Utilities Segment
White Paper

Winning growth strategies for a new power landscape

Enabling unprecedented electricity demand

Is your utility ready? Never-before-seen increases in electricity demand are coming from many directions — data centers, electrification of everything (buildings, homes and transportation), reindustrialization and more.

Electricity demand has not grown for two decades. Now, we are seeing 2 to 4% load growth year over year. Yet, forecasts for the near term vary substantially and are much more dramatic. Recent research from S&P Global Market Intelligence that was commissioned by Eaton suggests utilities in North America are anticipating load growth of 36% in the next five to ten years[1]. In the U.S., power demand from data centers alone is expected to double or triple by 2028, moving from 176 terawatt hours (TWh) in 2023 to somewhere between 325 and 580 TWh[2].

This surging electricity demand requires coordination across industries to work together. Strategic collaboration between utilities, suppliers and customers will be essential. This kind of demand growth is a call to work differently and creates opportunities for new collaboration, accelerated technology development and adoption, infrastructure modernization, as well as additional energy sources.

EATON
Powering Business Worldwide

Multi-pronged efforts to help fuel demand

There is no single solution to solve surging electricity demand. Investments to modernize and optimize the grid, add capacity and infuse flexibility are vital. That is just the beginning.

The ability to add new capacity will certainly be essential. Intelligent power management solutions can help support these initiatives, but simply adding capacity will not be enough to meet anticipated load growth fast enough.

Current infrastructure is either insufficient and/or outdated to accommodate growth, cited by 44% of utility respondents to the S&P Global Market Intelligence Survey. Back in 2015, the U.S. Department of Energy found that 70% of U.S. transmission lines were over 25 years old (or older). There is $7.6 billion in funding for 105 selected utility grid hardening projects in all 50 U.S. states.

Importantly, utilities in North America and beyond believe there is unused capacity on the grid that could be put to use. Digital tools can help free up significant capacity; 44% of utilities believe you can add upwards of 24% of extra capacity on the grid and an additional 40% of utilities suspect the potential increase is even more (upwards of 49%)[3].

Addressing growth will invariably require flexibility in managing supply and demand. When you think about the future generation mix and resource needs for the grid, it is not just about investments in the grid or adding capacity. Demand-side flexibility is vital; without it, energy use will run up against the physical limitations of distribution lines, substations and transformers that were not sized for the increases in demand. This flexibility can be put to work for grid management, helping orchestrate the grid through automation and edge control. And there are powerful tools able to help, whether on the grid, at home, in data centers, or across buildings and industrial operations.

At Eaton, our electrical solutions and expertise play a vital role in critical infrastructure nearly everywhere. For the last century our solutions have worked on both sides of the electric meter. Today, our portfolio of products, services and solutions enable the bi-directional flow of electricity, providing new flexibility for utilities, data centers, industrials, buildings, homes and more. And we see new and much needed opportunities for collaboration within and across industries and applications to support a more dynamic grid.

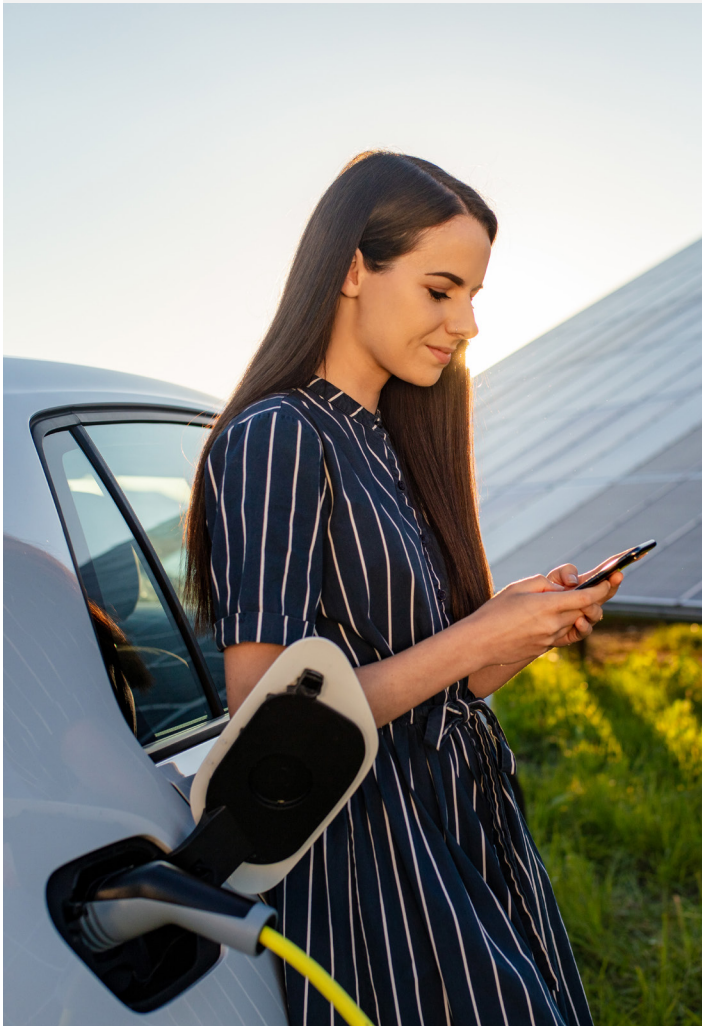
Grid solutions at hand

The best way to add new resources and capacity onto the grid, safely and cost-effectively, starts with good planning. Meanwhile, grid flexibility hinges on powerful grid automation and controls and understanding changing customer energy usage patterns. There is an acute need to facilitate and expedite interconnection studies, validate the viability of interconnecting both new resources and loads on the grid, actively plan for the demand ahead, evaluate shifting energy usage patterns and enable new control and flexibility at the grid edge.

Grid modeling software plays an important role in helping break traditional silos to share data and transform distribution planning. It enables grid planners to expedite analysis essential for energy projects and design non-wires alternatives quickly and safely, while reducing the risk of human error. This means the analysis needed to validate the viability of new capacity can take a matter of hours, rather than weeks or months. This proven and powerful tool provides a holistic and accurate view of as-built and as-planned model for utilities to manage change and get ahead. At Eaton, we work alongside utilities to customize their model—for the data you have today and what you will need in the future.

How will changing customer energy behaviors impact the grid? There is also a tool for that. Increasingly, traditional energy consumers are adding solar, energy storage and electric vehicle (EV) charging. So, it is more important to understand and evaluate how diverse usage patterns impact the grid and find opportunities to optimize it. Today, one of the best ways for utilities to know where EV charging is being added, for example, is through incentive programs. Increased visibility into EV (charging) adoption is especially important and advanced analysis can help. Providing needed insights to help you foresee and manage the impact of EV charging, helping monitor critical assets for capacity issues.

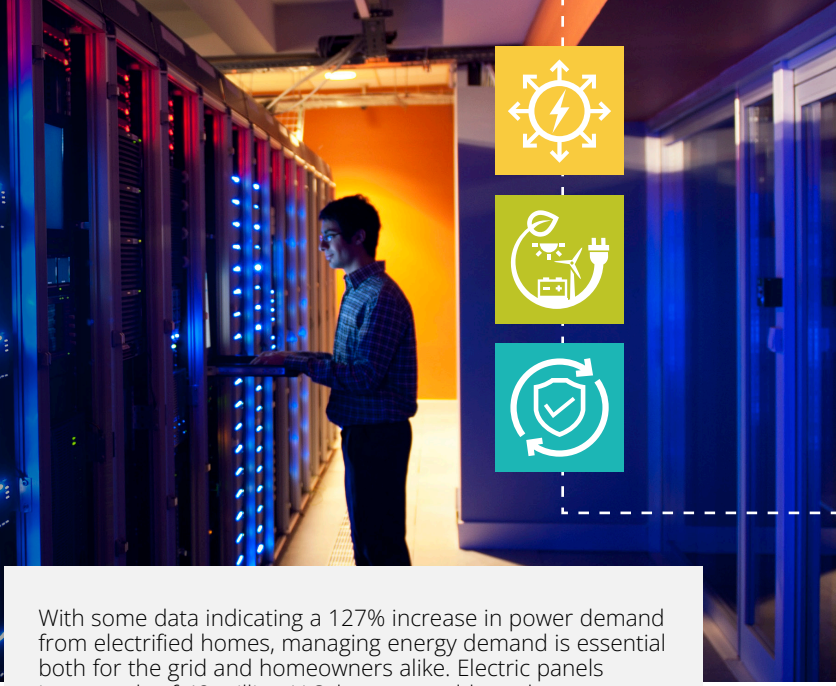
When it comes to enabling flexibility in supply and demand on the grid, automation and control are critical and we at Eaton have enabled these technologies for decades. For example, demand response programs are accessing novel behind-the-meter insights and data and control to support resilience and flexibility. We are also working on controls to coordinate various energy sources at the grid edge.



Behind the meter coordination and collaboration

More than ever, traditional energy consumers are generating, storing and using energy in new ways. This dynamic is changing the relationship between utilities and customers. As a result, customers can now become partners in power production and support grid flexibility. In this environment, energy consumers everywhere may be called upon to help push power onto the grid when needed. This approach puts investments in onsite power to work for the grid and helps reduce overall demand. Everyone benefits from this scenario, easing the path to a more energy-hungry future—helping accelerate data center and industrial growth, supporting electrification of everything and reducing costs.

Data centers are expected to shift from needing less than 2% of U.S. energy resources (in 2018) to somewhere between 6.7 and 12% by 2028—making data centers the fastest growing market[4]. Beyond increasing power needs, AI data centers have wide load swings, making the traditional approach of planning for peak capacity exceptionally costly. In this environment of growth and load swings, putting energy investments to work harder is essential both for the grid and data centers.



How does this play out? Grid-interactive uninterruptible power supplies (UPS) can help both smooth the load profiles of AI data centers and support frequency response in areas with high penetration of renewables, while also supporting emergency power needs. This is accomplished with two independent inverters; one inverter supports the data center load, while the other can absorb or release power from the battery on demand, when requested by the grid operator. This strategy supports frequency stabilization and is already widely used in Europe.

Microgrid and energy storage systems deployed by large energy consumers like industrials and data centers can also support grid resiliency and flexibility objectives. For example, a clean energy microgrid provides more than half of the energy needed to support our Arecibo manufacturing facility and can push power back to the grid, supporting regional electricity demand. The microgrid controller provides important real-time management and optimization to manage load variability.

Additionally, EVs have the potential to become a tremendous grid resource if properly integrated. We are working with utilities, vehicle manufacturers, industry partners and more to lay the ground for vehicle-to-grid (V2G) standards[5]. Today, only direct current (DC) V2G is currently permissible in California, and it requires an additional inverter. In collaboration with the utility, we worked to demonstrate alternating current (AC) V2G technology, which uses the onboard vehicle inverter (and reduces onsite equipment requirements)—making it simpler and cost-effective.

With some data indicating a 127% increase in power demand from electrified homes, managing energy demand is essential both for the grid and homeowners alike. Electric panels in upwards of 48 million U.S. homes would need more service capacity to support electrification[6]. To avoid capacity increases, many homes can use intelligent load management to manage loads—not everything needs to be on at the same time. With intelligent load management incorporated into the circuit breakers, many homes can avoid capacity increases. At the same time, the technology enabling load management can provide new visibility and control at the grid edge for demand response programs. The technology has been demonstrated through EPRI field tests to provide granular, behind-the-meter insights on energy use and control—delivering flexibility for the grid and enabling intelligent load management at home[7].

Growth cycle drives the grid of the future

For over a century, the electric grid functioned in the same way. Delivering safe, reliable and affordable power involved moving electricity from where it was generated (centrally) to wherever it was needed.

Today, this reality has been upended by new grid dynamics. Following years of flat—or even declining—growth, we are now in the early stages of a new growth cycle. Megatrends such as the energy transition, electrification, (AI) data centers, reindustrialization and green regulations are reshaping the electric grid. As a result, utilities are poised for several decades of tailwinds.

Traditional energy consumers can do much more than receive power from the grid; they can now generate, store, manage and use energy in new ways. This dynamic unlocks new opportunities and strategies to manage the grid.

By bringing together the priorities of multiple stakeholders, utilities will continue to shape a grid that is smarter, more dynamic and flexible. Meeting load growth projections and the grid needs into the future hinges on flexibility and smart strategies that put energy assets to work in new ways:

- Finding capacity on the grid
- Adding more capacity where it is needed
- Managing supply and demand on both sides of the meter to optimize and right-size energy systems

While there are many solutions available today to increase flexibility into the electric grid, more investments in capacity, grid control and automation and research and development efforts are vital. Industry education and training are key to keeping up, especially as energy systems change. Strong collaboration with suppliers, customers and industry will create new pathways and more effective strategies. This is an extraordinary time. We all need electricity more than ever. Utilities will continue to lead the way and manufacturers like us will support them in their efforts to adapt the grid to power a new energy landscape.

[1] Adoption, execution and expansion of digital transformation in the wake of AI, data collection and analysis by 451 Research, S&P Global Market Intelligence, 2024.

[2] 2024 Report on U.S. Data Center Energy Usage by the Lawrence Berkley National Laboratory, December 2024.

[3] The "energy trilemma" calls for unique solutions and a holistic approach, data collection and analysis by 451 Research, S&P Global Market Intelligence, 2024.

[4] 2024 Report on U.S. Data Center Energy Usage by the Lawrence Berkley National Laboratory, December 2024.

[5] EV teamwork: setting new road rules for vehicle-to-grid in Energized by Edison International, April 2024.

[6] Addressing an electrification roadblock: residential electric panel capacity by Pecan Street, August 2021.

[7] Data-driven insights for electricity customers in EPRI Journal, May 2018.

To learn more, visit **Eaton.com/utilities**

Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Printed in USA
Publication No. WP083066EN
March 2026

Follow us on social media to get the latest product and support information.

Powering Business Worldwide