growth from data centers.
- Rising demand will be served through a mix of existing resources, renewables, storage, natural gas, and nuclear, with data center customers increasingly valuing speed-to-power attributes of solar and batteries.
- Utilities are adopting specialized rates for large load customers to shield existing ratepayers from capital costs and stranded-asset risk.

Even in casual conversations, the rising cost of utility bills has become a common topic. It's no question the number of kilowatts zipping through the grid is increasing. Fingers are quick to point at data centers and artificial intelligence (AI) as the buzzwords of the time.

Electricity demand is increasing. AI is accelerating the trend. Higher demand has collided with slow power supply growth and significant plant retirements over the last decade, resulting in higher price signals across the power industry.

Breckinridge is investigating these themes to better understand evolving risk and reward opportunities in the Utilities sector. Our research focuses on quantifying power demand and its impact on the energy transition. We also are exploring the ways utilities may protect rate payers from rising bills, while maintaining reliability and increasing generation capacity. (For further insights into shifting energy transition trends, see our 2025 Climate Report.)

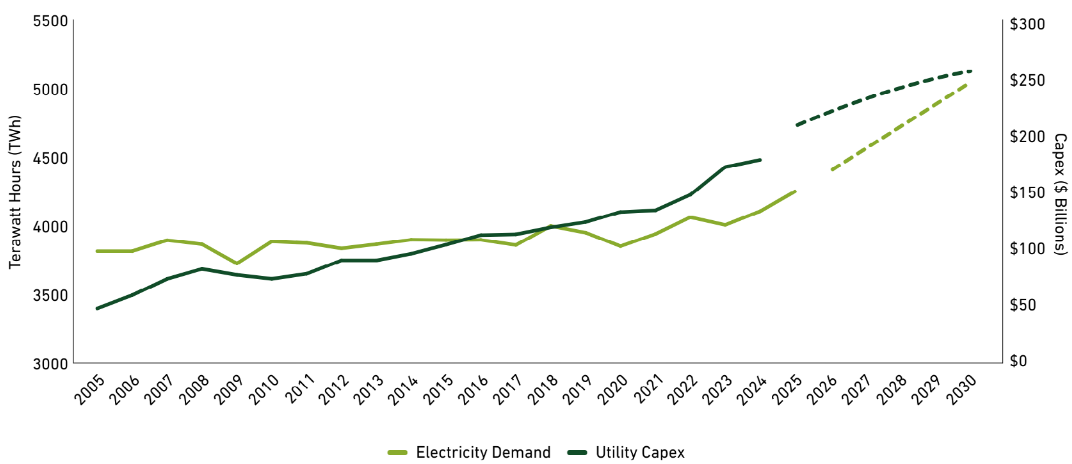
U.S. POWER DEMAND IS BACK ON AN UPWARD TRAJECTORY

Electric demand flatlined from 2005-2020, with energy efficiency and outsourcing offsetting economic growth. From 2020 to 2024, growth averaged 1.5 percent, entering new stages of electrification such as electric vehicles and industrial processes. More recently, power demand forecasts accelerated with some estimating up to 25 percent growth by 2030, equating to 3 to 4 percent annual growth.[1]

Per the U.S. Energy Information Administration (EIA), the U.S. consumed over 4,000 terawatts[2] per hour (TWh) of electricity in 2024. Based on growth assumptions, U.S. electricity consumption would approach 5,000 TWH in 2030. For comparison, 1,000 TWh of incremental demand equates to approximately 100 million homes or alternatively, the electricity usage of California, Texas, and Florida combined (See Figure 1).

HOW MUCH DEMAND RELATES TO AI?

FIGURE 1: U.S. ELECTRICITY FORECAST



Source: U.S. Energy Information Agency, Breckinridge calculations, ICF International Inc. forecast released June 2025. Edison Electric Institute's capex forecast released October 2025.

Third-party power consumption estimates for data centers are wide, ranging from 300 TWh to over 1,000 TWh by 2030. The midpoint is about 650 TWh. This means over 50 percent of forecasted electricity growth is attributable to data centers. It also means non-data center demand represents significant growth. Without AI, demand would still be growing. Non-data center sources include electric vehicles, electric heating, reshoring of manufacturing, electrification of oil and gas drilling, liquid natural gas (LNG) exports, and other industrial growth.

1. Rising Current: America's Growing Electricity Demand, ICF, June 2025
2. 1 TWh is a trillion watts per hour, equal to the electricity used by approximately 100,000 homes in a year.

New demand requires about 140 gigawatts[3] (GW) of generation capacity by 2030. Breckinridge expects an energy-abundance approach[4] for grid additions. New sources of generation include operating the existing fleet at higher utilization while adding renewables, battery storage, natural gas, and nuclear. Fuel type will depend on cost and speed-to-power (See Figure 2 and corresponding notes).

FIGURE 2: COST & SPEED-TO-POWER COMPARISON OF POWER GENERATION TECHNOLOGIES[5]

Technology[6]	Capacity	LCOE[7] $/Megawatts/hour (MWh)[8]	Capital Cost $/Kilowatts (kW)[9]	Speed-to-Power	Notes
Solar	20-25%	$58	$1,375	1-2 years	Excludes Inflation Reduction Act (IRA) tax credits
Solar + Battery	36-40%	$91	$1,627	1-2 years	
Onshore Wind	33-37%	$61	$2,100	1-2 years	
Natural Gas Combined Cycle	60-80%	$107	$2,500	4-5 years	2025 market data, $1,400/kW in 2023
Traditional Nuclear	90%	$169	$12,000	~10 Years	Reflects Vogtle Unit 4[10]

Source: Lazard Levelized Cost of Energy Report released June 2025.

SPOTLIGHT ON POWER GENERATION TECHNOLOGIES

Solar and Batteries:

Solar and batteries are among the lowest cost and can be operational in less than two years. Pairing a 4-hour battery to a solar farm can boost capacity factors to nearly 40 percent, reducing at least some dispatchability concerns. While H.R. 1 – One Big Beautiful Bill Act sunset solar and wind IRA credits earlier than expected, credits for batteries will provide incentives through most of the 2030s. Batteries will also help shave pricing during peak demand periods helping to reduce customer bills. The U.S. installed 56 GW of power in 2024 of which 60 percent was solar.[11]

Natural Gas:

Breckinridge expects higher natural gas usage. Gas is dispatchable and will provide important baseload and peaking generation during high demand or during low renewable resource availability. However, high global demand for gas turbines has nearly doubled the cost of new build. The lead time for a new gas plant is four to five years due to turbine backlogs, in addition to permitting and lateral pipeline buildout.

Nuclear:

Nuclear matches the always-on operating profile of a data center, while generating zero emissions. Recognizing clean and reliable attributes, hyperscalers[12] have entered long-term contracts with existing plants to secure power at premium prices. They have also partnered with asset owners to restart recently retired reactors. Restarts are expected to be online by 2029 but add only 2 to 3 GW of incremental capacity. Hyperscalers have also announced agreements to explore advanced nuclear technology such as Small Module Reactors. The willingness for well capitalized players to provide funding for emerging technology is positive for the energy transition but SMRs are not expected to be viable until well after 2030. History suggests a new large-scale nuclear reactor would take over 10 years to build.[13]

Existing Resources:

The U.S. is estimated to have 15 GW of available excess capacity.[14] Higher asset utilization leads to increased revenue and lower per unit costs. Savings can be passed through to customers. However, higher utilization would contribute to higher emissions. Natural gas is 42 percent of the U.S. grid.[15] Coal accounts for only 16 percent of generation but contributes half of electric sector emissions.[16] Since 2015, the U.S. retired about 120 GW of coal. The Institute of Energy Economics and Financial Analysis (IEEFA) forecasts 60 GW of coal retirements by 2030.[17] Retirements could be delayed one to two years to maintain grid reliability, but planned coal shutdowns are expected to proceed due to operational and environmental costs.

3. 1 GW is 1 billion watts.
4. An energy-abundance approach is a policy or economic framework that emphasizes expanding the supply of affordable, reliable, and clean energy as a foundation for growth, rather than focusing on conservation or scarcity.
5. Please see Spotlight on Power Generation Technologies in this paper for more details on the technologies discussed in this table.
6. The Lazard Levelized Cost of Energy (LCOE) Report is an annual analysis that compares the cost of generating electricity across different technologies such as solar, wind, gas, coal, and nuclear. The data in the table reflects the midpoint of Lazard estimates unless otherwise noted. For more, see the Lazard Leveled Cost of Energy Report. June 2025.
7. LCOE is the average cost to generate a unit of electricity over the project lifetime factoring capital costs, capacity factor, fuel costs, fixed and variable operating costs, and other variables.
8. 1 MWh equals 1 million watts per hour.
9. 1 KWh equals 1,000 watt hours., the unit reported on residential electricity bills.
10. Vogtle Unit 4 is the newest nuclear reactor at the Alvin W. Vogtle Electric Generating Plant in Georgia, which began commercial operations on April 29, 2024. It is part of the first new nuclear units built in the U.S. in more than 30 years.
11. Dan McCarthy, "Chart: 96 percent of new US power capacity was carbon-free in 2024," Canary Media, January 10, 2025.
12. Hyperscaler refers to cloud and internet companies like Amazon, Microsoft, and Google that operate large hyperscale data centers.
13. U.S. Energy Information Administration, "U.S. commercial nuclear capacity comes from reactors built primarily between 1970 and 1990," June 30, 2011.
14. Morgan Stalney, "Turning Up the GPU Dial, and Assessing the Intelligence Bottlenecks," December 1, 2025.
15. International Energy Agency, as of December 31, 2024.
16. Environmental Protection Agency, March 31, 2025.
17. Dennis Wamsted, Seth Feaster, "Nowhere to go but down for U.S. coal capacity, generation," IEEFA, October 24, 2024.

AS UTILITIES INCREASE CAPITAL SPENDING & ELECTRICITY CONSUMPTION ACCELERATES, AFFORDABILITY RISK EMERGES

Higher electricity demand is contributing to record utility capital spending (capex). Utility sector capex doubled from $104 billion in 2015 to $208 billion in 2025 and is expected to reach $248 billion in 2029.[18] Regulated utilities pass through a portion of capital costs and earn a regulated return on investment.

Over 50 percent of spending is on Transmission and Distribution modernization. For data center-specific capex, utilities are adopting specialized large-load tariffs to protect rate payers from data center connection costs and stranded asset risk. A utility may spend hundreds of millions or billions of dollars to supply power to a large load, only for the customer to use less power or shut down sooner than expected.

Utilities working alongside regulators are establishing contract provisions that provide ratepayer protections. Terms include a combination of upfront fees, exit fees, minimum volume commitments, contract length requirements, and collateral postings. Provisions vary by state.

We see affordability risk in states with weaker large load contract provisions and higher utility bill wallet share. We are also monitoring customer concentration risk as data centers become a greater portion of an individual utility's load.

We also see greater affordability risk in regions with unregulated or competitive power generation, which accounts for two-thirds of the U.S. In these regions, electric bills consist of supply and delivery components. The delivery component is controlled by regulators and utilities. However, the supply charge is set by market prices, which follow supply and demand curves, meaning utilities and regulators have minimal control over a large portion of the bill.

Market power prices[19] have more than doubled from $20 to 30/MWh to $50 to 70/MWh depending on the region, since 2020. Revenue raised from the PJM[20] capacity auction increased from $2.2 billion for delivery year 2024-2025 to $14.7 billion for delivery year 2025-2026, $16.1billion for delivery year 2026-2027, and $16.4 billion for delivery year 2027-2028. PJM capped the clearing price to prevent further increases in the two most recent auctions. We are monitoring PJM and FERC policy changes that could impact future results. Capacity revenue is ultimately paid by ratepayers to power plant owners as an incentive to stabilize revenue, maintain grid reliability, and provide lead time to build or retire assets.

Breckinridge is monitoring power market dynamics, data center trends, and evolving federal and state policies. Affordability and reliability remain top of mind for investors, ratepayers, management teams, regulators, and politicians.

Utility capital spending will bring a wave of new debt issuance. We expect utilities to maintain current credit ratings driven by rate increases, increased equity funding in the form of common stock and hybrid issuance, and asset sales. Breckinridge also integrates energy transition factors into the fundamental research process.

18. Edison Electric Institute (EEI) Financial Analysis Department, updated September 2025.
19. Calendar year around the clock forward power prices in PJM and Energy Reliability Council of Texas (ERCOT).
20. The PJM Interconnection is a regional transmission organization that coordinates wholesale electricity across 13 states. The PJM auction results released December 17, 2025 for delivery year 2027-2028 cleared at $333/MW-day setting a record high. PJM estimates that without the temporary price cap, the capacity price would have been $530/MW-day.