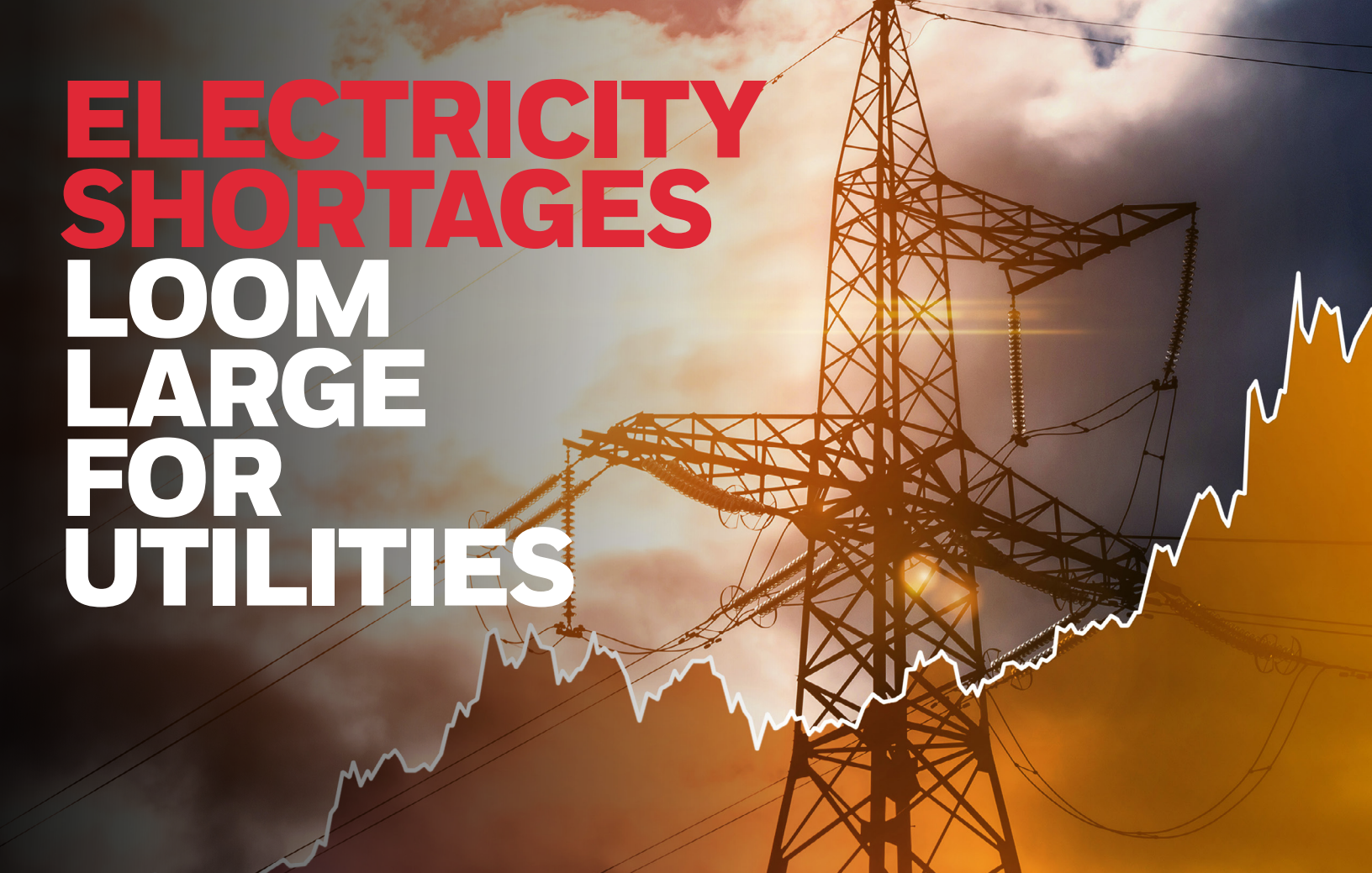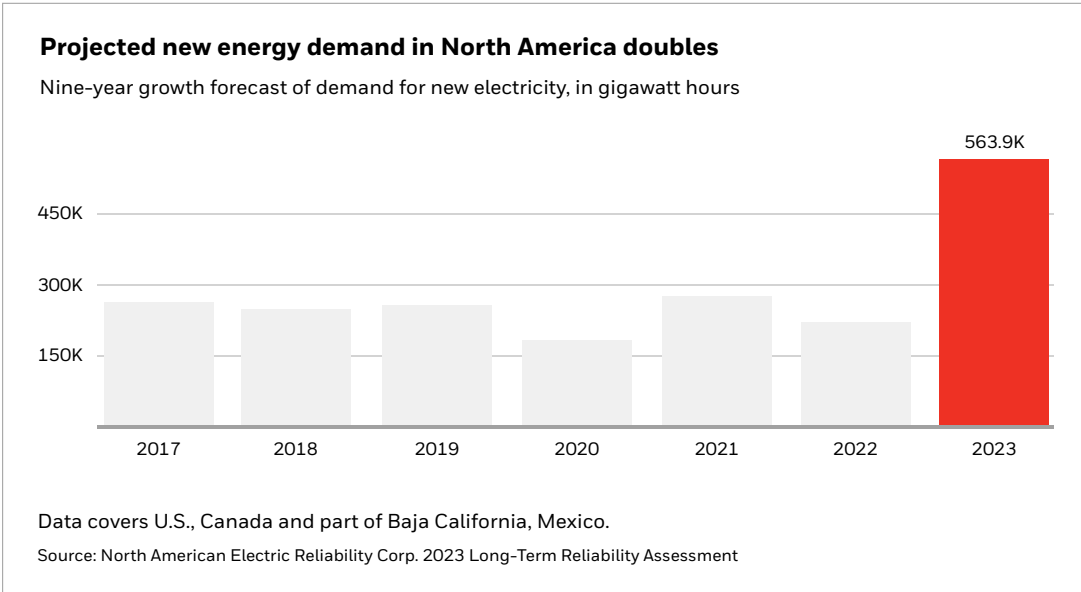# ELECTRICITY SHORTAGES
LOOM LARGE FOR UTILITIES

Insights into Data Centers, AI, Cryptocurrency Mining and Their Impact on Electricity Consumption Projections

Look at any commercial business, an industrial facility or even a modest home or apartment and take a mental inventory of the energy-hungry devices found there. Then think about how many of these devices didn't even exist 10, or even five years ago, and the behind-the-scenes technology required to run them. Now, multiply their energy consumption by 111 million, the estimated number of commercial, industrial, residential and even government buildings in the United States.[1] There is great power in energy.

Current estimates now show the availability of electricity in many parts of the United States have skewed way off previous projections.[2] These miscalculations are setting the country up for significant shortages due in large part to peoples' growing reliance on energy-hungry data centers that house the computational muscle. This exponential increase in energy use has dramatically exceeded projections, jeopardizing energy providers' abilities to produce and deliver enough electricity to meet expected demand. Not only has the number of devices increased, but so have power-hungry data centers, a reliance on artificial intelligence (AI) and cryptocurrency mining — an uptick of unrelenting demands taxing an already tired, aging electric infrastructure in the U.S. Adjusted estimates show that the demand for new electricity in North America nearly tripled from 2022 and 2023, jumping from 200,000 gigawatt hours to more than 563,000.[2]

As a result, many regions of the U.S. are now at risk and are likely facing an energy shortage due to these exponential increases in energy consumption. Utilities are scrambling to keep pace, requiring existing users to become more efficient with their electrical use. The ability of providers to be nimble and reactive with existing systems will be critical.

Honeywell

Projected new energy demand in North America doubles

Nine-year growth forecast of demand for new electricity, in gigawatt hours

						563.9K

450K

300K

150K

2017	2018	2019	2020	2021	2022	2023

Data covers U.S., Canada and part of Baja California, Mexico.

Source: North American Electric Reliability Corp. 2023 Long-Term Reliability Assessment

THE CHALLENGE OF PROJECTIONS AND CALCULATIONS

Utility companies must navigate myriad, complex challenges when anticipating electrical demand. They often base their projections on historical data, economic trends and population growth. However, rapid technological advancements, shifts in consumer behavior and the resulting demands on energy use have created inaccuracies in these projections.[2] Infrastructure limitations, including outdated grids and limited generation capacity, hinder scalability. Regulatory constraints add additional layers of difficulty, requiring adherence to standards while adapting to dynamic market needs. All of these factors can lead to miscalculations, ultimately causing frustrations and concerns for providers and users. Getting the numbers right poses significant challenges.

The emergence and subsequent eruption of new industries — data centers, artificial intelligence technologies and cryptocurrency mining — have led to higher-than-anticipated electrical demand. The existing, aging infrastructure is near capacity, hampering utility companies' abilities to meet peak demand, especially during extreme weather events or sudden surges in consumption.[3] Regulatory frameworks and restrictions also limit infrastructure development, pricing mechanisms and energy generation sources, impacting the flexibility and agility of utility companies in responding to demand fluctuations. It also can take more than a decade to bring a new power generation facility online after initial construction begins, making a reactive solution to producing more energy a long, complex and expensive process.

Upgrading and modernizing infrastructure with smart technologies enables real-time monitoring, better scheduling for predictive maintenance and decentralized energy distribution; integrating renewable energy sources further enhances sustainability and resilience. Utility companies will be increasingly forced to embrace agility and innovation to navigate evolving energy landscapes.

GROWING DEMAND FROM DATA CENTERS

Data centers have become an essential part of everyday life, enabling delivery of real-time data analytics, supporting high-performance computing tasks and facilitating communication. While data centers play a crucial role in powering the digital economy, they also pose challenges and strains on electrical grids, especially hyperscale data centers associated with companies such as Google, Amazon, Facebook, IBM and Microsoft. The proliferation of digital devices, adoption of cloud computing, rise of big data and analytics and, particularly in recent years, the expansion of online services and ecommerce are helping drive the need for data center services.

As much as human ingenuity will plant the seeds of innovation, data centers serve as the incubators that drive and enable growth and productivity. In 2022, the 2,700 data centers in the U.S. drew more than 4% of the country's total electrical use; by 2026, it is expected that they will use 6% of all electrical energy in the U.S.2 Industry experts believe that dependency will continue to grow rapidly.

2022   **2026**

4% of
electric use

6% of
electric use
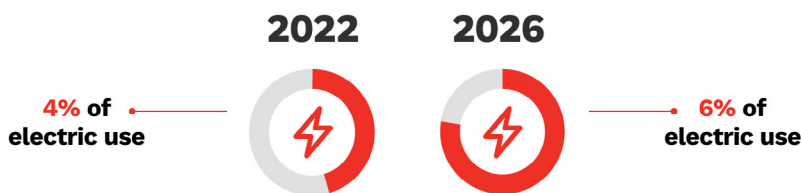
The role data centers play in our personal and professional lives cannot be overstated — it's not all photos of our cats and dogs. These facilities serve as the backbone of our digital existence, hosting the websites, documents, images and videos that satisfy the essential needs (and indulgences) of people, businesses and governments. Data centers perform a multitude of functions critical to our digital economy. They store, process and distribute data for a wide range of applications, including cloud computing, artificial intelligence, e-commerce, social media and more. Without data centers, many of the services and technologies we rely on daily would not be possible. Characterized by their massive scale and high-energy consumption to power (and also cool) the servers within, they can put significant pressure on local and regional electrical infrastructures. Understanding the functional significance data centers play will be essential for utility decision-makers as they effectively manage and optimize reliable electrical resources.

Data centers will play an increasingly vital role in tomorrow's digital landscape, driving innovation, economic growth and societal advancement. Ensuring energy availability to adequately meet the growing demands of data centers requires substantial investments and time to upgrade electrical grids, plus enhance transmission and distribution networks while also integrating sustainable energy sources. However, these demands and their energy-intensive nature present growing challenges, too. While addressing these challenges will require collaboration between data center owners and operators, utilities and policymakers, electrical providers can pursue several alternatives to decrease demand and do more with less.

The more people and businesses strive to do more, the more electricity they require. One area in particular that is driving energy use and the resulting skewed projections for electrical demand is the infusion of AI and cloud computing. As energy demands grow, so do the facilities that drive the demands — both in scope and scale. Mega data centers, those beefed-up facilities that house the mammoth technologies behind AI, the Internet of Things (IoT) and other related emerging operations, are expected to further fuel the demand for data center infrastructure and the energy to power them.
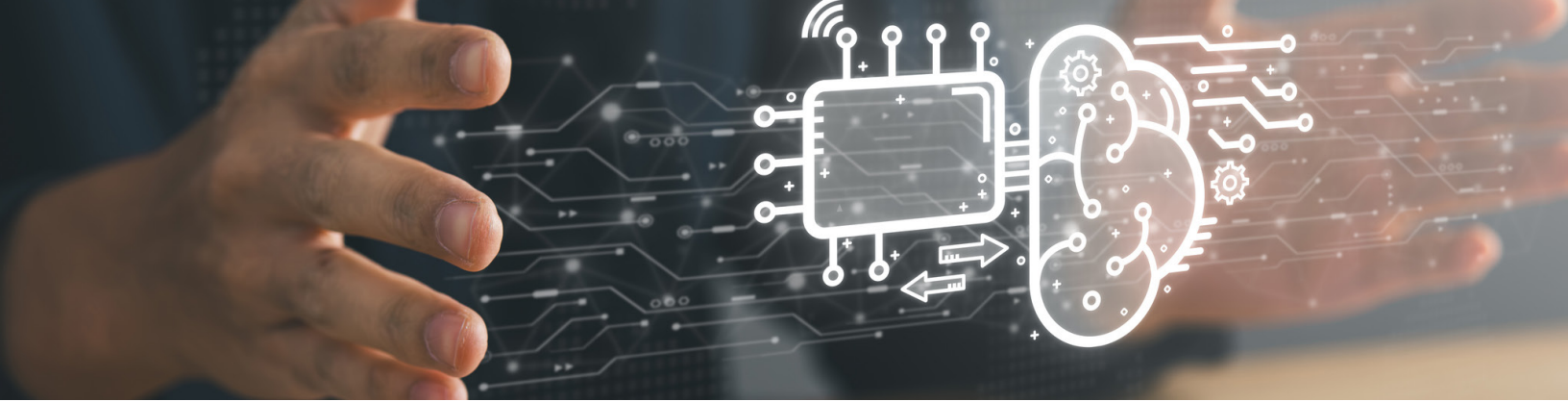
ARTIFICIAL INTELLIGENCE IS POWERING OUR LIVES

Artificial intelligence has permeated nearly every part of our lives whether we know it or not — such as manufacturing, healthcare and transportation — revolutionizing operations but also posing challenges in terms of energy consumption and infrastructure. AI relies heavily on computational power, data processing and storage capabilities to run complex modeling programs and sophisticated algorithms. As a result, these technologies have substantial energy requirements.

In manufacturing, AI-powered automation systems in factories and production lines require high-performance computing systems, robots, sensors and data analytics platforms. Similarly, in healthcare applications, AI uses powerful computing resources and data processing capabilities to run medical imaging analysis and patient diagnosis. In transportation sectors, AI is helping implement the introduction of autonomous vehicles and oversee traffic management systems and other targeted logistics operations. While all these systems collectively optimize processes and improve efficiency, they also contribute to increased electrical demand, especially in data centers and cloud computing infrastructure that support AI applications.

The proliferation of AI-powered devices and systems, including smart home devices, IoT sensors and edge computing devices, adds to electrical demand across residential, commercial and industrial sectors. As the reach of this impressive technology expands, our understanding of the energy requirements and adjusted impacts specific to AI technologies becomes increasingly important for electric utility providers — not only because of the energy use needed to power AI technologies but also because of the ancillary (and energy-dependent) impact that AI allows consumers. New warehouses and logistics functions would need energy for construction and operations to house and manage AI-driven automation in e-commerce fulfillment centers, sophisticated robotic systems in automated storage and retrieval systems and conveyor systems powered by electricity.

One researcher has estimated that if Google required the same amount of energy for one of its 9 billion daily searches as ChatGPT does for a single request on its platform, Google would use as much energy as the entire country of Ireland in one day just to power its search engine capabilities.[3]

CRYPTOCURRENCY MINING: A POWER-HUNGRY INDUSTRY

Even if they don't own any Bitcoin, Ethereum or Dogecoin, utility providers are too familiar with cryptocurrency and the strain its activities put on a grid. Cryptocurrency mining is the process of validating and adding transactions to a blockchain ledger through complex mathematical computations, an energy-intensive practice that requires facilities to house the thousands of mining rigs, computers engineered specifically for cryptocurrency processing 24/7. The scale of these operations, combined with the increasing difficulty of mining algorithms, significantly strains power resources.

The popularity and value of cryptocurrencies have led to a global surge in mining activities. However, mining activities are typically concentrated in areas with abundant energy sources, leading to localized energy demand spikes and infrastructure challenges for electric utility providers that must manage grid stability and reliability.

RAMIFICATIONS BEYOND 'NOT ENOUGH ENERGY'

Just like powering AI or cryptocurrencies can have an exponential impact on energy use and requirements, the proliferating impact of electrical shortages can have far-reaching consequences on economic development and environmental sustainability for industries, communities and the people who live and work in them.

Electrical shortages mean potential industrial development setbacks that limit investment opportunities, disrupt supply chains and increase operational costs for businesses. The ripple effects extend to industries and communities. Manufacturing, agricultural and healthcare sectors experience production delays, reduced productivity and higher costs with reduced reliability. Projected increases in demand for energy is also, in some locations, impacting land prices as developers use energy availability, and not potential workforce, to determine where to locate energy-dependent projects.[2]

Delayed energy infrastructure projects exacerbate challenges in the transition to sustainable practices. Fossil fuel plants, often relied on during shortages, contribute to air pollution and greenhouse gas emissions, exacerbating environmental concerns. Clean energy adoption already faces hurdles without robust infrastructure, hindering progress toward carbon-neutrality goals. In some instances, energy providers are electing to delay the sunset of aging fossil fuel energy production facilities that had been scheduled to be mothballed, continuing and extending the reliance on fossil fuels instead of transitioning to more sustainable facilities and practices.[2]

Electric vehicles (EVs) also play a bit of a dual role; while offering potential solutions to reduce emissions and reliance on traditional fuel sources in the long term, EV adoption requires adequate and more immediate charging infrastructure changes to get there. Projected electrical shortages impede this progress, limiting the transition to cleaner transportation options.

Addressing electrical shortages goes beyond immediate challenges — it shapes the trajectory of economic development, environmental sustainability and energy resilience for generations to come. Utility companies must prioritize proactive measures to navigate these complexities and drive positive impacts on infrastructure, the economy and the environment, along with people and communities. Collaboration between utilities, regulators and stakeholders is vital to foster innovation, drive sustainable practices and build resilient energy ecosystems.

INNOVATIONS, TECHNOLOGIES AND SOLUTIONS FOR EFFICIENT ENERGY USE

Utility companies are at the forefront of adopting innovative solutions and technologies to reduce electrical consumption, improve energy efficiency and promote sustainability in the energy sector. Smart meters, IoT-enabled devices and demand-response systems enable real-time monitoring and control of energy use, allowing utilities to optimize consumption patterns, reduce peak demand and engage customers in energy-saving behaviors.

Honeywell Forge Performance+ for Utilities is a comprehensive platform designed specifically for utility companies, integrating advanced analytics, AI-driven insights and real-time monitoring capabilities to enable better energy management and grid optimization. By leveraging data analytics, utilities can identify inefficiencies, optimize energy distribution and enhance overall grid performance, leading to reduced energy waste and improved operational efficiency.

Renewable energy sources play a crucial role in alleviating strain on traditional grids and promoting a more sustainable energy ecosystem. Solar, wind, hydroelectric and geothermal power offer clean and renewable alternatives to fossil fuels. Integration of these sources into the grid reduces carbon emissions, enhances energy resilience and diversifies the energy mix, contributing to a more sustainable and reliable energy infrastructure. These advancements empower utilities to adapt to changing energy dynamics, optimize resources and meet evolving customer demands while contributing to a more sustainable energy future.

CONCLUSION

Addressing unforeseen projected shortages requires proactive planning, innovative solutions and collaborative efforts among utility companies, stakeholders and policymakers. By adopting strategies like demand-side management, grid modernization and renewable energy integration, utility companies can mitigate risks, improve energy efficiency and contribute to a more sustainable, reliable and resilient energy future.

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For more information

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