2025–2030

U.S. Grid Outlook

& Parallax Forecasting Insights

highlights and implications

TELESTO
STRATEGY

Table of Contents

TELESTO STRATEGY

Executive Summary

The U.S. electricity sector is expected to undergo a substantial change in the next 5 years, shifting from a modest electricity surplus today to an expected shortfall by 2030, which is roughly enough to power 2.4 million American homes for one year. A range of supply and demand drivers are at play, including:

Rapid growth in demand

- Significant investment in data centers to support the expansion of AI
- A push by the Trump administration towards onshoring of manufacturing

Constricting supply

- Regulatory changes at the federal level curtailing funding for the deployment of renewable sources of energy, slowing the greening of the grid and putting downward pressure on supply
- Persistent transmission bottlenecks
- Tariff and trade dynamics decreasing the availability of imported energy from Canada and increasing the cost of materials and components for the energy sector

Taken together, these demand-side pressures are expected to **increase electricity demand in the U.S. by 14-19% by 2030**, while the supply-side constraints **reduce the availability of electricity by 40 TWh** during the same time period (enough to power 3.8M American homes for a year).

The impacts of these policy changes and related market forces are projected to:

- Move the U.S. from an electricity surplus of ~150 TWh in 2024 to **a deficit of ~25 TWh by 2030;**
- Contribute to an **average increase in electricity price of more than 5% per year**; and
- **Raise the total cost of electricity** for Americans by **nearly $250B between 2026 and 2030**.

And while the effects will be felt nationally, certain subregions where the pressures are greater are expected to experience even greater increases in cost.

For energy-intense sectors – like real estate and advanced manufacturing, which represent nearly 75% of the U.S.'s electricity demand – the current market dynamics impacting the grid could present significant challenges in the future, including increased exposure to outages, curtailments, and price shocks. If these risks materialize, it will mean higher operating costs, increased capital and compliance costs for local building performance standards (BPS), elevated reliability risk, and inability to meet energy and emissions targets. Being proactive in understanding where and how these trends will play out will be critical for business' profitability and reliability.

FIVE Macrotrends

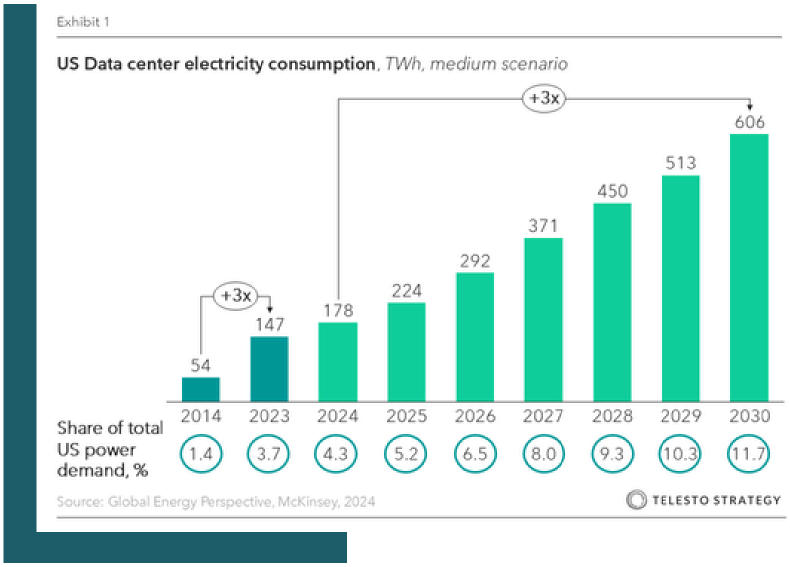
What's Going On?

While the U.S. electrical grid is a complex system made up of hundreds of subregions and utilities, Telesto research has found that five prevailing macrotrends are likely to have the largest impacts on the availability, cost, and carbon content of the grid in the coming years. We explore each of those macrotrends in detail in this section.

And while the effects will be felt nationally, certain subregions where the pressures are greater are expected to experience even greater increases in cost.

1 Exponential data center expansion

Driven by AI and cloud computing, U.S. data center load growth has **tripled over the past decade**, and future growth is expected to be even more rapid. Indeed, by some estimates data centers are **projected to triple power consumption** in the U.S. by 2030, particularly in concentrated markets like Northern Virginia, metropolitan Atlanta, and metropolitan Phoenix. By 2028, data centers are expected **to consume between 6.7% and 12%** of total U.S. electricity, up from 4.4% in 2023. As of June 2025, U.S. data center construction spending was up **~30% from the previous year**.



TELESTO STRATEGY

1

Exponential data center expansion

The continued proliferation of data centers and subsequent growth of energy demand will strain grid capacity and potentially increase reliance on fossil fuels in some regions, thereby raising emission factors. Current projections assume that renewables will only meet **40% of data center power demand growth** through 2030, with most of the remaining demand being met by natural gas. Nuclear energy, which has the **full support of the Trump administration**, can take decades to deploy, making new generation capacity predominantly viable after 2030. For context, the average timeline for a new utility-scale nuclear plant is 11-25 years whereas solar PV is 5 years and gas is 6 years. In the meantime, gas turbine orders and gas capacity are **currently rising across all regions except New York Independent System Operator (NYISO)**. In anticipation of strain on the grid and potential deficits in supply, data centers are increasingly turning to on-site generation to bypass these issues. As of 2025, **19% of datacenters were already implementing** behind-the-meter power, with **30% of all sites expected to use onsite power** by 2030.

2

Regulatory changes

For most of the Biden administration, regulations favored decarbonization efforts and increased deployment of renewable energy. For example, when President Biden signed the Inflation Reduction Act (IRA) into law in 2022, it directed almost **$660** billion in federal funding towards energy security and climate change [AA1] measures through 2031, mainly in the form of tax credits but also through grants and loans. Studies from 2024 estimated that[AA2] , by 2030, the IRA would have been responsible for a **10% to 15% decline i**n emissions from 2005 levels.

However, some IRA incentives have already been undone by the passing of the "One Big, Beautiful Bill Act" (OBBBA), and the Trump administration has threatened to rollback key other key policies like the **Clean Air Act Section 111** (CAA §111). CAA §111 establishes a framework for the Environmental Protection Agency (EPA) to regulate air pollution from stationary sources such as power plants and industrial facilities. The roll-back of IRA clean energy incentives has the potential to reduce **new renewable energy capacity by 15%** and increase annual household bills by **up to $400 in the next 10 years**. **Credits for electric vehicles and residential energy products were also repealed** while others are restricted or phased out more quickly. New Foreign Entity of Concern restrictions might make taking advantage of the remaining credits cost prohibitive. The Department of Treasury issued guidance in August 2025 **eliminating the 5% beginning-of-construction safe harbor** for wind and solar energy projects for the purposes of qualifying for IRA-era tax credits, but the changes are not retroactive and only apply to projects starting on or after September 2, 2025. Guidance for Foreign Entity of Concern rules under the OBBBA is still being drafted. **Unobligated IRA funding for many programs was repealed** including the Greenhouse Gas Reduction Fund and transmission development. Other regulations are also at risk of being repealed like, for example, CAA §111. In June of 2025, the EPA proposed to repeal all greenhouse gas limits for **new and reconstructed gas turbines and existing and modified coal and oil/gas-fired power-generating units**.

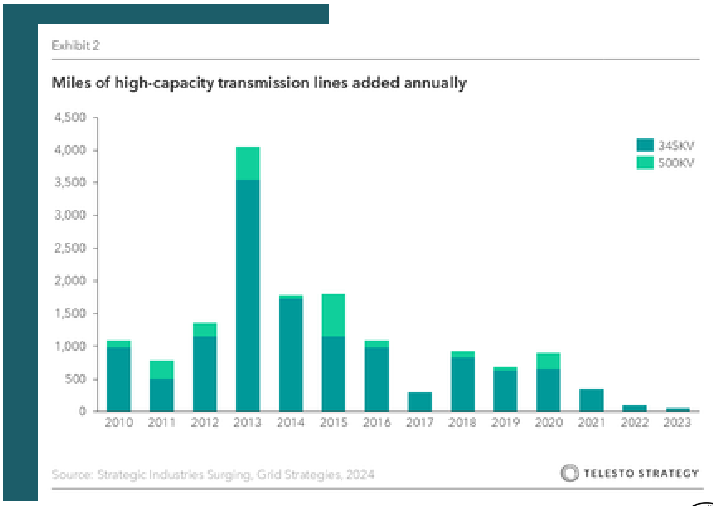
Despite federal policies, which are seemingly opposed to renewable energy and sustainability, local governments across the U.S. are enacting pro-sustainability and -energy efficiency regulations. Perhaps most notable among them are Building Performance Standards (BPS) ordinances, which usually include a restrictive maximum allowance for energy use, emissions, and/or water use per square foot. Boston's **Building Emissions Reduction and Disclosure Ordinance (BERDO)**, for example, is a particularly strict BPS which is coming into effect in 2025. Under BERDO, companies must report key building characteristics and annual energy and water usage through the **ENERGY Star Portfolio Manager**. Then, starting in the first year of reporting and repeating every year thereafter, companies must hire a third-party qualified energy professional to verify reported data. BERDO's fines vary by building type and size, ranging from $150-$1,000 per day on top of a $1,000-$5,000 fine for failing to accurately report information. While federal action appears to be slowing the greening of the grid and reducing generation capacity through fewer incentives for renewables, local regulations are moving in the direction of requiring more energy- and emissions-efficient buildings.

Transmission bottlenecks and slower renewable deployment

3

Over 70% of U.S. transmission lines are more than 25 years old, and because much of the U.S. electric grid was built in the 1960s and 1970s, many lines are nearing the end of their 50- to 80-year lifespans. Recent analysis from Bank of America Institute estimates that 31% of transmission lines are "beyond useful life." Despite unprecedented proposals for expansion of generation through renewables (2.6 TW were queued in 2024, double current U.S. capacity), insufficient transmission infrastructure and significant lead times for interconnection requests are slowing project execution. In fact, the grid connection backlog grew by 30% in 2023, and most of the generation capacity waiting in the queue is renewable. Consequently, reports suggest that successful interconnection reform could boost deployment of grid-scale clean energy by 60% by 2030 and by 90% by 2040; however, the U.S. added only 55 miles of high-voltage (>345KV) transmission in 2023, creating a critical mismatch between demand growth and infrastructure deployment, which leads to grid congestion, curtailments, and delayed greening of the grid.

In 2022, transmission congestion in the Electric Reliability Council of Texas region (ERCOT) [AA1] increased system costs by $2.8 billion (8.7%) and emissions by 13 million tons of CO_2e (7.5%). **In 2023, 50% of renewable generation capacity across ERCOT** could not be delivered to where there was customer demand in Houston because of transmission congestion[KM2] [DB3] , and 70% in the Pennsylvania-New Jersey-Maryland Interconnection (PJM) could not be delivered to customer demand in Virginia. The passing of OBBBA rolls back support for clean energy and expands fossil fuel production by making available more land for coal and gas development and reducing royalty costs for producers. Lack of federal support will slow renewable deployment that, when combined with reliance on fossil fuels, could lead to more congestion, more reliability issues, and increased costs.



TELESTO STRATEGY

4

Manufacturing resurgence

Spurred by federal incentives and reshoring, over **150 major industrial facilities** (including EV batteries and semiconductor fabs) have announced new or scaled up operations in the U.S. since 2021, creating concentrated, energy-intensive hubs —particularly in the Midwest and Southeast. While the Trump administration has made clear its ambitions to bring back more manufacturing to the U.S., there were other indications in recent years that manufacturing activity was picking up: **manufacturing construction spend increased 199%** between Q1 2020 and Q2 2024, **750,000 new manufacturing jobs** have been created since 2021, and **mentions of reshoring in S&P 500 earnings calls increased by 128%** in the first quarter of 2023 compared to the previous year.

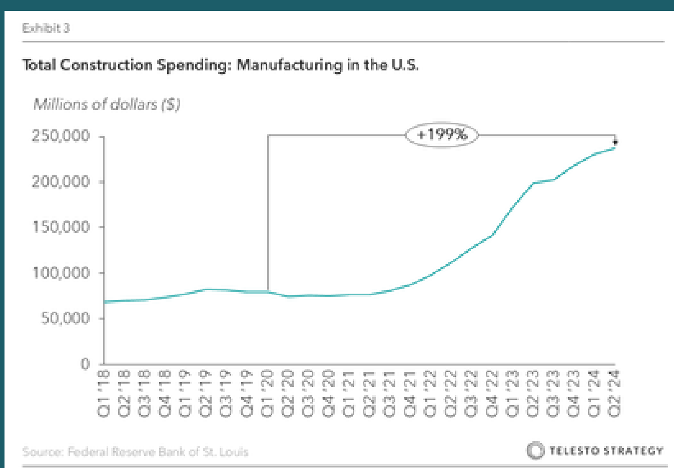


Exhibit 3
Total Construction Spending: Manufacturing in the U.S.
Source: Federal Reserve Bank of St. Louis

+199%
growth

Given commitments by the Trump administration to further promote U.S.-based manufacturing, driven by "America First" policies like tariffs and targeted tax cuts, growth of major industrial facilities is likely to accelerate in the coming months. In response to these policies, companies across a variety of industries (e.g., **automotives, steel, technology, pharmaceuticals**) are investing more in their U.S. based manufacturing networks. Taiwan Semiconductor Manufacturing Co., for example, agreed to a deal with the Trump administration in March, 2025, promising **$100 billion investment in five new "cutting edge" facilities on US soil**. Similarly, Micron Technology, Inc. announced plans to invest **$200 billion in U.S. semiconductor manufacturing and R&D** in June, 2025.

Between 2002 and 2018, U.S. manufacturers consistently consumed **around 14% of U.S. electricity**. Recently constructed manufacturing facilities, however, have individual estimated annual loads **of up to +1,000 GWh** – equivalent to powering +95,000 homes in a year and +100 times higher than **the ~8 GWh annual load** for the **average sized U.S. manufacturing facility**. An increase in construction of energy-intensive manufacturing facilities will result in load additions to the grid. If the expected growth of manufacturing activity cannot be matched by existing or planned generation, it could place local grids under significant stress and become a constraint to business growth.

TELESTO STRATEGY

Trade dynamics and tariffs

5

In the past decade, developing the competitiveness of U.S. trade and the resilience of U.S. supply chains have been high priorities for both the Trump and Biden administrations. At the end of 2024, the average effective U.S. tariff rate was estimated to be 2.3%, but by August 1, 2025, it was estimated to be 15.8%. Trade negotiations are ongoing under the Trump administration, but as of the beginning of August, the U.S. had enacted tariffs on a variety of countries including Mexico, Canada, China, and others ranging from 10 to 50%, and it had imposed tariffs on imports of certain materials and components, including 50% on steel and aluminum, 50% on copper, and 25% on foreign-made cars, engines, and other car parts.

While tariffs may spark domestic investment, they are also expected to increase the cost of renewables and critical grid equipment by up to 50%, making the U.S. one of the most expensive markets for solar energy. China, which has been a main target of the Trump administration's tariffs, is estimated to account for between 40% and 98% of global manufacturing capacity for key clean technologies and components. Meanwhile, the U.S. has become reliant on imported components for clean energy technologies like solar panels, wind turbines, and batteries. Last year, for example, the U.S. imported over 54 GW of solar panels, 70% of wind turbine blades installed in the U.S., and $24 billion in battery cells from countries like Vietnam, Thailand, Malaysia, Cambodia, Mexico, Canada, China, Japan, and South Korea - all of which are subject to tariffs ranging from 15-35%.

In parallel, the Trump administration's tariffs on Canada have resulted in retaliatory measures. Canada supplied certain regions in the U.S. – including the Independent System Operator New England (ISONE) region, NYISO, and the Midcontinent Independent System Operator (MISO) region – with as much as 5% of their electricity. In March 2025, the Ontario premier threatened to restrict electricity exports to the U.S. amid tariff increases on imported Canadian goods. A 25% surcharge on electricity exports from Ontario to Michigan, Minnesota, and New York was temporarily enacted, but later suspended after President Trump backed down from a 50% tariff on Canadian aluminum and steel. As of July 22, 2025, the Ontario premier has signaled that an electricity export tax is still possible if trade talks fail. Canada's retaliatory actions could not only make it harder for businesses to get access to electricity but also mean that the electricity they are accessing is less green on average, as 82% of Canada's electricity comes from non-greenhouse gas emitting sources.

TELESTO STRATEGY

Grid future

Although the ways in which the macrotrends mentioned above will play out can already be deduced – at least directionally – it can be more complicated to determine how they will interact with each other and how uncertainty about their timing and magnitude will materialize. As such, we explore what the likely effects of these macrotrends will be on the grid through analysis of their impact on grid capacity, electricity prices, and emissions.

Capacity

National demand for electricity is increasing at a rate that is outpacing the growth of supply. As soon as 2026, the U.S. Energy Information Administration (EIA) expects that the **growth of nationwide electricity consumption** will be higher than the **growth of electric power generation**. In the short term, demand growth outpacing supply often results in electricity price increases, but in the long term it has the potential to create even more substantial shortages.

Up until 2024, there had been a relatively balanced equilibrium between **supply** and **demand** in the U.S., with an excess generation potential of ~150TWh (representing roughly 4% of total electricity demand). However, driven by demand and supply pressures, we project that the grid will move towards a deficit of 25TWh by 2030. Given the **average U.S. household electricity consumption**, 25 TWh of electricity would power +2 million homes annually. The proliferation of **data centers** and the **manufacturing resurgence** already outweigh the expected supply increase, which indicates higher likelihood of experiencing local shortages. Moreover, **decreases in renewable energy additions spurred by the OBBBA**, **decreases in renewable capacity due to tariffs**, and **persistent transmission bottlenecks** contribute to an expected net deficit of generation potential of the grid.

The proliferation of data centers and resurging manufacturing are already causing upward pressure on demand that is only going to increase with time. Indeed, Berkeley Lab projects that there will be an **increase of 149-404 TWh of electricity demand by data center's** by 2028. Taking the mid-point in this range, we project an increase in electricity usage by data centers of 330 TWh by 2030. Similarly, **according to Deloitte**, the 150 U.S. onshore facilities announced between 2021-2023 are expected to have an annual electricity usage of at least 13 TWh; half of which is expected to be operational in 2025. Considering this trend and reshoring announcements after 2023, we expect an increase in demand from manufacturing of 20 TWh by 2030. There is a critical mismatch in the U.S. between development of strategic industries, like AI and chip manufacturing, and the procurement of new generation and transmission to meet the subsequent load growth. Even if all currently known data center power supply plans are delivered, there could still be a data center energy supply deficit of **more than 15 GW in the U.S. by 2030**.

TELESTO STRATEGY

Simultaneously, regulation, transmission bottlenecks, and tariffs are exerting downward pressure on supply. Before the Trump administration, the U.S. was expected to reach **59% renewable electricity by 2030.** However, with changes in U.S. energy policy brought about by the OBBBA, new wind, solar, and energy storage additions are expected to **drop by 23% through 2030 compared to earlier forecasts**. Some of this **may be replaced by natural gas**, but current supply chain backups may prevent any major additional gas buildout in the next five years. As such, we project a 20 TWh decrease in expected supply associated with regulatory shifts.

Similarly, transmission bottleneck issues are expected to persist. Past completion rates indicate that **only about 13% of all capacity that enters the queue ever comes online**, but current trends suggest that this ratio could be even lower over the next few years, reaching only 10%. Applying the 10% ratio to **data from Berkeley Lab** on the capacity of active interconnection requests by proposed online year (a total of ~980 GW until 2030), we project a 15 TWh decrease in supply. Likewise, tariffs have the potential to not only increase the cost of imported energy and important components for generating domestic energy, but also to catalyze the restriction of energy exports from important trade partners. Comparing scenarios from **McKinsey** where global tensions escalate and productivity accelerates, tariffs could decrease 2035 installed solar capacity in the U.S. by 9% and battery storage system capacity by as much as 4%. As such, we project a 5 TWh decrease in supply. Combining these factors with the removal of support for renewable deployment, we expect to see an exacerbation of severe preexisting transmission congestion which will compound into a stressed grid which is incapable of handling persistently increasing demand.

Indeed, the Department of Energy recently reported that the U.S. could face **800 hours of annual blackout as soon as 2030**, which is up from single digits today. Shortages are also likely to be more pronounced in certain regions. Under this scenario, utilities might choose to disincentivize electrification efforts. For example, a building owner might be prevented from replacing a gas furnace with an electric heat pump if it is known this will increase the system's load significantly. These types of restrictions are also more likely to affect energy-intensive buildings, like data centers and manufacturing sites. For example, Ohio Power has proposed a **data center tariff** which would allow them to suspend service if a customer's usage exceeds its contract capacity by more than 1 MW.

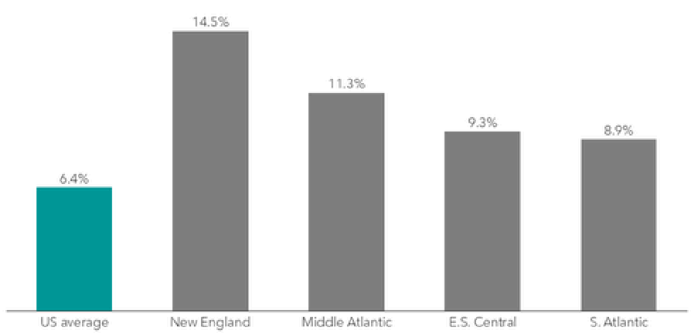
Electricity prices

Average electricity prices have climbed **13% nationally** since 2022, and forecasts suggest that residential rates could rise an **up to 40% by 2030**. In 2026 alone, electricity prices across the U.S. are projected to rise by 6%, with higher increases expected in specific regions (e.g., New England, where the increase is expected to reach 14.5%).

Taking all the supply and demand factors discussed above, we project that the U.S. will experience a 5.2% average annual increase and 35% total increase in electricity prices by 2030, up from 3.1% and 20% on "Baseline" projections. Taking this difference in the growth rate of electricity prices relative to the baseline scenario, we project that these factors will contribute to an additional total cost of electricity of nearly $250B for Americans between 2026 and 2030.

Exhibit 5

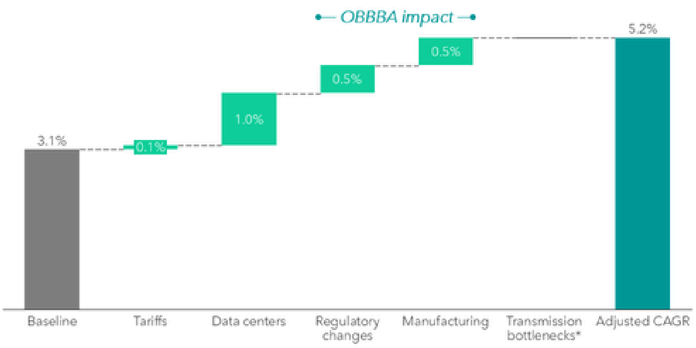
Projected change in electricity prices to ultimate customers by 2026; *selected regions*



Source: EIA Short-Term Energy Outlook, 2025 TELESTO STRATEGY

Exhibit 6

Projected CAGR of electricity prices until 2030



*Price increases due to transmission bottlenecks subject to high degree of uncertainty, but they could contribute to an even higher expected price increase

Source: EIA Short-Term Energy Outlook, 2025, Yale Budget Lab, Bain, Energy Innovation TELESTO STRATEGY

Based on **analysis from the Yale University budget lab**, the isolated price impact of tariffs on the average annual electricity price increase is found to be less than 0.1%. Moreover, given the need for capital investments to meet data center demand growth, customer utility bills could incrementally **increase by 1% annually through 2032**. Similarly, a mid-range estimate of **electricity rate increases caused by the OBBBA** is a 1.1% average annual increase. This increase is allocated in equal parts to regulatory uncertainty and manufacturing given the comparable impact on supply and demand projections demonstrated in the previous section on "Capacity." Finally, price increases due to transmission bottlenecks are subject to a high degree of uncertainty, and so are left as "Undetermined," but they are expected contribute to an even higher expected price increase.

Rising electricity prices may also be exacerbated by supply chain issues caused by current trade policies. Imports of key equipment and base materials to fabricate them are **necessary for both drilling and production infrastructure in oil and gas**. Many metals and equipment, including steel and copper, have been heavily tariffed in recent months. On the renewables side, **lithium-reliant grid batteries will face tariffs of 65%** and **many solar components which are manufactured in East and Southeast Asia** are facing country-specific tariffs. The energy industry is facing significant cost increases that will likely be passed on to consumers.

Emissions

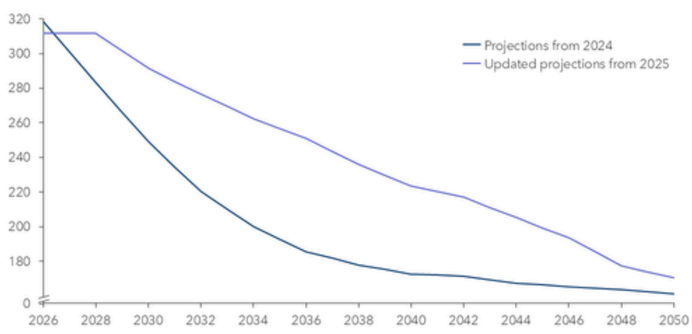
A final area where the impact of these supply and demand macrotrends will be felt is emissions. The carbon-intensiveness of the electricity supplied by the grid is largely determined by the share of electricity which is generated by renewable sources (e.g., solar, wind) compared to those which emit greenhouse gasses (e.g., natural gas, coal). For many businesses and non-profits, the emissions associated with consuming electricity – often referred to as Scope 2 emissions – can be their single largest source of emissions. As such, understanding how the grid is expected to green in the coming years can have a material impact on organizations with emissions reduction targets.

In 2024, federal regulatory headwinds were expected to accelerate the greening of the grid. **Parallax**'s optimistic and base scenarios reflected this to varying degrees, while the pessimistic scenario was based on projections before the signing of the IRA. Projections consider national level factors, but also more localized inputs like local regulations, commitments, and renewable energy deployments for specific subregion projections. Considering demand growth from data centers and manufacturing, and downward supply pressure from regulatory changes, transmission bottlenecks and tariffs as discussed above, refreshing national emission projections in the first half of 2025 revealed a slower greening of the grid expected in the future compared to previous year's projections. In 2040, for example, this year's projections (223 $kgCO_2/kWh$) are almost 30% higher than previous projections (172 $kgCO_2/kWh$).

Given the regional nature of these factors, particularly for data center and manufacturing sites and at-risk imported Canadian energy, the difference in emissions projections is even more dramatic in certain regions. Mapping the varying regional impact shows states with **highly saturated** and **high future growth data center markets**, states at **risk of losing Canadian energy imports**, states with the **highest number of manufacturing jobs** as a proxy for high levels of manufacturing activity, and states with the **highest solar capacity in the interconnection queue** that are consequently vulnerable to regulatory uncertainty. Exhibit 9 shows only the most dominant factor in each state, but many states experience multiple of these factors.

Exhibit 7

Base case US national average emission factor, *$kgCO_2e/MWh$*

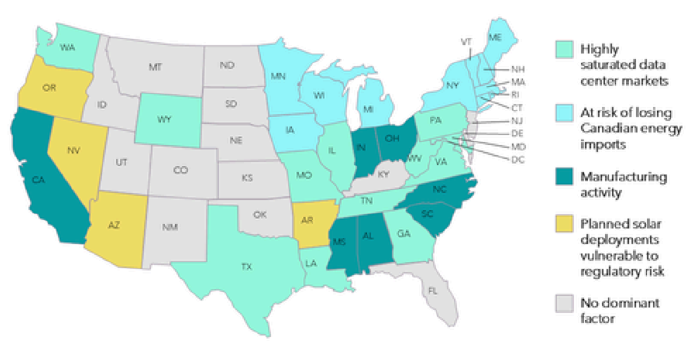


Source: Parallax (Telesto's proprietary emission factor projection tool)

TELESTO STRATEGY

Exhibit 9

Map of impact of 5 macrotrends on electricity grid



Sources: CSIS, Business Facilities, Berkeley Lab

TELESTO STRATEGY

TELESTO STRATEGY

Closing THOUGHTS

The Trump administration influences policy levers like data center and manufacturing growth, federal regulatory uncertainty, the persistence of transmission bottlenecks, and tariff and trade dynamics. The recent and ongoing push for "unleashed energy," reshoring, and "America first" policies have serious consequences for the U.S. electricity grid given the combined impact of these factors. Throughout this report, we outlined projections for a potential generation supply deficit of ~25 TWh, increasing electricity prices that could cost the electricity sector ~$250B between 2026 and 2030, and slower greening of the grid.

U.S. businesses and the electricity sector have both converging needs and converging risk profiles that need to be mitigated by accelerated electrification planning, investment in behind-the-meter renewables and storage, and adoption of portfolio-level tools (e.g., Parallax) to model emissions, reliability and cost risk under alternate regulatory and demand scenarios. The future of the grid could present significant challenges, in the form of increased exposure to outages, curtailments, and price shocks. Materialization of these risks will mean higher operating costs, increased capital and compliance costs for local building performance standards (BPS), elevated reliability risk, and inability to meet energy and emissions targets. Business' profitability and reliability depend on being proactive in understanding where and how these trends will play out.

Net zero commitments and local building performance regulations are becoming increasingly common. Given updated emission factor projections, there is additional cost and difficulty associated with complying with these new regulations. Emerging building performance standards (e.g., **New York's Local Law 97**) impose hefty penalties on energy-inefficient and high-emitting properties. Five years ago, there were only 13 BPS ordinances in the U.S. but now there are 35 enacted and more than 50 others in development or discussion. Most buildings are relying on electrification to be compliant. However, owners are being pushed to electrify just as demand overtakes new supply based on our projected deficit. The consequence is harder and costlier compliance unless owners seize control behind the meter with energy management systems, on-site renewables, and storage. Building owners need to be cognizant of both looming regulations and grid emissions forecasts to minimize their risk exposure.

Authored by

Andrew Alesbury
Partner

Ben Vatterott
Partner

Diego Bernstein
Manager

Katie McCurrie
Analyst

TELESTO STRATEGY

About Parallax

Parallax, a proprietary tool developed by Telesto, forecasts how changes to the U.S. electricity grid will impact the built environment in the future, helping business and non-profits make informed, forward-looking decisions at the local level. By aggregating data from public and proprietary sources, Parallax models scenarios that capture the ripple effects on grid capacity, emissions, and pricing in the future – at the zip code level – from actions made today. Considering everything from federal policy changes to the expansion of data centers and shifting trade dynamics, Parallax equips your organization with the forward-looking insights necessary to make strategic investment decisions.

This report leverages key findings uncovered through Parallax's modeling and explores the prevailing macrotrends today which are shaping the electricity grid of tomorrow. Diving into each of these macrotrends in detail, we unpack what is driving them and analyze what they mean for capacity, price, and emissions.