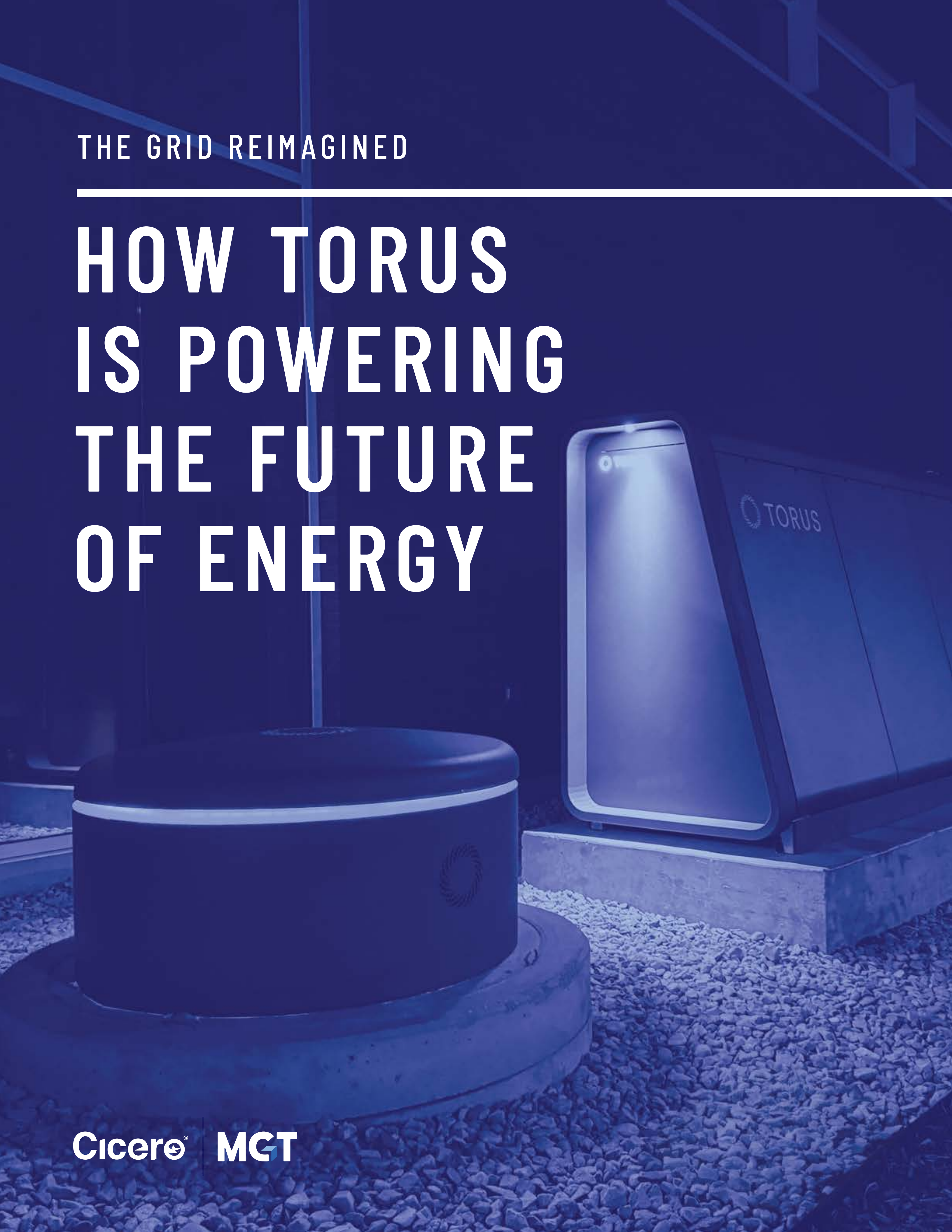
THE GRID REIMAGINED

HOW TORUS IS POWERING THE FUTURE OF ENERGY



Cicero | MGT

CONTENTS

INTRODUCTION FROM CICERO | MGT

Cicero, now part of MGT, is proud to present this white paper on the future of American energy infrastructure. For more than two decades, Cicero has worked at the intersection of strategy, research, and execution, helping organizations navigate market disruption and chart paths for sustainable growth. Today, as MGT, we carry that mission forward at greater scale, backed by 50 years of collective experience. We provide specialized technology and advisory solutions that address mission-critical challenges on our clients' leadership agenda, serving as trusted advisors who deliver custom solutions with lasting impact for our clients, their people, and their communities.

Energy is one of those defining challenges. The United States is at a critical inflection point: demand for electricity is rising at unprecedented levels, new technologies are reshaping how power is produced and consumed, and national priorities require both resilience and sustainability. Against this backdrop, Torus is pioneering innovative solutions that address the reliability, security, and adaptability of the grid.

This white paper reflects our effort to examine the state of the U.S. energy system, the structural challenges it faces, and the transformative potential of distributed storage. It is intended to inform policymakers, industry leaders, and communities about the opportunities ahead — and the urgent need to act.

As Cicero | MGT, we are committed to advancing knowledge, supporting bold innovators, and helping build the systems that power the future.

By the Numbers

- MGT, with over 1200 employees across six continents, has achieved explosive growth — a 3,300% growth since 2016, making us a "Super-grower" — and a 144% CAGR since 2021
- MGT's performance has been repeatedly recognized on the Inc. 5000 list, including a 405% revenue increase ranking at #1436 in 2023
- MGT has over 1,770 current clients and executed over 30k client engagements

Mission-driven Leadership

"Client impact has been a critical piece to our overall expansion and consistent growth." – LAWRENCE COWAN, COO OF MGT, REVENUE OPERATIONS

"Our jump in the Inc. 5000 ranking is 100% attributable to the quality, character and commitment of our people" – TREY TRAVIESA, CEO OF MGT

"We live at the intersection of innovation and impact - helping leaders drive measurable change and adapt with confidence to the rapid shifts in technology and society." -MICHAEL JENSON, PRINCIPAL, AI PRACTICE LEAD


MCT

EXECUTIVE SUMMARY

The U.S. energy system is facing a generational inflection point. Accelerating electricity demand – from the rapid growth of data centers, the explosion of AI, electric vehicles, and industrial onshoring – is straining an aging grid infrastructure that was not built for today's complexity or scale. Not only do we demand more electricity, but our complex systems and machinery require higher quality and more reliable electricity as we adopt increasingly sensitive technologies in automation, highly precise manufacturing processes, quantum computing, etc. These challenges are urgent and will only intensify over the next century as humankind enters an era of even more rapid intellectual and technological development.

> **"We're essentially in the largest race between knowledge and energy, probably very akin to what happened back in the industrial revolution."** – NATE WALKINGSHAW

A New Energy Paradigm

As a nation, we are in an existential battle to build the energy infrastructure needed to support a knowledge race that may determine our place in the global hierarchy. The energy needed to support the coming advancements in AI, quantum, robotics and automation require not just an upgrade, but a new way of organization and distribution. Similar to how Amazon transformed data storage by moving from monolithic architecture to cloud-based distributed systems, our energy infrastructure requires a comparable paradigm shift. The current centralized grid model is inadequate for meeting the scale, flexibility, and reliability demands of next-generation technologies.

Building for Resilience and Security

We must not only unleash an abundance mindset towards new energy sources but architect an entirely new ecosystem for energy distribution that prioritizes resilience, security, and adaptability. This challenge extends beyond simply increasing energy production capacity. We must develop new frameworks for energy distribution beyond incremental changes. Countries that successfully develop and deploy these advanced energy systems will gain substantial competitive advantages in the global economy and have a pronounced edge for decades to come.

Pressures on Today's Grid

At the same time, as the velocity of our demand increases, the country faces mounting challenges from extreme weather events, rising security risks, and the complex integration of intermittent renewables. These pressures are reshaping the energy landscape, demanding smarter, more resilient, and decentralized systems that can deliver reliable, high-quality power while supporting the clean energy transition and protecting grid integrity.

Torus: Power at the Grid Edge

As a solution built for speed, scale and decentralized distribution, Torus is uniquely positioned to propel this transformation forward. Its vertically integrated, full-stack approach brings together advanced storage, real-time energy orchestration, and localized microgrid capabilities. Torus' technology creates a decentralized energy system that is much easier to scale and is much more resilient than traditional monolithic power generation and distribution systems. This model enables greater energy control, precision, and security across commercial, industrial, and critical infrastructure settings. By embedding resilience and intelligent systems directly at the edge of the grid, Torus offers an operational advantage for customers navigating today's volatility. Furthermore, with technology engineered and manufactured in the US, Torus is helping to reduce reliance on foreign supply chains and is enhancing national energy security.

Torus Spin™ installation at Waterford School. Sandy, UT.

Leading the Future of Energy

Looking ahead, the stakes are high, but the opportunity is vast. As the nation, and the world, navigates a fundamental reconfiguration of its energy infrastructure, leadership will belong to those capable of delivering both innovation and execution – solutions that are adaptable, domestically sourced, and built for the distributed grid of the future. Torus stands out not just for its technology, but for its strategic alignment with the industry's biggest needs: grid reliability, infrastructure modernization, and clean energy readiness. With a focus on innovation that drives speed, scale, and decentralization, Torus is poised to play a defining role in shaping a more secure, sustainable, and self-reliant energy future.

Nate Walkingshaw
CEO & Co-founder, Torus Inc.

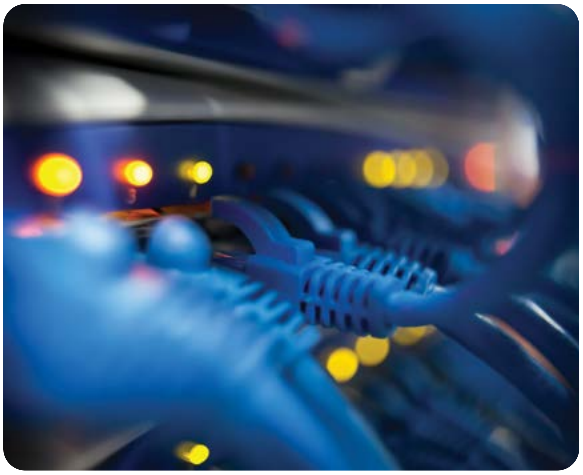
THE TORUS PRODUCT SUITE

Torus Spin™

The Torus Spin™ is an innovative flywheel energy storage system that enhances grid stability by providing true inertia and fast frequency response. Recognized as one of TIME's Best Inventions of 2024 and the R&D Award in 2025, it is designed to support a cleaner and more resilient energy grid while being environmentally friendly due to its recyclable materials and 25-year lifespan.

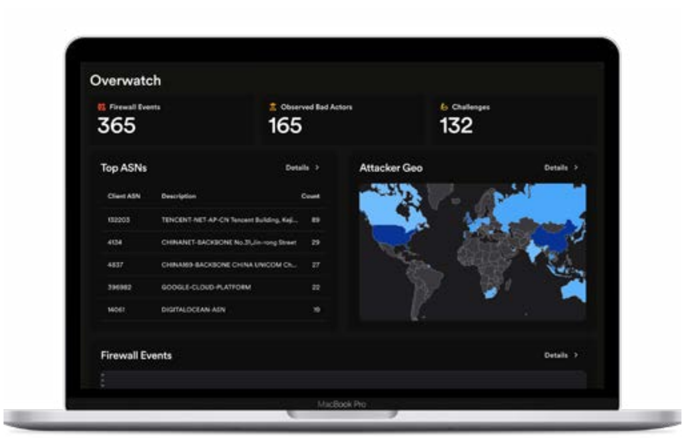
Torus Pulse™

The Torus Pulse™ is a modular lithium-iron phosphate battery energy storage system designed to provide reliable and scalable long-duration storage for various applications. It integrates with the Torus Spin™ flywheel system to enhance energy delivery and efficiency.



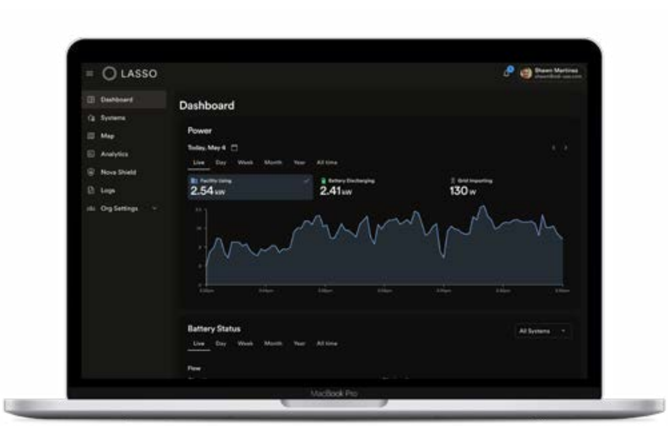
Torus Shield™

The Torus Shield™ is a sophisticated security hardware solution designed to protect energy assets from unauthorized access and cyber threats. It integrates advanced cybersecurity measures across the Torus product suite to ensure robust protection against evolving risks.



Torus Overwatch™

Torus Overwatch™ is a comprehensive suite of managed services designed to enhance security and performance of energy infrastructures through 24/7 monitoring and expert support.



Torus Lasso™

Torus Lasso™ is an AI-driven energy asset management software designed to optimize operations for utility companies and commercial customers by coordinating power flows among distributed energy resources. Its advanced capabilities enhance grid management and operational efficiency.


Ansell

CHAPTER 1

INDUSTRY & MARKET CONDITIONS

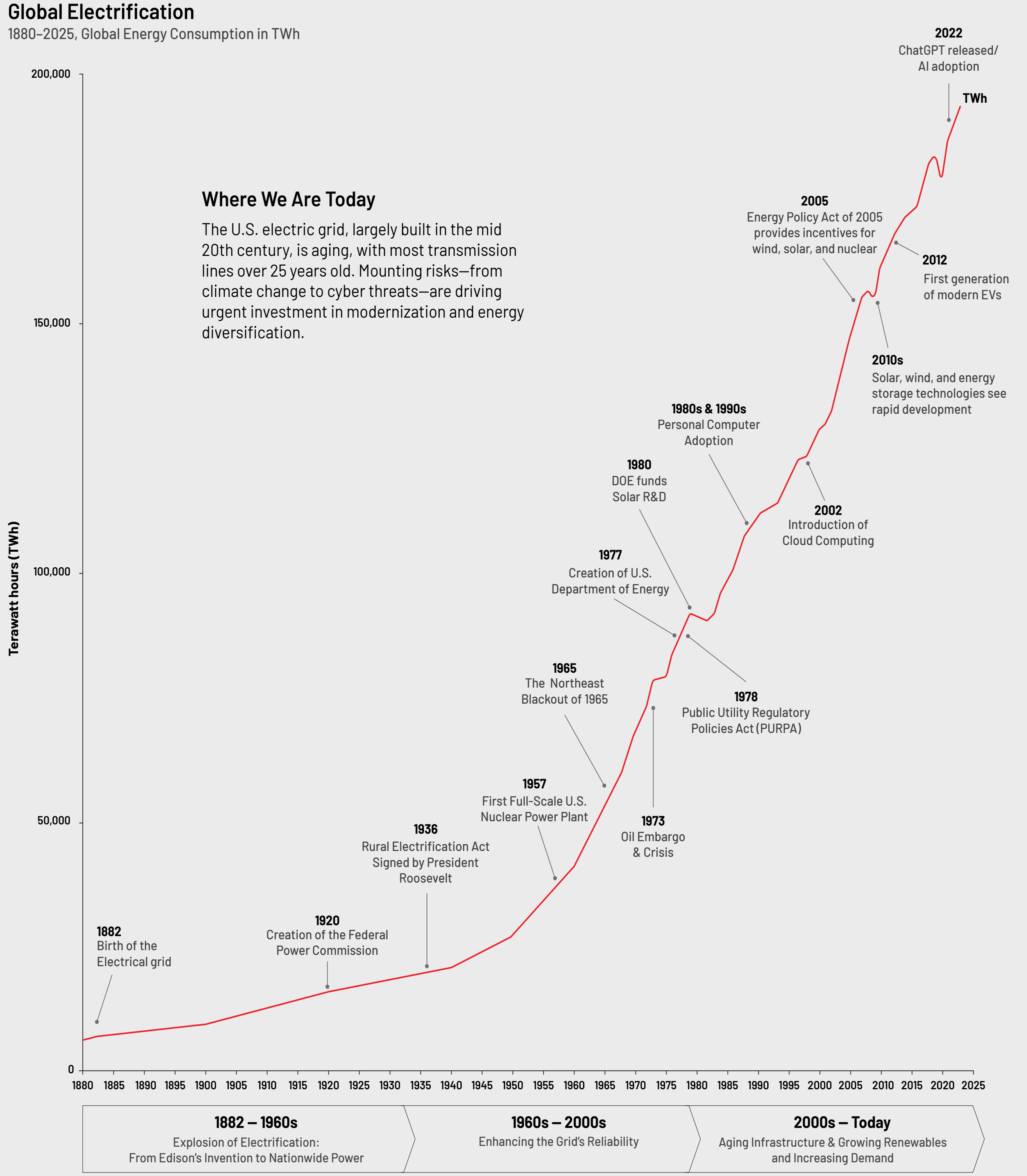
HISTORY OF ELECTRIFICATION & GRID INFRASTRUCTURE IN THE US

Global Electrification

1880–2025, Global Energy Consumption in TWh

Where We Are Today

The U.S. electric grid, largely built in the mid 20th century, is aging, with most transmission lines over 25 years old. Mounting risks—from climate change to cyber threats—are driving urgent investment in modernization and energy diversification.



Source: Our World in Data [1]

Where We Are Today

Today, the U.S. electric grid faces the reality of its aging infrastructure: Most of the modern grid was built in the 1960s and 70s, with 70% of transmission lines now over 25 years old and nearing the terminal years of their expected lifecycle[2]. The consequences for this dated infrastructure vary from reduced power reliability to increased cyber-attack vulnerability. With growing concerns related to climate change, natural disasters, energy dependence, and national security, an increasing focus on building future resilience and diversifying the nation's energy mix is inspiring new growth and investment in energy infrastructure.

> "Over the last century, energy consumption grew 100-fold while population only grew 6-fold. The next century will dwarf that growth—we're looking at 1000x expansion" - **NATE WALKINGSHAW**

Timeline & Key Events

Explosion of Electrification: From Edison Invention to Nationwide Power (1882 to 1960s)

- 1882 | Birth of the electric grid in the United States with the establishment of the Pearl Street Station in New York City by Thomas Edison[3]
- Late 1880s – 1890s | The advent of high voltage alternating current (AC), championed by Westinghouse Electric, and development of transformers allowed for power to be transmitted across significantly larger distances. These innovations led to the development of the traditional model for delivering electricity we predominantly see today: large scale, centralized generation facilities sending electricity via transmission and distribution lines to consumers. The model allowed for the exploitation of economies of scale, driving down the cost of electricity and fostering expanded access as electric service was delivered to regions across the U.S.
    - 1886 | George Westinghouse and team built the first AC-powered transmission system for commercial use in the U.S.[4]
    - 1896 | The Niagara Falls Hydroelectric Project, widely seen as a victory of AC over DC, powered the city of Buffalo, 26 miles away, using AC[5]
- Early 1900s | As the scale and reach of electricity generation grew, an expanded role for governing bodies beyond the local level was necessary, leading to the rise of state-level commissions, federal bodies, and interconnections.
    - 1907 | Creation of the Public Service Commission (PSC) by New York State to regulate electric companies[6]
    - 1908 | 10% of U.S. households were now connected to the grid[7]
    - 1920 | Formation of the Federal Power Commission, the predecessor to today's Federal Energy Regulatory Commission (FERC)[8]
    - 1927 | In response to the continued need for regulatory governance and oversight, the Pennsylvania-New Jersey interconnection was established, a predecessor to PJM[9]
- 1935 – Early 1960s | Electrification in rural areas grew from just 13% in 1935 to 94% by 1945,[10] as electrification was viewed as a tool to combat poverty and improve quality of life. By 1950, electricity consumption had tripled since 1935 with 8% annual demand growth in the post-war period.[11]
    - 1936 | President Franklin Roosevelt signs the Rural Electrification Act[12]
    - 1945 | Electrification in rural areas reached 94%, up from just 13% in 1935[13]
    - 1957 | First full-scale U.S. nuclear power plant[14]
    - 1960 | High-voltage transmission network reaches 60,000 circuit miles[15]

Enhancing the Grid's Reliability (1960s to 2000s)

- 1960s | By the 1960s, the limits inherent in the established electric grid began to emerge with a number of significant blackouts across the country. As a result, growth in the electric grid after the 1960s was focused primarily on ensuring reliability upgrades, as opposed to expansion.
    - 1965 | The Northeast Blackout of 1965 – a significant power failure – lasted for 13 hours and affected 33 million people[16]
    - 1968 | Establishment of the National Electric Reliability Council (NERC) to set reliability standards for utility companies and transmission developers[17]
    - 1970s | Geopolitical tensions, among other factors, contributed to the instability of oil and energy prices in the 1970s which led to policy development aimed at increasing reliability for the grid and promoting stability for energy production, delivery, and consumption. Such conditions fostered an era of significant growth in nuclear power.[18]
    - 1973 | The 1973 Arab Oil Embargo caused volatility in oil prices and strained the US economy[19]
    - 1977 | Creation of the U.S. Department of Energy (DOE) to research alternative sources for power generation in addition to increasing energy efficiency[20]
    - 1978 | Congress passed the Public Utility Regulatory Policies Act (PURPA) to allow smaller-scale, non-utility generators to operate in the transmission system[21]
    - 1980s – 2000s | Continued focus on enhancing grid access and reliability with additional blackouts (Northeast Blackout of 2003) leading to policy enactments.
- 1980 | DOE funds solar research and development[22]
    - 1980s – 1990s | Personal computer adoption becomes widespread[23]
    - 1992 | Congress passed the Energy Policy Act (EPACT) giving further access to non-utility generators[24]
    - 1999 | The New York Independent Service Operator (NYISO) is founded to monitor and operate the New York state grid[25]
    - 2005 | Energy Policy Act of 2005 established a federal framework for mandatory reliability standards[26]

Aging Infrastructure, Growing Renewables & Increasing Demand (2000s to Today)

- 2002 | Introduction of cloud computing[27]
- 2005 | Energy Policy Act of 2005 provides incentives for wind, solar, and nuclear[28]
- 2010s | Solar, wind, and energy storage technologies see rapid development[29]
- 2012 | First generation of modern EVs[30]
- 2022 | ChatGPT released, starting widespread AI adoption[31]

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ENERGY INDUSTRY OVERVIEW & STRUCTURE

Market Structure

The $515B+[1] electricity industry in the United States can be viewed as an ecosystem of interdependent stakeholders. The key players in the energy and electric power industry feature:

- Regulated utilities providing grid service including **investor-owned utilities (IOUs)**
- **Publicly-owned utilities** (administrations, authorities, or cooperatives, as well as municipally owned utilities)
- Other service providers include **competitive generators** and independent power producers, as well as **transmission/distribution service providers** operating within market regions
- **Oversight bodies** ensuring reliability and electricity access (regional transmission organizations, state commissions, federal organizations, etc.)[2]

Market structure varies depending on whether a given energy market is regulated wholesale or restructured (deregulated) wholesale.

In the case of a regulated wholesale market:

- Utilities are typically vertically integrated monopolies
- They are solely responsible for generating, transmitting, and distributing electricity to customers as well as deciding their energy mix contingent on approval from state public utility commissions
- This model is seen most in the South and West[3]

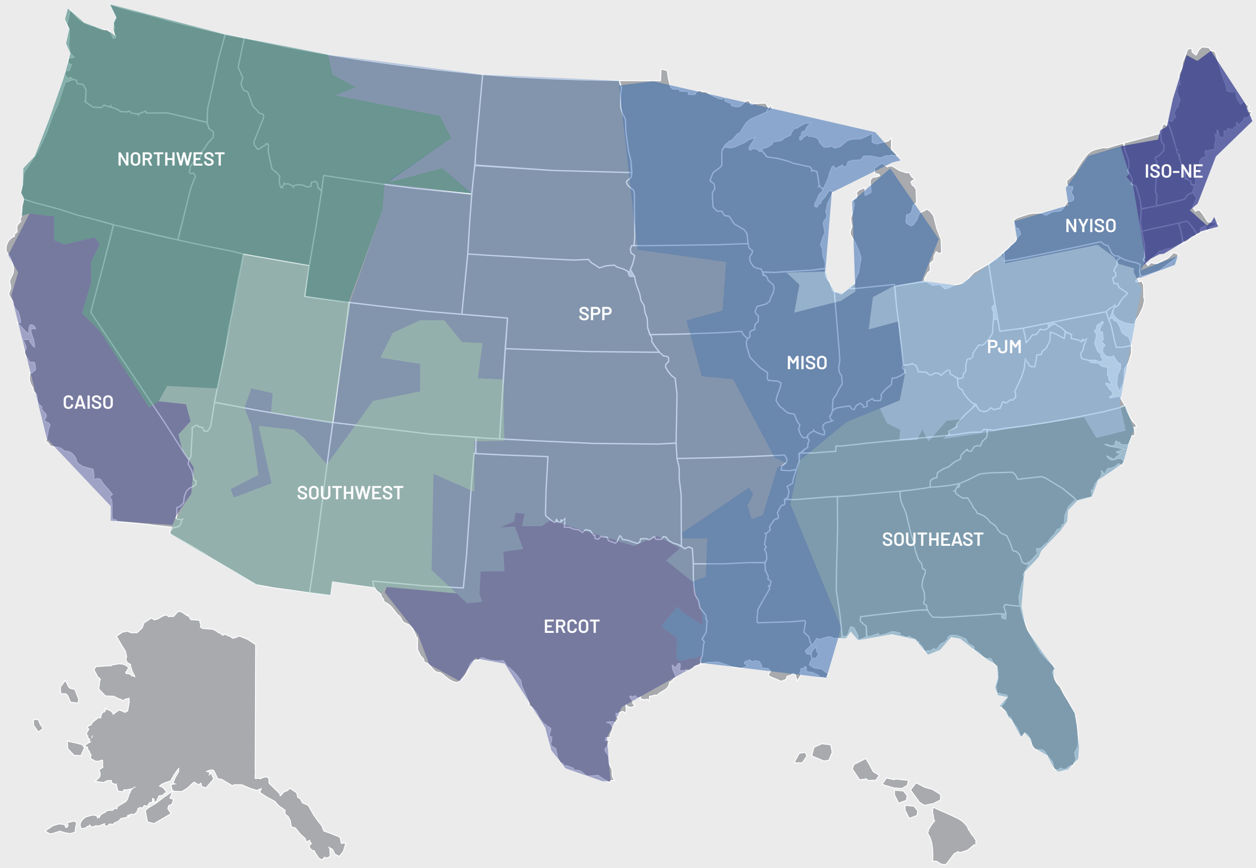
For restructured markets:

- Utilities are responsible for only the delivery of electricity to customers, while other entities generate electricity
- These generators then sell their electricity through competitive power markets called independent system operators (ISOs) and regional transmission organizations (RTOs) who oversee the generation and delivery of electricity to consumers
- ISOs and RTOs establish the processes that allow generators to compete based on price to generate electricity, and they collectively serve about two-thirds of electricity consumers in the United States

Torus Pulse™ installation at Schaeffer Metal Fabrication. Lindon, UT.

Power Sales & Energy Markets[4]

Source: FERC



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INDUSTRY ANALYSIS

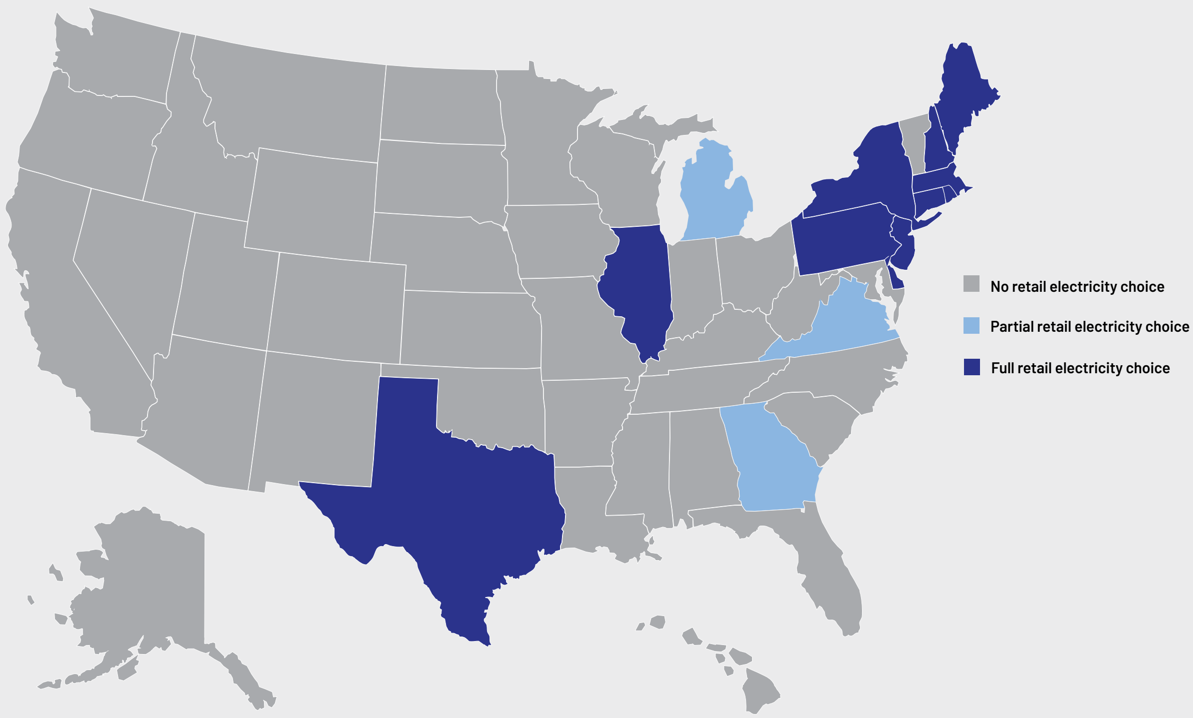
Who Controls Our Power Supply?

On the generation side of the industry, moderate competition exists as hundreds of producers compete in wholesale restructured markets across the country. Producers, including more efficient natural gas plants as well as renewable energy sources, have gained significant market share over less competitive sources like coal.

Contrastingly, competition is relatively low in the retail and distribution segment of the market as most consumers can only buy from their local utility (a regulated monopoly), and retail choice (where customers may purchase electricity from retail suppliers other than local utilities) is limited to certain states predominantly in the Northeast[1].

Figure

Retail Electricity Choice by State[2]



Even when customers can switch suppliers, the transmission infrastructure is a natural monopoly, so utilities face little direct rivalry for delivering power. This means the degree of competitive pressure varies by segment: generation has moderate competitive pressure (especially for merchant generators in deregulated markets), while local delivery remains a monopoly service with minimal competition.

New Currents & Renewables Diversification

The power industry has historically maintained high barriers to entry. Enormous capital investment and technical expertise was necessary to build generation and transmission networks. This has changed. Regulatory reforms including PURPA and FERC Orders (i.e. FERC Order No. 2222 for Distributed Energy Resources)[3] intentionally lower entry barriers by guaranteeing grid access to independent power producers (IPPs) or providing other mechanisms to better facilitate market participation.

At the same time, the cost of generating renewable energy has declined over the past decade, surpassing fossil fuels as the cheapest source of electricity from new power plants[4]. As a result, solar deployments have experienced an average annual growth rate of 28% over the past 10 years[5]. **The Distributed Energy Resource (DER) market in the US is expected to nearly double from 2023 to 2027**[6]. This focus on **smaller scale deployments and projects** to generate, store, and manage power represents an opportunity for growth in a **new frontier of the development of the US energy grid**.

Although electricity as a product has few direct substitutes for most of its end-uses, indirect substitutes and changing energy choices are important considerations in the industry. For example, on the demand side, customers can invest in energy efficiency or distributed generation to reduce the amount of grid electricity they need. A business may install solar panels on-site to reduce their grid consumption, or residential customers may reduce energy usage by investing in energy-efficient HVAC and kitchen appliances. This demand-side management and push toward greater efficiency is causing utilities to respond by evolving their business models, investing in rooftop solar, efficiency, and storage services, to both serve customers as well as reduce costs by minimizing investment in expensive peak load management measures like peaker plants[7]. Growing concern over grid reliability will only continue to incite greater regulatory support for energy efficiency and distributed energy resources[8].

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THE UTILITY LANDSCAPE

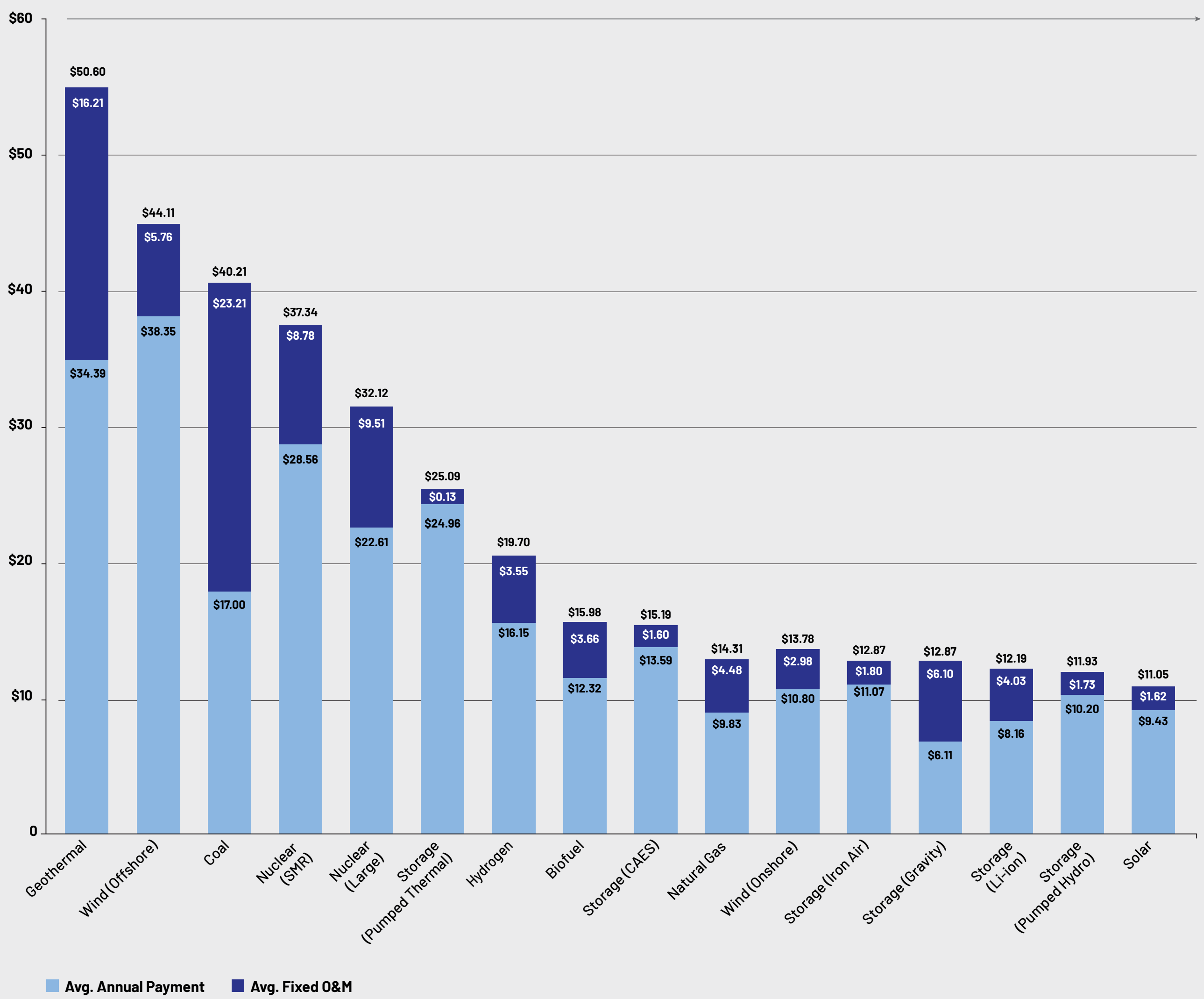
Utility Market Conditions

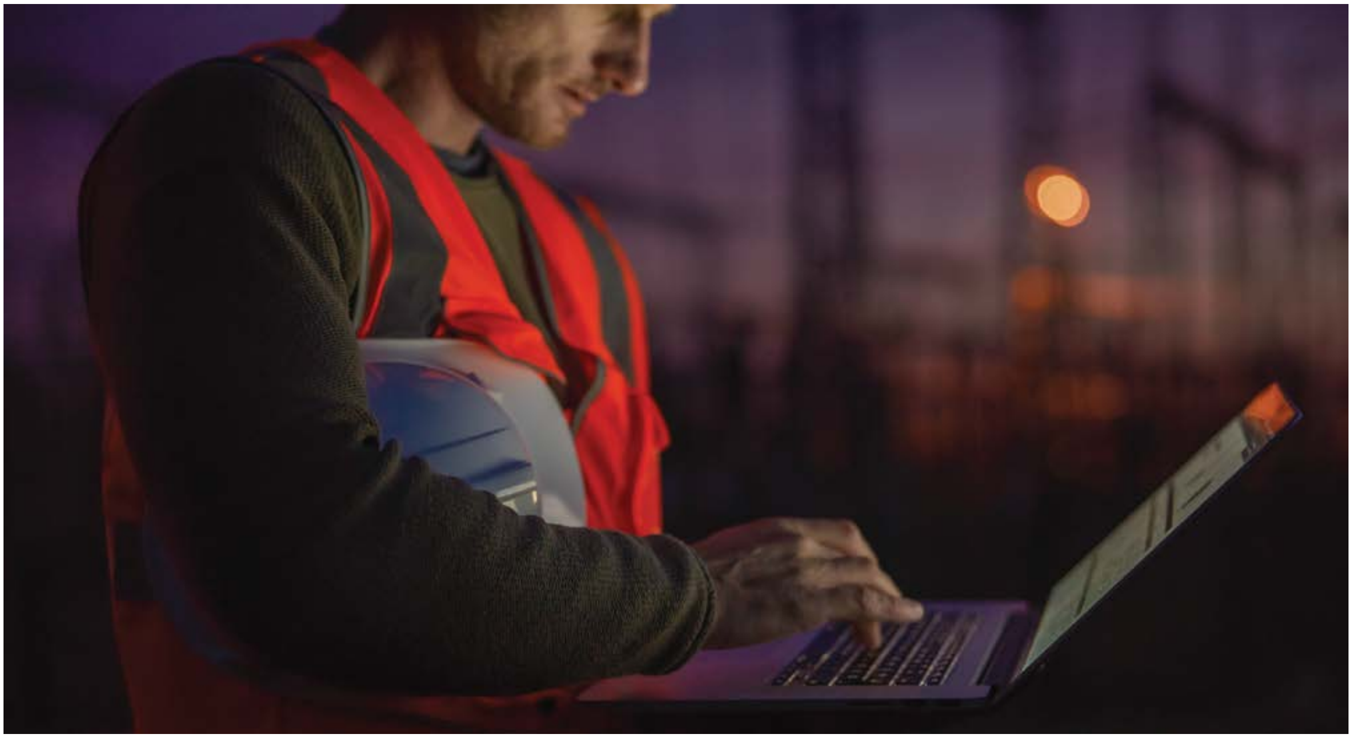
The utility industry in the United States is grappling with a complex environment in which they're being tasked to simultaneously invest in meaningful supply growth and grid reliability enhancements, while lacking the ability to offset such costs with largely fixed rates in a regulated market. This is, in part, **accelerating the shift towards a more diversified energy supply** and necessitating **innovative partnerships to deliver to their customer base**.

Solar and Storage to Combat Mounting Capital Costs: The combination of capital investments across new generation, transmission and distribution upgrades, cyber and physical security enhancements, as well as EV and energy storage capabilities is placing a heavy burden on grid operators. Investments in renewables offer lower capital costs ($/kW) with a quicker timeline to implementation but result in higher future replacement rates due to their shortened lifespan. On the net, utilities are moving to lower cost resources in solar and storage technologies.

Figure

Cost of Storage ($/kWh-month) Including O&M by Technology



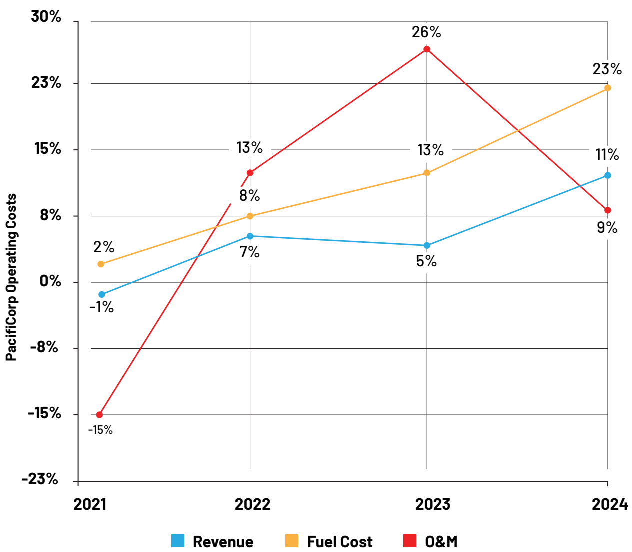


Operating Costs Straining Margins

Utilities face a difficult operating environment as fuel and O&M costs have outpaced revenue growth. Characterized by rising PPA prices, wildfire mitigation spending, cybersecurity enhancements, and elevated insurance premiums, the industry is struggling to combat margin compression with little-to-no flexibility in charging higher customer rates in a regulated environment. Thus, utilities are turning toward long duration battery investments as an opportunity to expand margins with ~1.5-2x higher rates (kWh).

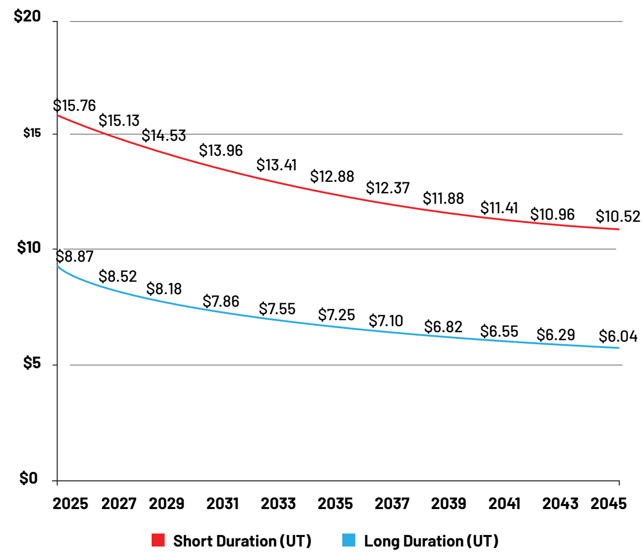
Figure

PacifiCorp OpEx vs Revenue Growth (2021-2024)



Figure

kW-month Rates by Battery Duration

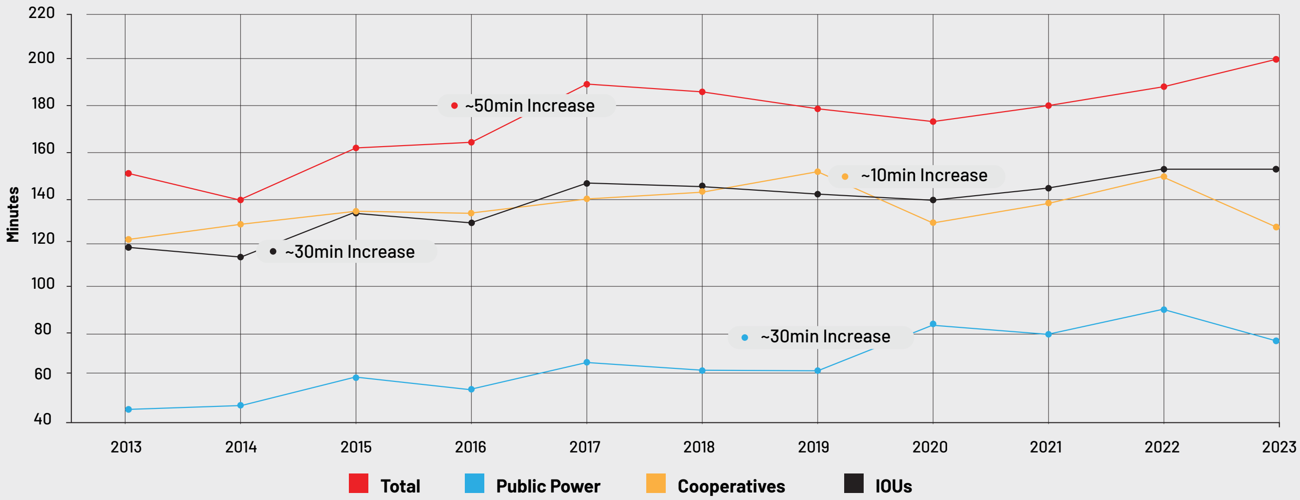


Grid Reliability Trends Lower

2 of the 3 nationally tracked measures of grid reliability – from SAIDI and CAIDI – indicate a trend of weakening reliability. For both the US system and the average US customer, we find the average duration of power interruptions is increasing across all segments – public power, cooperatives, IOUs, etc.

Figure

US System Average Interruption Duration (SAIDI) by Utility Type

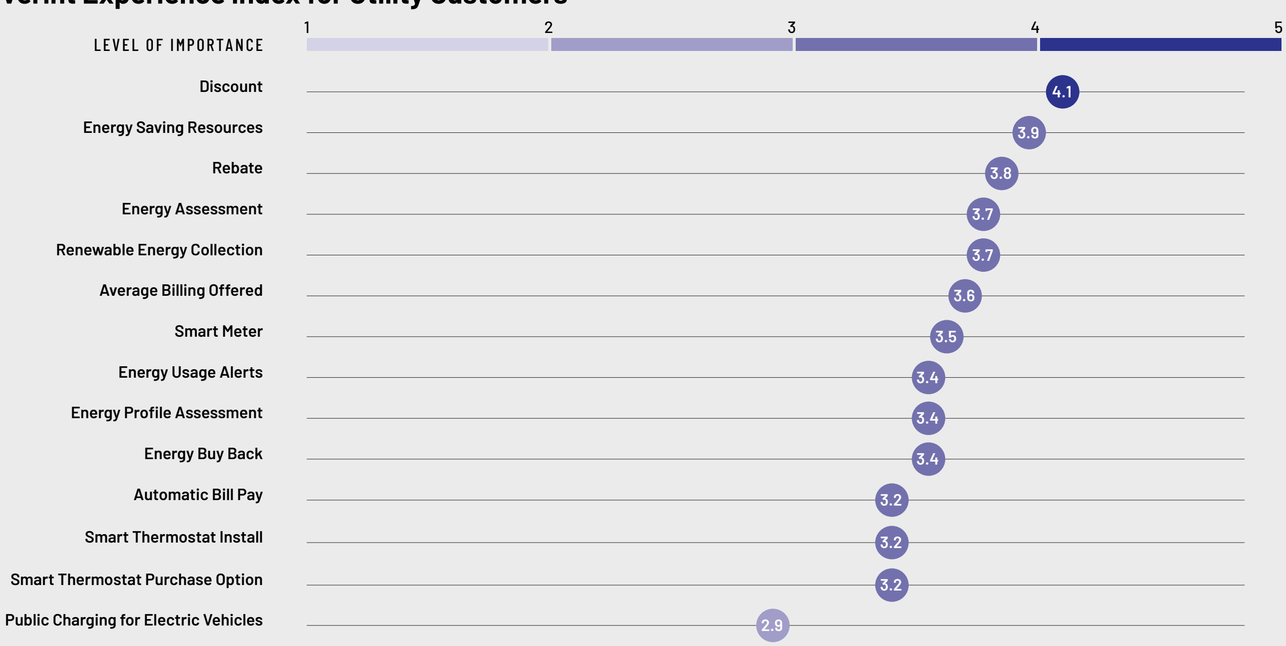


Low But Improving Satisfaction

The average utility NPS, at 20.3, is low by all accounts; however, utility customer satisfaction is improving with 65% of C&I customers indicating their electrical service "Excellent." Customers value discounts and energy savings as top resources, contributing more to satisfaction than selling energy back to utilities.

Figure

Verint Experience Index for Utility Customers



WORKING WITH UTILITIES

Mechanisms for Demand Response and Flexible Load Services

Demand response and flexible load services – where users are compensated to reduce or shift electricity consumption at critical times – are becoming increasingly vital for grid management and cost control. Independent power producers (IPPs) and DER aggregators deliver these using intelligent batteries, control systems, and storage technologies that provide grid-supporting flexibility. To partner with utilities, these providers have two primary avenues for contracting: Power Purchase Agreements (PPAs) and Utility Tariff Programs.

While each has distinct advantages, they're far from being mutually exclusive and often complement each other in the modern grid. Both are supported by a favorable landscape of regulations and market needs: federal policies are opening markets for aggregated DERs, reliability standards endorse their use, and state regulators are pushing utilities to leverage demand flexibility for cost and environmental benefits. In an evolving U.S. electric grid, demand flexibility has graduated to a mainstream resource, and both PPAs and tariff programs will play pivotal roles in deploying it at scale.

1. Utility Tariff Program

The second major pathway is through a utility's demand response tariff or program. These standardized programs, approved by state Public Utility Commissions (PUCs), offer customers incentives – such as bill credits or payments – to curtail load during designated events. Eligible customers, often supported by third-party providers, enroll in advance to provide load reductions when called upon. Unlike custom contracts, independent power producers (IPPs) and aggregators participate under a fixed program structure.

Utilities must justify program costs (incentives, admin, equipment) in their PUC filings, with recovery typically built into rates or surcharges. Once approved, the tariff becomes an official offering, enabling utilities to procure flexible demand much like supply – using it for spinning reserves, peak shaving, or even wholesale market participation.

Tariff programs offer a reliable, regulated, and scalable model for virtual power plant deployment. With regulator oversight, utility backing, and simplified enrollment, these programs ensure fair compensation while providing system flexibility. Looking ahead, they'll be central to scaling distributed energy resource (DER) integration across the U.S.

> "The Public Utility Commission mandates that utilities deliver reliable power to customers at the lowest possible cost. That's their directive – affordability and reliability. But there's growing tension as utilities face aging infrastructure and rising costs, making it increasingly difficult to meet that mandate." **– PATRICK REEDY**

2. Power Purchase Agreement (PPA)

A Power Purchase Agreement (PPA) is a long-term contract where a utility commits to buying power or capacity from a provider under defined terms. While traditionally used for energy from generators like wind or solar, PPAs can also support demand-side services. In this context, load reductions—often called "negawatts"—are treated like generation, with the utility contracting a service provider to deliver dispatchable capacity or demand reduction as needed. This transforms demand flexibility into a tradable asset.

Specifically, the parties negotiate defined terms which includes:

- Capacity (kilowatts or megawatts) the provider will make available
- Dispatch terms outlining what triggers an event, how often, and for how long reductions can be called
- Payment structure which often includes a capacity fee (e.g., $ per kW per month or year of availability) and sometimes a performance payment for energy actually curtailed during events.

PPAs offer service providers a tailored, contract-based revenue and align with utility resource planning by ensuring firm capacity and enabling rapid deployment – often helping avoid expensive infrastructure upgrades. However, each PPA is utility- and market-specific, subject to regulatory approval by state Public Utility Commissions (PUCs), and can reduce flexibility for utilities if needs shift during the agreement's term.

> "The reason utilities offer incentives is because it's more cost-effective to drive down energy demand than to build new infrastructure. Energy efficiency and demand response are considered a least-cost resource – cheaper than building a new solar or gas plant, or even a new transmission line." **– PATRICK REEDY**

Tariff Schedule 114 For Load Management

Tariff Schedule 114 – Rocky Mountain Power's Wattsmart demand response program in Utah and Wyoming – is among the most advanced utility load management tariffs in the U.S., according to the Department of Energy[1]. It serves as an umbrella tariff supporting multiple dispatchable demand response measures, with activation windows ranging from near-real-time to day-ahead events[2].

Service providers must qualify as approved vendors to participate, acting as facilitators who help commercial and industrial (C&I) customers deploy onsite batteries and systems. These customers receive upfront rebates and ongoing bill credits—subsidizing equipment costs. In 2024 alone, the program was dispatched over 130 times, demonstrating its scalability and effectiveness[3]. Expansion is straightforward: enrolling more customers or adding new technologies under the same approved tariff avoids the need for new procurement processes.

Schedule 114 exemplifies a collaborative, scalable model where utilities, third-party providers, and customers align under a unified program. The Wattsmart program shows how tariff-based approaches can rapidly deliver grid reliability, integrate advanced technologies, and generate shared economic value.

> "Designing for peak demand is expensive for utilities. By helping offset that peak – both for utilities and their customers – we enable better use of existing infrastructure. That, in turn, allows utilities to grow their rate base and serve new loads like data centers and manufacturers that they'd otherwise have to turn away due to capacity constraints. We help unlock bottlenecks within the grid." **– PATRICK REEDY**

Comparison of PPAs and Tariff Programs

	Utility Tariff Program	Power Purchase Agreement (PPA)
Agreement Structure	• Standardized tariff open to eligible customers, enrolling many participants in a one-size-fits-all program • Pre-set terms approved by regulators	• Bilateral, customized contract between utility and provider • Negotiated terms often tailored for a specific project or capacity needs
Operating Model	• Utility makes calls & dispatches events per tariff rules via enrolled participants • Provider intermediates and facilitates enrollment, installation, and aggregation	• Utility buys a defined amount of capacity/energy from the provider • Provider aggregates and controls loads to deliver on call per contract terms
Term & Commitment	• Long-term commitments (5-20 years) • Program continues indefinitely with regulatory renewal • More adaptable to market changes and new technologies	• Typically, long-term commitments (e.g., 3–20 years) for a fixed amount of capacity or generation • Exposes utility to less flexibility should conditions or needs change • Contract stipulates performance
Payments & Financing	• Fixed incentives/rates for all participants – e.g. fixed $/kW credits, rebates, or discounts published in tariff • Utility recovers costs via rates	• Negotiated payments – e.g. $/kW-month capacity payments, event-based energy payments, etc. • Prices locked in by contract
Regulatory Oversight	• PUC-pre-approved tariff with ongoing oversight and recurring filings • Changes require PUC approval; Regulators can modify or set conditions	• Requires case-by-case approval by the PUC with emphasis on cost recovery • Can only be amended with regulatory approval
Scalability & Participation	• Suited for broad, streamlined participation distributed among many sites and customers • Allows easier onboarding & geographic scale, aggregating to large totals	• Suited for large-scale or targeted needs (utility may seek tens of MW in a specific area or system-wide)

> "One thing Torus does better than anyone is what I call tariff busting—we bypass outdated utility tariff structures to unlock grid flexibility without overhauling the entire regulatory framework." **- NATE WALKINGSHAW**

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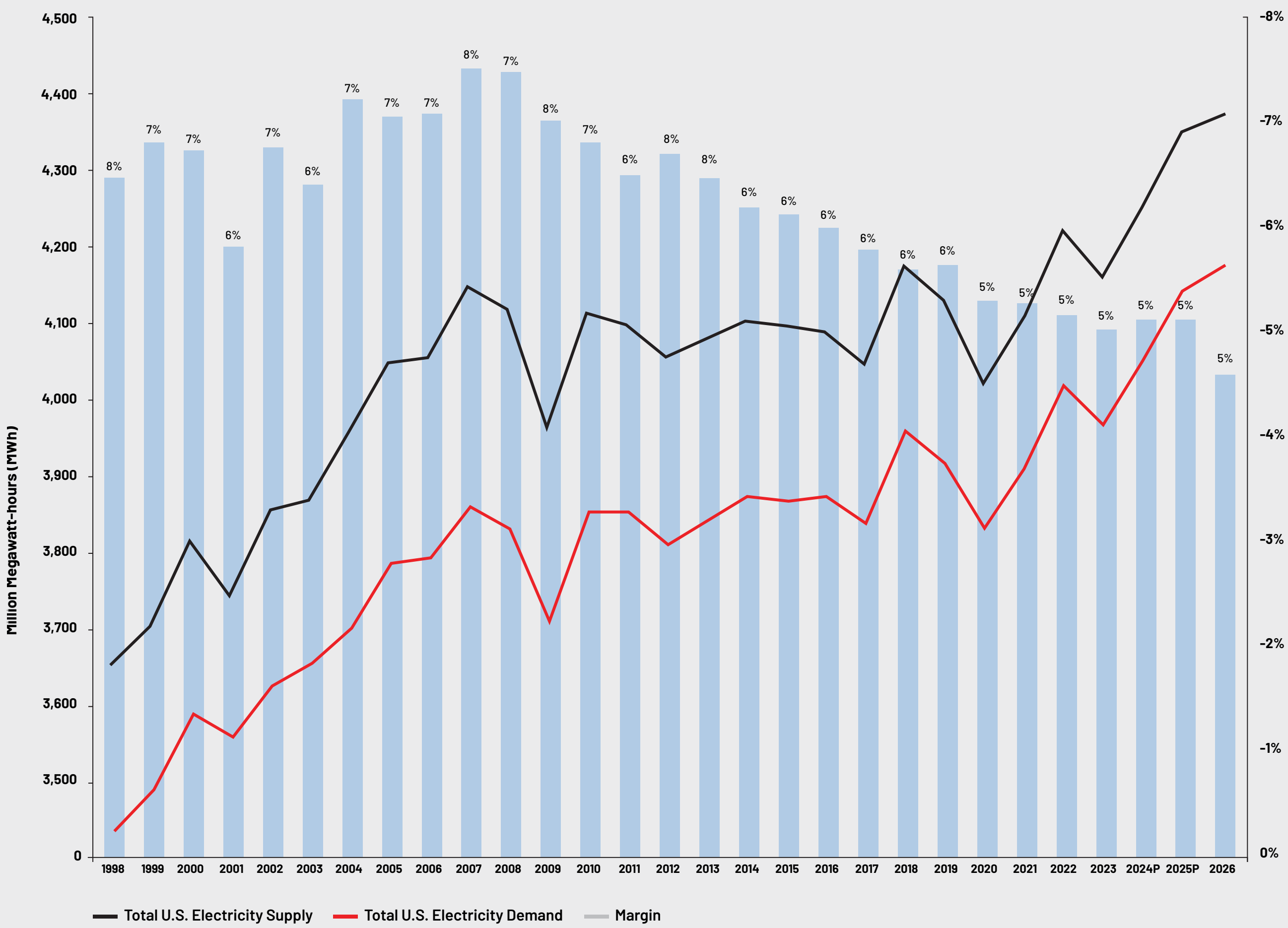
HOW POLICY, TECHNOLOGY, AND CLIMATE ARE RESHAPING U.S. POWER

The U.S. is currently managing a complex balancing act of scaling up clean energy supply and network capacity to serve growing and changing demand, while retiring older infrastructure and ensuring reliability amid new stresses. So far, the balance has been maintained with generally sufficient supply nationally – with no nationwide shortfalls, although local emergencies have occurred. However, newfound demand growth is placing further strain on the country's power grid and points towards a meaningful supply challenge going forward.

Fortunately, the U.S. has a vast resource base, so physically the supply can expand; rather, the issues in are rooted in timing and coordination. Maintaining equilibrium will require continued investment and smart planning – building transmission to connect new supply, deploying storage and flexible distribution to handle demand variability, and using both market mechanisms and regulatory oversight to ensure supply meets the rising demand at all times.

Total U.S. Electricity Supply & Demand

1998–2024A, 2025–2026P



Sources: EIA Electric Power Annual, Electric Power Monthly, and Short-Term Energy Outlook (STEO[1],[2],[3]

Capacity and Energy Assessment

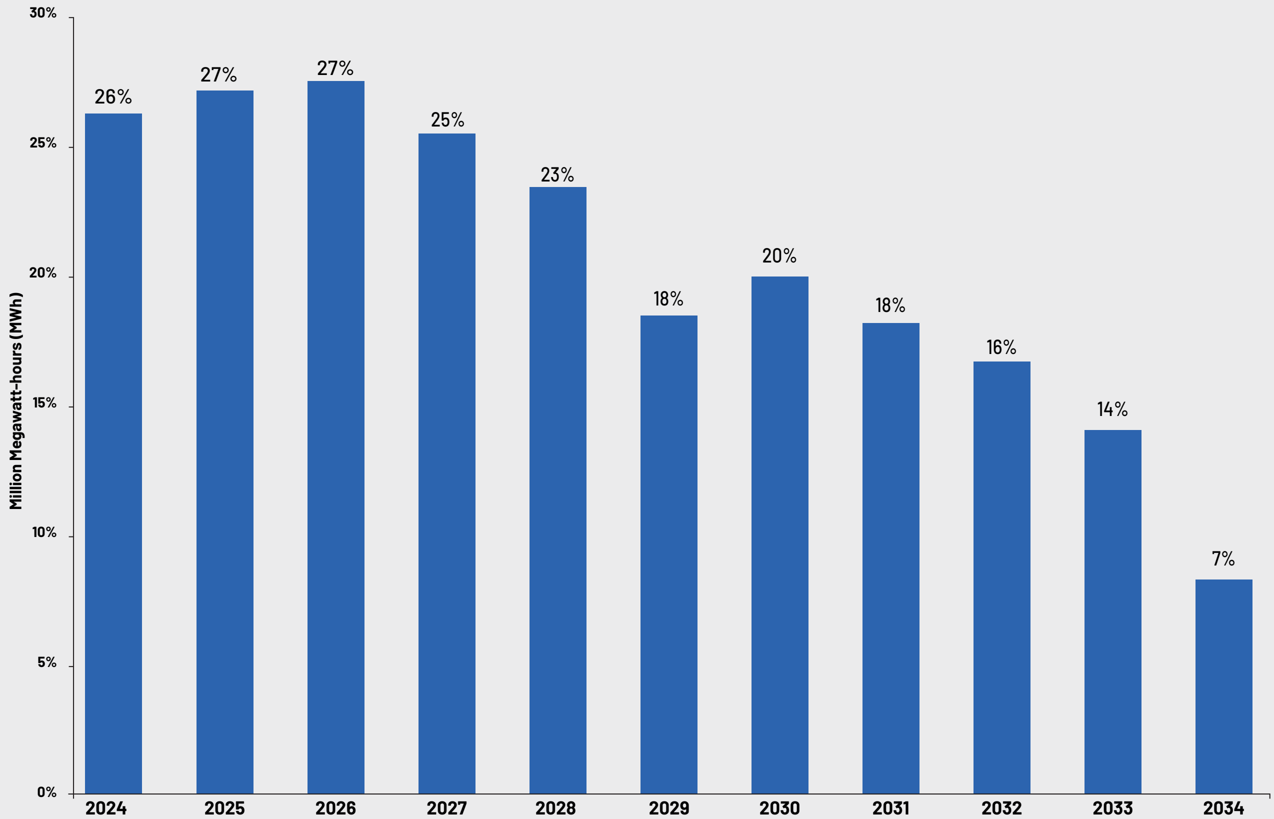
Anticipated Reserve Margins with Announced Retirements[4]

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
MISO	17.70%	10.30%	10.30%	13.20%	8.60%	7.10%	10.60%	8.20%	7.50%	4.20%	-2.50%
MRO-Manitoba	12.50%	21.30%	18.40%	18.00%	15.00%	9.80%	0.50%	-0.60%	-1.70%	-2.90%	-4.20%
MRO-SaskPower	28.90%	27.80%	26.60%	31.10%	29.40%	7.00%	28.80%	28.00%	26.70%	26.80%	1.20%
MRO-SPP	28.30%	26.70%	26.00%	25.00%	20.80%	19.10%	26.70%	24.90%	23.50%	22.40%	8.10%
NPCC-Maritimes	18.90%	20.60%	25.50%	25.10%	18.60%	3.90%	23.40%	20.70%	19.10%	17.70%	-1.30%
NPCC-New England	20.40%	25.00%	25.00%	26.30%	24.90%	23.50%	22.00%	20.10%	19.70%	17.10%	14.60%
NPCC-New York	18.40%	17.10%	21.40%	22.50%	22.40%	21.60%	20.70%	18.30%	16.70%	14.90%	13.60%
NPCC-Ontario	22.50%	20.80%	23.60%	15.70%	23.00%	9.50%	5.10%	-0.20%	-1.40%	-3.90%	-5.50%
NPCC-Quebec	12.50%	12.20%	13.10%	14.20%	12.60%	11.30%	9.80%	6.20%	3.50%	0.50%	-2.20%
PJM	29.80%	34.90%	35.70%	28.10%	21.40%	18.20%	23.10%	21.60%	20.10%	18.50%	10.30%
SERC-C	28.20%	18.90%	18.90%	15.00%	16.00%	15.20%	17.30%	17.10%	18.40%	21.10%	11.80%
SERC-E	30.40%	27.30%	25.80%	24.60%	20.60%	14.40%	14.30%	10.20%	6.30%	4.60%	-2.20%
SERC-FP	27.00%	25.40%	26.00%	23.20%	22.10%	20.90%	18.40%	22.00%	20.40%	18.20%	16.00%
SERC-FE	44.90%	39.90%	35.90%	31.50%	24.50%	21.40%	27.70%	25.80%	24.70%	23.70%	13.00%
TRE-ERCOT	24.30%	30.20%	32.50%	29.70%	25.60%	25.40%	27.80%	28.00%	28.40%	28.90%	24.90%
WECC-AB	36.30%	35.80%	35.70%	38.50%	41.70%	41.90%	35.40%	41.20%	33.60%	27.80%	27.00%
WECC-BC	20.90%	25.20%	25.20%	15.80%	15.90%	22.30%	22.10%	21.60%	21.20%	13.40%	19.90%
WECC-CA/MX	38.60%	45.50%	45.20%	38.40%	43.10%	28.80%	29.60%	23.30%	25.00%	15.20%	11.10%
WECC-NW	34.50%	40.30%	38.90%	35.60%	30.70%	24.50%	18.30%	12.20%	10.20%	8.10%	5.90%
WECC-SW	28.60%	37.00%	35.60%	31.60%	24.20%	17.40%	11.30%	7.70%	0.20%	-4.70%	-9.60%
Average	26.18%	27.11%	27.27%	25.16%	23.06%	18.16%	19.65%	17.82%	16.11%	13.58%	7.50%


TORUS

Anticipated Reserve Margins with Announced Retirements by Region[4]

Source: NERC



The U.S. is currently managing a complex balancing act of scaling up clean energy supply and network capacity to serve growing and changing demand, while retiring older infrastructure and ensuring reliability amid new stresses. So far, the balance has been maintained with generally sufficient supply nationally – with no nationwide shortfalls, although local emergencies have occurred. However, newfound demand growth is placing further strain on the country's power grid and points towards a meaningful supply challenge going forward.

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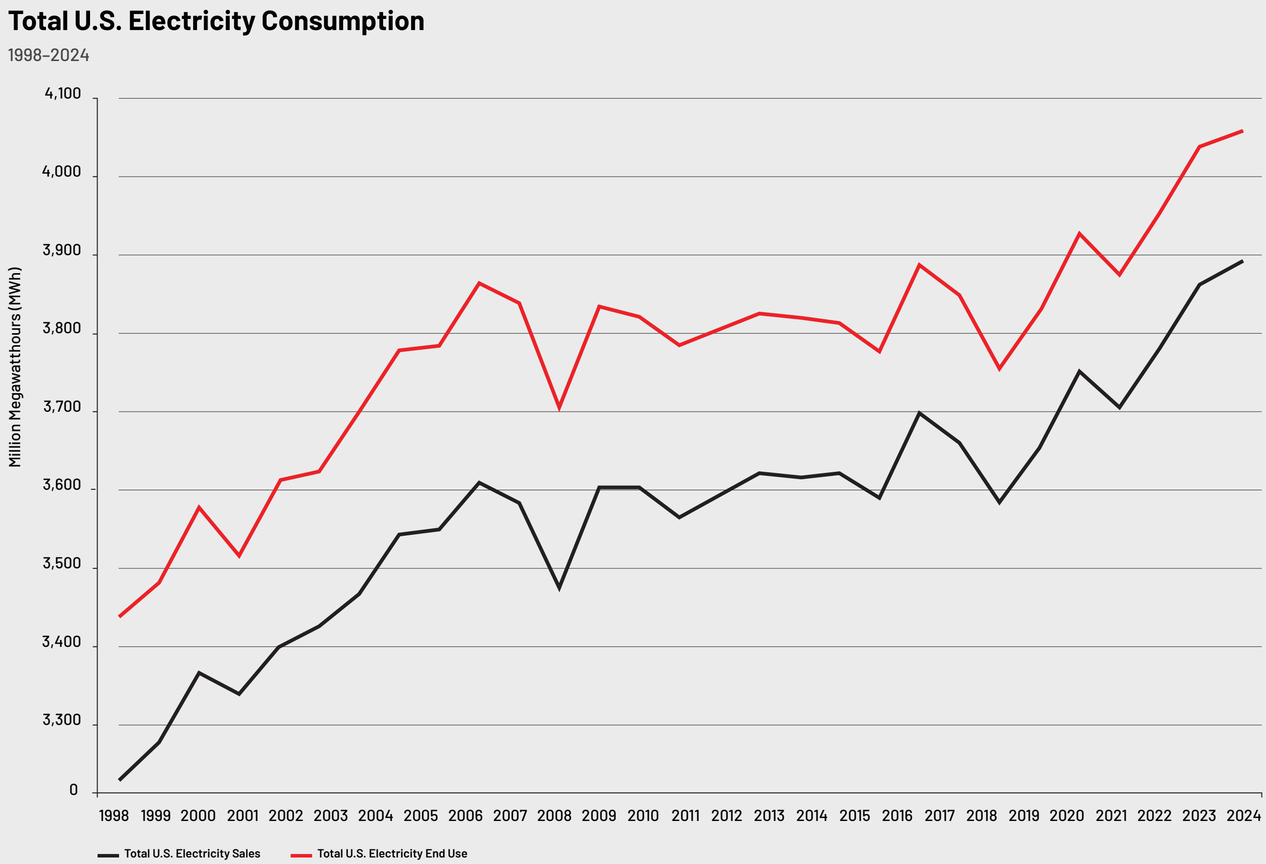
ENERGY DEMAND



Sources: EIA Electric Power Annual; EIA Electric Power Monthly; EIA Short-Term Energy Outlook (STEO)

From 2005 to 2020, total electricity consumption was relatively flat due to gains in efficiency with annual fluctuations driven primarily by weather and economic cycles[1]. However, after almost two decades of stagnant growth, electricity demand is now on an upswing due to new electrification trends. US electricity consumption reached 4,067 million MWh in 2022 – a record high – and remained above 4,000 million MWh in 2023[2]. The EIA's Energy Outlook projects modest annual growth of ~2-3% over the next two years and recent data already reflect this – for instance, 2024 demand was ~2.2% higher year-over-year, and early 2025 data show further increases as new loads come online[3].

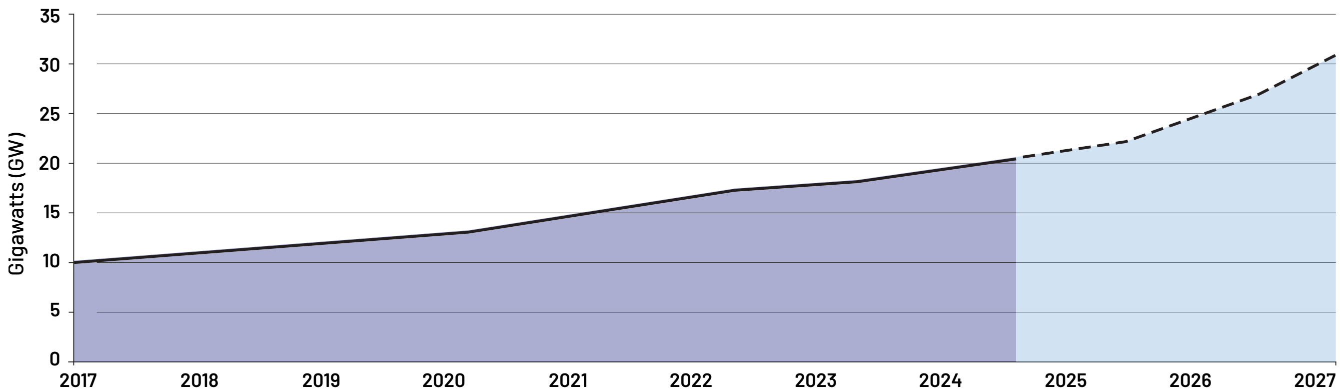
While these new demand drivers have historically represented a small portion of total load, they are ramping up quickly – from data centers and AI to EVs and continued electrification. The convergence of policy, technology, and social change is now firmly pointing toward rising electricity demand over the coming decade, and utilities and grid planners are taking note. In the words of FERC Chair Willie Phillips, "We're not talking about regular demand. We're talking about dramatic increases of demand on our system[4].

Data Center and AI Energy Consumption

Source: Goldman Sachs Research[5]

North America Data Center Supply

2017–2024, 2025-2027P



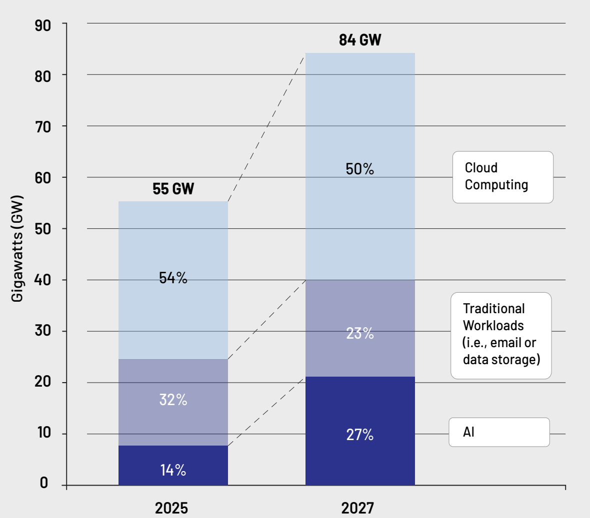
Key Data

- Data centers consume 10-50x more energy than a traditional commercial office building[7]
- Global AI adoption grew from 55% in 2023 to 78% by July of 2024, while generative AI adoption more than doubled to 71% over the same period[8]
- Data center energy consumption is expected to increase from 55 GW in 2025 to 84 GW in 2027, with AI's share growing from 14% to 27% over the period[9]

Technology is creating new electricity-consuming applications that are growing exponentially. The speed of technology adoption is leading to greater grid demand at an increasingly faster pace. The foremost example is digital technology and big data where the rise of artificial intelligence (AI), cloud computing, cryptocurrency mining, and connected devices have led to a boom in data centers and server farms. US data center construction closed 2024 at a record 6,350 MW, more than doubling from 2023[10]. These facilities are extremely power-hungry – some large data centers consume 100 MW or more continuously, equivalent to tens of thousands of homes[11]. In 2023, data centers accounted for 4.4% of total consumption with estimated forecasting they'll draw as much as 12% of U.S. electricity by 2028[12].

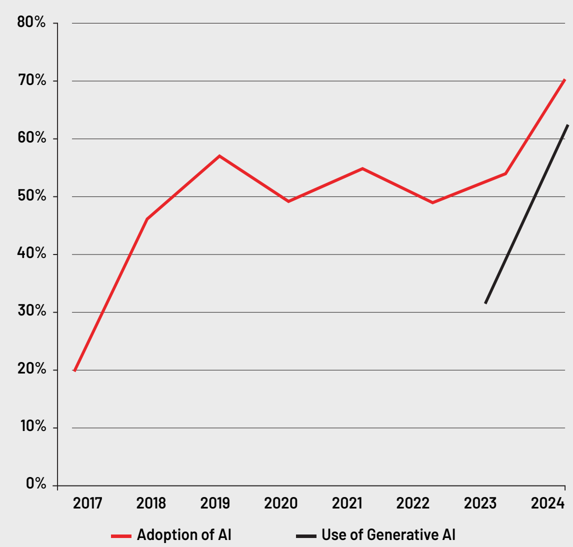
Global Data Center Market Power Consumption, by Consumption Type

2025,2027



Organizations that have adopted AI in at least 1 business function,

2017-2024, % of Respondents

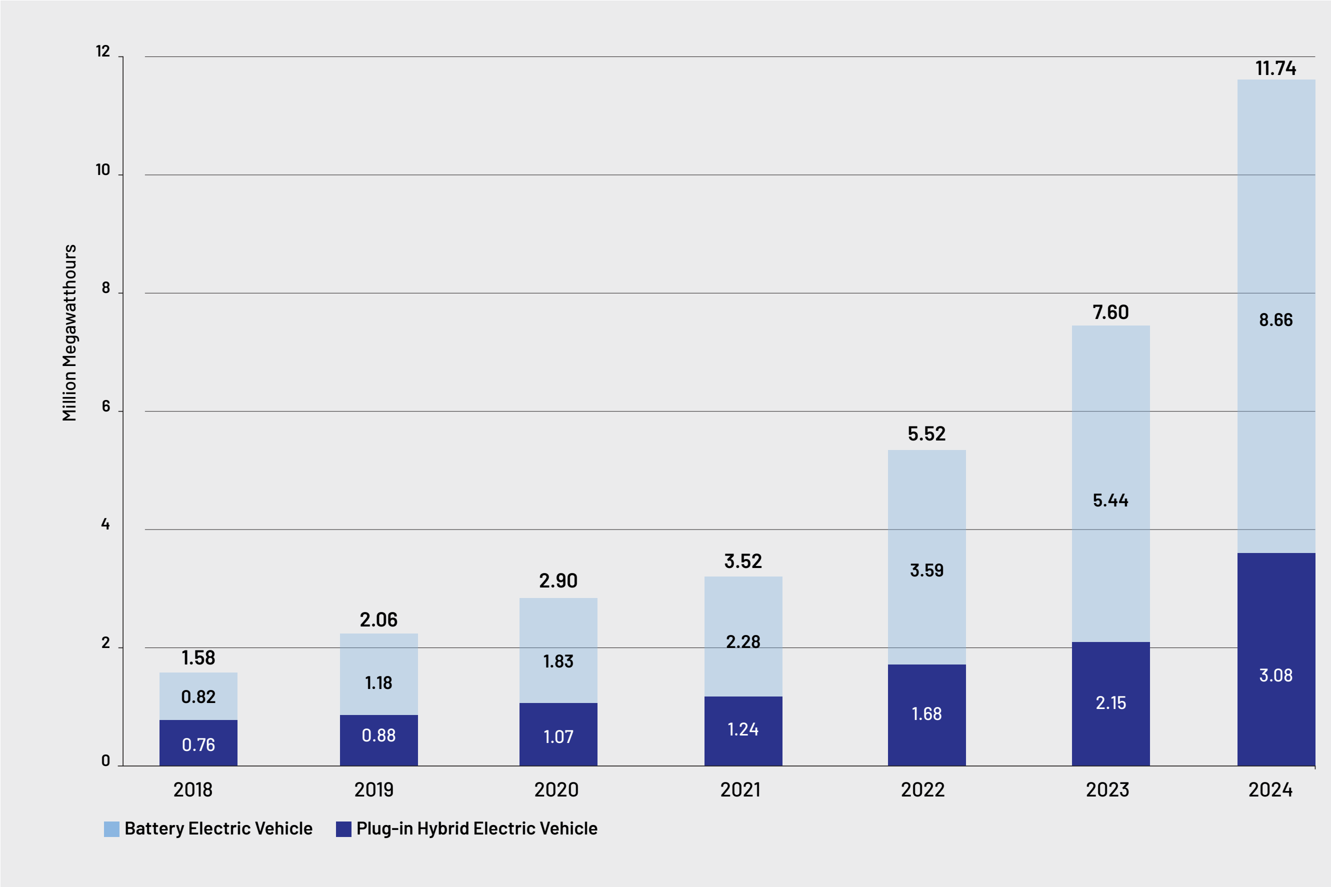


"Trying to plan for data center load is like planning for a brand new city."

- NATE WALKINGSHAW

EVs and Continued Electrification
2018 – 2024

Source: EIA Electric Power Monthly, Table D1[13]



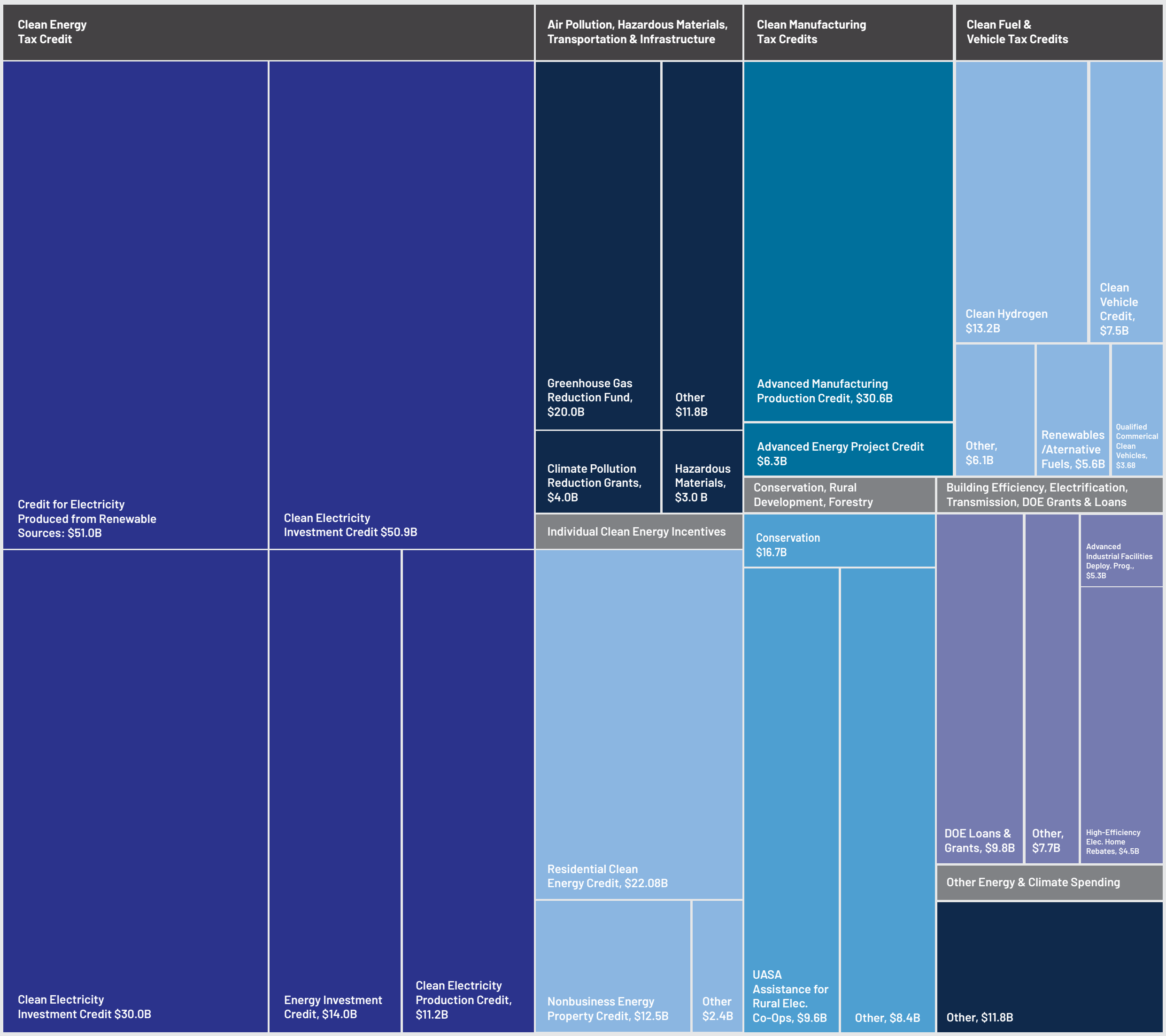
Key Data

- In 2024, EVs consumed about 11.7 TWh of electricity, a 55% jump from the year prior
- By 2030, new demand from data centers and EVs alone is projected to reach 35 GW[14]

Regulatory tailwinds, economic factors, and shifting consumer preferences are driving EV adoption and continued electrification. In 2024, EV sales accounted for ~20% of all new US light-duty vehicles, up from 12.9% in 2022[15]. As more drivers go electric, growing charging needs add to residential and commercial demand. In 2020, EV charging in the US used approximately 2.9 TWh of electricity; in 2024, EVs consumed about 11.7 TWh, a 55% jump from 2023 alone[16]. It's a small portion of total US electricity demand, but the growth rate is exponential. With continued adoption, it's estimated that EVs will demand an additional 100-185 TWh of electricity annually by 2030[17].

Beyond EVs, technology is creating new demand through the electrification of historically nonelectric processes. A similar analysis applies to the electrification of heating – modern cold-climate heat pumps can efficiently heat homes even in cold winters, making electric heating competitive with gas furnaces and thus encouraging fuel switching to electricity. Converting homes from gas and oil to electric heat could add a few thousand kWh per home annually[18].

Inflation Reduction Act & Energy Sector Investment Are Stimulating Demand



Source: Estimated IRA Spending (2022-2031) As of 2023.[19]

Today, with the Bipartisan Infrastructure Law and Inflation Reduction Act, continued investment in renewable energy development is a critical priority for the U.S. grid[20]. The Bipartisan Infrastructure Law of 2021 allocated $7.5 billion to build a nationwide network of EV charging stations,[21] while the Inflation Reduction Act (IRA) of 2022 secured consumer tax credits and rebates for electric vehicles, electric heat pumps, efficient electric appliances, and home solar/storage systems[22]. These incentives lower the cost of switching to electric end-uses, thereby stimulating electricity demand. Collectively, the current regulatory environment is one where public policy is aligning to promote electrification as a means to achieve energy security and climate goals, directly increasing long-term electricity demand.

Industrial Onshoring & Advanced Manufacturing

Construction Spend on Manufacturing Facilities in the U.S.[23]

2022–2025, USD

The US economy and its industry composition have a significant influence on power demand. The ongoing economic and geopolitical trend of deglobalization and "re-shoring" is causing an industrial resurgence. Offshore factories that previously demanded energy abroad are now being built in the US. For instance, since 2020, TSMC has invested over $65 billion to build three advanced semiconductor manufacturing fabrication plants in Arizona[24]. We also seen a boom in battery gigafactory construction across the Midwest with investments supported by the Inflation Reduction Act. As more and more of these manufacturing facilities and loads start to come online, this industrial resurgence raises domestic electricity demand.

> "We have a 2.5 million square foot New Balance factory here in Salt Lake that's almost entirely automated. These modern manufacturing facilities require tremendous amounts of reliable power—that's the future of American manufacturing." **- NATE WALKINGSHAW**

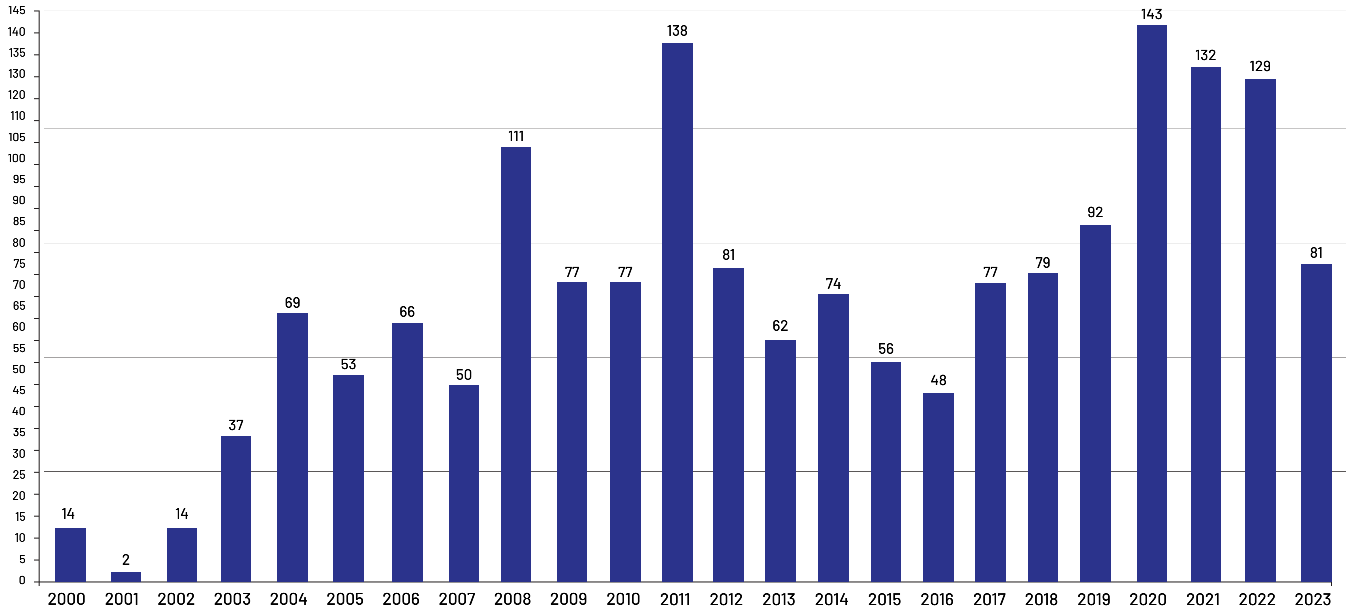

TORUS

Environmental Factors

Weather Releated Major U.S. Power Outages

2000-2023, Number of Outages

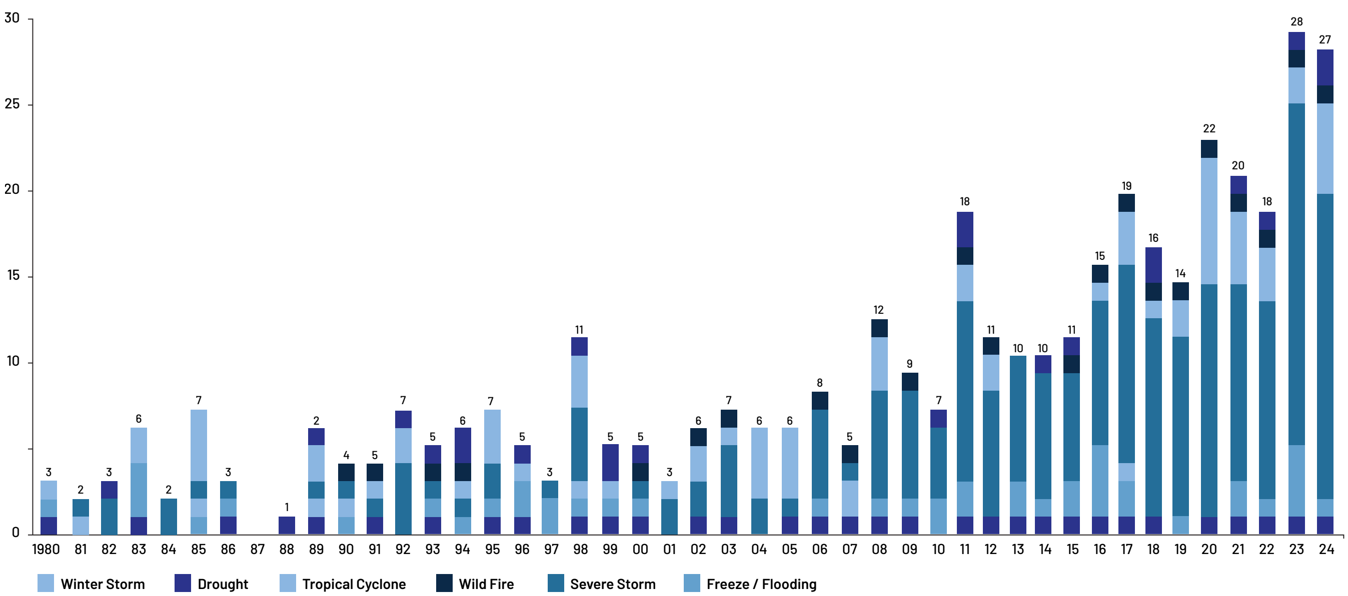
Source: Climate Central[25]



Number of Billion Dollar Natural Disaster Events

1980-2024

Source: NOAA[26]



Key Data

- Weather-related events accounted for ~80% of all major power outages from 2000 to 2023
- In 2024, there were 27 weather and climate disasters with total damages over $1 billion, second only to the record-high 28 in the year prior.[27]

As climate change brings about more volatile weather patterns, many regions across the country are experiencing hotter summers and more extreme heat waves which are driving up demand for air conditioning. On the other hand, there's an increasing frequency of extreme weather events and disasters. In fact, weather-related events accounted for ~80% of all major power outages from 2000 to 2023.[28] Cold snaps, such as the Texas Winter Freeze of February 2021, can unexpectedly spike demand for heating[29]. While not a year-round effect, these extremes can strain grids and require utilities to plan for higher peak demand even if average demand is manageable.

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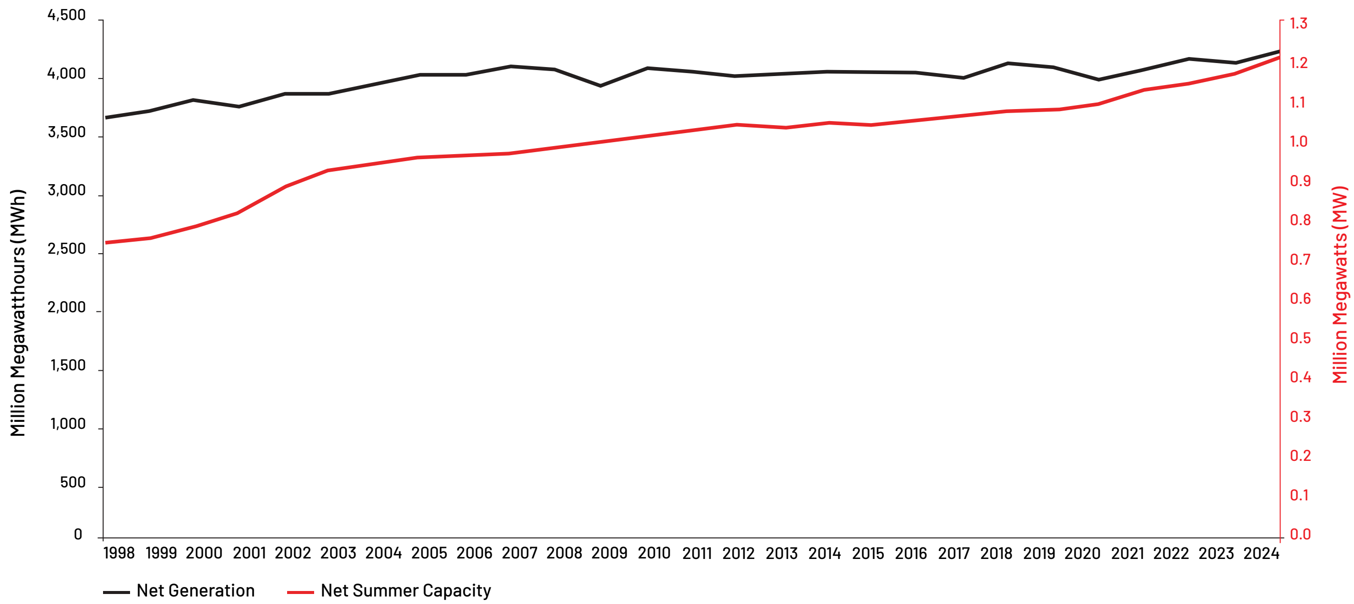
ENERGY SUPPLY

On the supply side, the U.S. power sector is undergoing a profound transition in its generation mix and facing challenges in expanding grid infrastructure. The overall supply of electricity, generation capacity and energy production, has been adequate but under strain in certain regions. In 2024, the U.S. electricity supply reached 4,337 million MWh[1]. Despite gaining 2.7% year-over-year, total supply has only grown at a 20-year CAGR of 0.4%. Naturally, this raises questions about whether supply is keeping pace with potential demand growth and how the composition of supply is changing.

U.S. Electricity Supply
1998-2024

Sources: EIA Electric Power Annual; EIA Electric Power Monthly; EIA Short-Term Energy Outlook (STEO)



The U.S. had ~1.23 million MW of net summer capacity in 2024 with net generation of 4,304 million MWh for the year[2].There is an aggregate reserve margin nationally, but distribution is uneven – some areas like California or New England have tighter capacity margins due to plant retirements or limited import capability, whereas others like the Midwest have surplus capacity. Supply growth in terms of new plant build-out has shifted in technology and slowed in net terms throughout the 2010s, as capacity additions were offset by many retirements of old coal units[3]. In the last few years, net capacity has started growing again due to renewables. Yet, when coupling demand growth with the country's aging infrastructure, the US faces an inflection point that could see supply begin to outstrip demand.

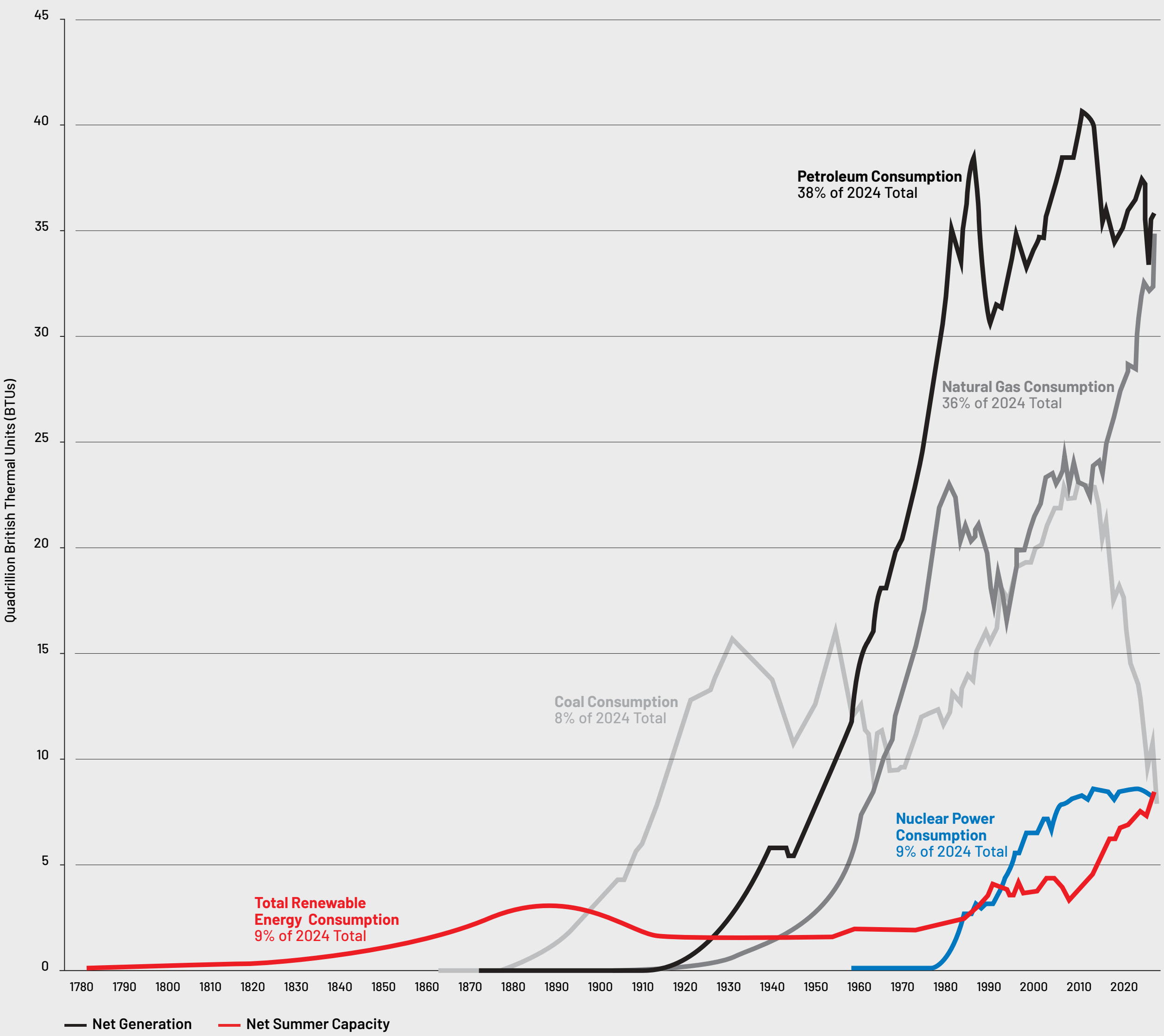
Increasingly Diverse Energy Mix

The most salient supply consideration is the changing generation mix. This shift toward a cleaner supply is being driven by the convergence of macroeconomic, technological, and geopolitical factors. While originally dominated by coal, energy consumption in the U.S. has grown increasingly diverse, with renewables poised to take a growing share. In 2000, coal-fired plants generated about ~50% of U.S. electricity; in 2016, natural gas surpassed coal as the top generation source; and in 2023, renewables surpassed coal for the first time in the generation share[5]. As renewables continue to make up a larger share of the supply mix, the need for flexible energy storage and deployment solutions becomes ever-more critical.

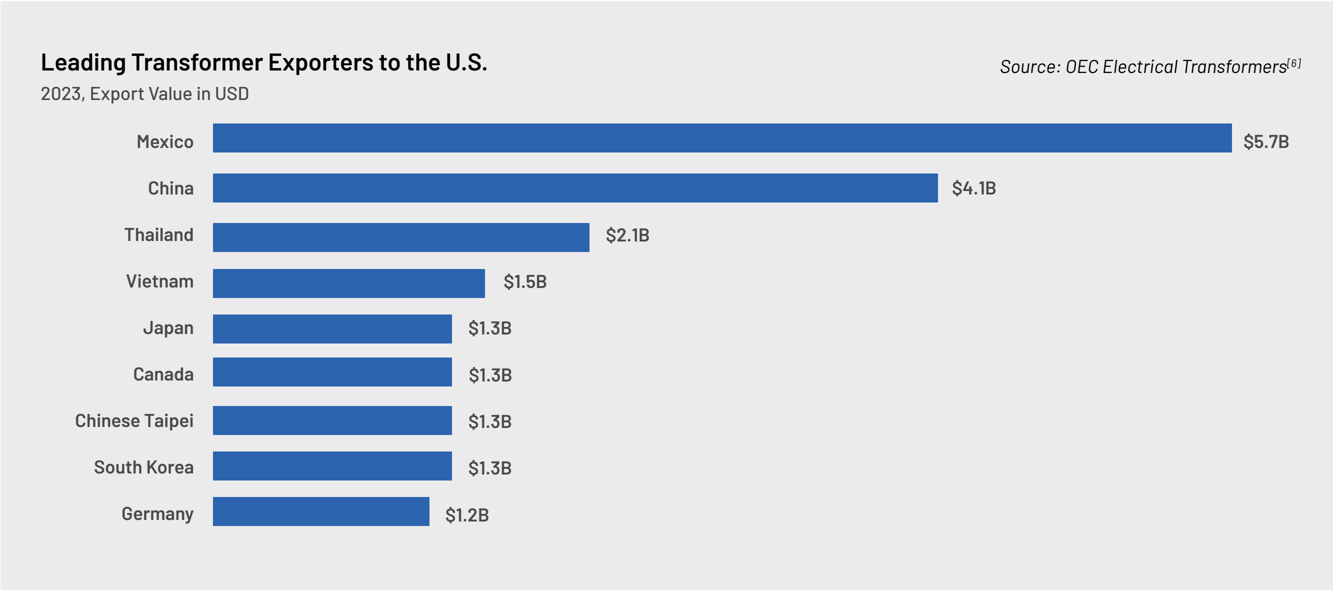
Annual U.S. Energy Consumption

1776–2025

Sources: EIA Today in Energy[4], EIA Monthly Energy Review[5]



National Security & Energy Independence

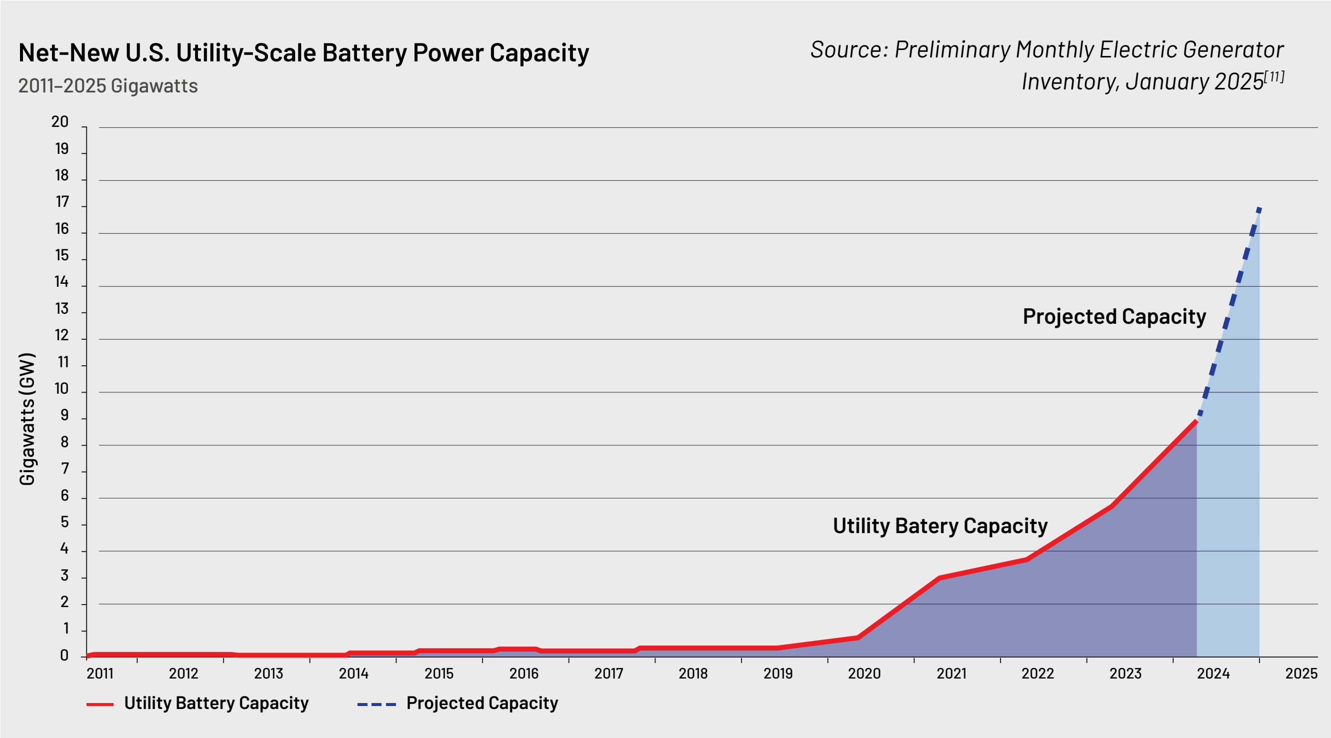


Geopolitics Are Also at Play

Historically, the desire for energy independence has meant support for domestic gas (fracking was enabled in part by policies easing drilling) and ensuring a diverse energy mix. Consequently, the United States has substantially improved its energy independence; since 2019, the U.S. has produced more energy than it consumes, annually[7]. The EIA forecasts 2025 total energy production of 106.20 and consumption of 94.32 quadrillion Btu[8]. Continued support for energy independence has helped drive a supply boom in renewables and associated infrastructure, further diversifying the nation's energy mix. However, U.S. dependence is still at risk with grid technologies heavily dependent on foreign supply chains. In fact, over 80% of large power transformers used in the U.S. are imported, primarily from China, Mexico, and Canada[9].

Moreover, the proliferation of Chinese cyberattacks on critical U.S. infrastructure, including Volt Typhoon, highlight elevated national security threats to grid control systems[10]. Ensuring generation and grid assets can operate through cyber or physical attacks is crucial. Reliability requirements may lead grid operators to maintain some legacy generation or backup generators, procure extra supply (capacity markets, etc.), or reduce demand via emergency programs to balance the system.

Technological Innovations to Unlock Capacity



Smarter Tech, Stronger Supply

Technology advancements on the supply side have unlocked new resources and improved grid management. Renewable generation and storage technologies have seen major progress: modern wind turbines are far more efficient and taller than 20 years ago, enabling economical wind farms in more regions, while solar PV systems have also seen efficiency gains, cost reductions, and new configurations that boost output. Battery energy storage has also emerged as a crucial supply-side technology. While batteries do not generate energy, they supply stored energy at peak times, effectively increasing the usable supply of renewables. In 2024, the U.S. had approximately 25.8 GW of battery storage capacity, up from ~5 GW in 2021, with another 18.2 GW slated for 2025 – a rapid deployment enabling high renewable penetration[12].

Digital grid technologies have also evolved. Smart forecasting tools, sensors, and control systems (the "smart grid") enable grid operators to manage supply resources more precisely, squeezing more out of existing assets and better integrating new sources. In this era of an increasingly distributed and complex supply mix, leveraging modern digital tools is imperative to enhancing grid flexibility, enhancing reliability, and unlocking additional capacity to meet growing demand.

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TORUS

CHAPTER 2

KEY CHALLENGES OVERVIEW

The United States energy industry is undergoing a profound transformation while grappling with persistent systemic challenges. Aging power lines, power plants, and pipelines are being pushed to their limits by rising demand and new uses (from electric vehicles to massive data centers). At the same time, the industry faces pressure to improve reliability and resilience against outages, reduce greenhouse gas emissions, and guard against emerging threats like cyberattacks. This interconnected set of challenges have deep historical roots and are being shaped by current market and policy trends. They also profoundly affect stakeholders ranging from utilities to grid operators to energy producers to commercial and industrial consumers. In fact, power outages alone (from blackouts to momentary voltage drops) are estimated to cost the U.S. economy over $150 billion annually[1]. The following sections examine each challenge in depth – what it means in today's market, how it emerged, its impact on key stakeholders, and its likely future trajectory – with a focus on the U.S. energy and electric power landscape.

High-Impact Data

- Reliability and power quality disturbances are estimated to cost the U.S. economy between $145 billion to $230 billion annually[2]
- U.S. peak demand to rise by 151 GW (17%) over the next decade[3]
- Federal goal of 100% carbon pollution-free electricity by 2035
- Cyberattacks on the U.S. power grid could cause over $1 trillion in economic damages[4]
- ASCE's 2025 Infrastructure Report Card gave U.S. energy systems a 'D+' [5]

List of Key Challenges

1. Power Quality
2. Peak Load, Grid Inflexibility & Outage Threats
3. Greenhouse Gas Emissions
4. Asset Cybersecurity
5. Aging Infrastructure Nears Breaking Point

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CHALLENGE #1: POWER QUALITY

Problem Statement

The U.S. electric grid is increasingly unable to deliver stable, distortion-free power as required by modern digital infrastructure, leading to costly disruptions and growing reliability concerns.

"Power quality refers to the absence of perturbations in the voltage and flow of electricity that could damage end-use equipment or reduce the quality of end-use services." [1]

Key Data

- Reliability and power quality disturbances are estimated to cost the U.S. economy between $145 billion to $230 billion annually
- Momentary events alone cost "digital economy" and continuous manufacturing sectors ~$60 billion annually

Where are we today?

Reliability and power quality disturbances are estimated to cost the U.S. economy between $145 billion and $230 billion annually[2]. Today's grid faces intensified power quality challenges from both sides: sensitive end-use loads and variable, inverter-based generation. Data centers, semiconductor fabs, and hospitals now require near-perfect power, while DERs (e.g., solar, wind) and fast chargers introduce harmonics and voltage variability[3]. Automated systems now record disturbances that were once invisible, increasing stakeholder awareness. EPRI reports that momentary events alone cost "digital economy" and continuous manufacturing sectors ~$60 billion annually, reaffirming power quality as an economic imperative.[4],[5]

How did we get here?

Power quality – maintaining stable voltage and frequency with minimal disturbances – emerged as a priority with the rise of digital and industrial automation in the late 20th century. Early grids, were designed primarily for reliability, with equipment tolerant of minor fluctuations. However, the rise of the digital economy and sensitive electronics made even millisecond sags or harmonics economically disruptive. By the early 2000s, disturbances were estimated to cost the U.S. economy over $119 billion annually[6]. The legacy electromechanical grid, long under-invested, has struggled to meet the precision demands of modern industries, prompting regulatory standards and encouraging the installation of protective devices.[7],[8]

Who does this impact?

Commercial and industrial users are directly affected – voltage sags can halt production or trigger data loss. Many deploy mitigation (e.g., UPS, filters, regulators), but still depend on utility-side stability. Utilities face reputational and financial risks from customer complaints, and some now offer premium-quality tariffs or deploy voltage control devices. Generators and grid operators must adhere to strict interconnection standards, as poor quality can ripple across regions. In aggregate, degraded power quality undermines confidence in grid reliability and imposes hidden systemic costs.

What can we expect moving forward?

Solutions are emerging through advanced grid controls and smarter infrastructure. Grid-forming inverters, energy storage, and microgrids can buffer disturbances or operate independently when quality falters[9]. Smart relays and phasor measurement units enable near-instant corrective action. FACTS devices and dynamic voltage restorers are increasingly deployed to regulate flows and mitigate events in real time. DOE's GRID 2030 vision sets a target of "near-zero economic losses from outages and power quality disturbances," enabled by decentralized intelligence[10]. Enhanced standards, regulatory visibility, and embedded monitoring are expected to reinforce this trajectory – making resilient, high-fidelity power delivery a baseline expectation in the grid of the future.

- DOE's GRIP Program has committed to invest ~$600 million per year (through FY 2026) in smart grid technologies to strengthen grid reliability and integrate renewables[11]
- US energy storage industry to invest $100 billion in domestic battery storage by 2030[12]

“When you get down to it, power quality has the biggest economic impact. Even when it’s not hitting your bottom line directly, it’s affecting your operations – imagine your manufacturing processes shutting down because of power quality problems. That’s where the real costs add up.” **– DAVE RACKHAM**

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CHALLENGE #2: PEAK LOAD, GRID INFLEXIBILITY & OUTAGE THREATS

Problem Statement

Rising peak electricity demand, intensified by climate-driven weather extremes, is straining an already fragile grid and resulting in more frequent and economically damaging interruptions and outages.

Key Data

- Power outages alone (from blackouts to momentary voltage drops) are estimated to cost the U.S. economy over $150 billion annually
- U.S. peak demand to rise by 151 GW (17%) over the next decade
- NERC's Long-Term Reliability Assessment projects summer peak demand to rise by 132 GW and winter by 149 GW over the next decade
- By 2030, new demand from data centers and EVs alone is projected to reach 35 GW
- The DOE has developed a $2.5 billion Transmission Facilitation Program (TFP) to help build out new transmission lines across the country

Where are we today?

After a decade of flat energy demand, the 2020s have seen a resurgence. NERC's Long-Term Reliability Assessment projects summer peak demand to rise by 132 GW (~896 GW to ~1,029 GW) and winter by 149 GW over the next decade[1]. Electrification (EVs, residential and commercial electrification, etc.) and large new loads (data centers, hydrogen fuel plants) are accelerating this shift. Meanwhile, supply is tightening. Many coal plants are retiring, while solar and wind are variable. Battery storage and demand response are expanding but not yet fully scaled. NERC warns that many U.S. regions face elevated summer blackout risk due to shrinking reserves and extreme heat[2].

How did we get here?

The U.S. electric grid was historically built to meet rising peak demand, with utilities expanding capacity through the mid-20th century. Regulatory support enabled overbuilding, ensuring robust planning margins. However, the 1990s ushered in deregulated markets, shifting investment incentives and fragmenting responsibility for capacity. As climate extremes intensified and legacy baseload plants retired, the once-stable equilibrium began to erode. High-profile failures – such as the 2021 Texas blackout – highlighted a systemic fragility under new stressors: extreme weather, changing demand patterns, and underinvestment in flexible resources.[3][4]

Who does this impact?

Utilities and grid operators must manage real-time balance and increasingly turn to demand response, emergency conservation pleas, or rolling outages. Regulators and reliability entities (FERC, NERC) are revising capacity market rules to incentivize firm, fast-ramping resources. Energy producers face financial rewards and reputational risks – nonperformance during peaks is increasingly penalized. Businesses face exposure to both rising demand charges and service interruptions, prompting investments in backup systems and enrollment in interruptible programs. For the public, peak-driven outages threaten health, safety, and economic continuity. In essence, the reliability challenge at peak times has made resilience a priority for all stakeholders.

> "The utility grid is designed around peak demand – which occurs less than 1% of the year. As a result, the system is significantly overbuilt and typically operates at just 40-60% of its capacity. When peak load increases, utilities must invest in even more infrastructure to meet that higher peak, further widening the grid's efficiency gap: the system is built for a peak that keeps rising, while average demand remains relatively flat." – **PATRICK REEDY**

What can we expect moving forward?

By 2030, new demand from data centers and EVs alone is projected to reach 35 GW[5]. Addressing risk from this unprecedented increase in energy demand (especially during peak hours) will require a mix of investment and innovation. Regional transmission interconnections, supported by DOE's $2.5B financing program, will improve load sharing across markets, but more transmission alone will not solve this problem[6]. Utilities are expanding efficiency programs and time-of-use pricing to flatten peaks with grid-scale batteries and "virtual power plants" helping increase grid flexibility in the face of growing outage threats. Smart thermostats, automated demand response, and eventually vehicle-to-grid systems will allow dynamic control of flexible loads. Long-term, a diversified, interconnected grid with overbuilt renewables, responsive demand, and dispatchable storage offers a pathway to sustained reliability – even under more extreme and volatile conditions.

- By 2030, the DOE plans to build 7,500 miles of new transmission lines, in order to expand long-distance capacity by 16%[7]
- Total energy storage connected to the US grid is projected to grow by 1,100% over the next 15 years[8]
- Coastal metros across the country are expected to experience more hurricane-induced power outages over the next 100 years
- Models indicate that the Miami metro area could experience a 119% increase in climate-related power outage events per person per decade[9]

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CHALLENGE #3: GREENHOUSE GAS EMISSIONS

Problem Statement

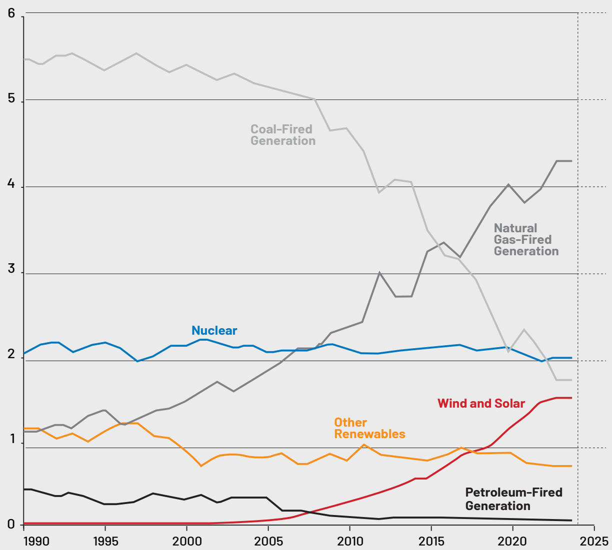
Climate goals and regulatory compliance have enabled clean energy progress, yet continued reliance on fossil-fueled electricity generation makes the sector a leading contributor to U.S. greenhouse gas emissions.

Key Data

- Electric power sector CO_2 emissions declined ~41% between 2005 and 2023
- Renewables grew from near-zero to ~21% of generation over the same period
- Today, the electric power sector contributes about 30% of U.S. energy-related CO_2 emissions
- The U.S. has a federal goal of 100% carbon pollution-free electricity by 2035

Share of U.S. Electric Power Sector Generation by Fuel Source[1]

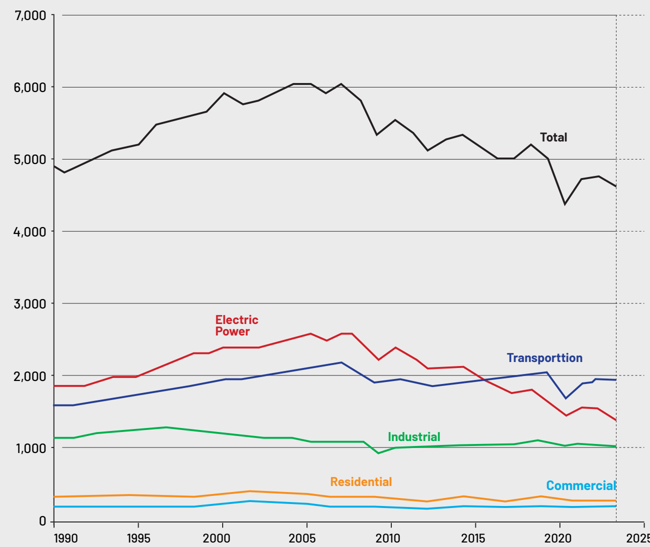
1990 – 2025



Source: U.S. Energy-Related Carbon Dioxide Emissions, 2023 [1]

Sector [2]

1990-2023, in million metric tons of carbon dioxide



Source: EIA: U.S. Energy-Related Carbon Dioxide Emissions, 2023 [2]

Where are we today?

Today, the electric power sector contributes about 30% of U.S. energy-related CO_2 emissions – down from its historic peak, now second to transportation[3]. Natural gas (~42% of electric power generation) has overtaken coal as the largest fossil contributor. The Inflation Reduction Act (IRA, 2022) introduced the largest-ever package of clean energy incentives – spurring record investments in renewables, batteries, and green hydrogen. Meanwhile, demand is electrifying (e.g., EVs, data centers), meaning the grid must grow while getting cleaner. The EPA is also in the process of tightening power plant CO_2 regulations.

How did we get here?

The U.S. energy sector – especially power generation – has long been a major source of greenhouse gas (GHG) emissions, primarily from coal and natural gas. Until the early 2000s, emissions rose steadily as coal dominated the grid. That trajectory reversed after 2005 due to a confluence of market and policy forces: the shale boom made natural gas cheaper, federal tax credits and state Renewable Portfolio Standards drove wind and solar deployment, and aging coal plants faced stricter pollution rules[4].These trends, even in the absence of a national carbon price, led to a ~41% decline in electric power sector CO_2 emissions between 2005 and 2023[5],[6]. Renewables grew from near-zero to ~21% of generation, while coal fell to ~16%[7].

Who does this impact?

Electric utilities face dual pressure: decarbonize while maintaining reliability. Many have set net-zero targets, accelerating coal retirements and investing in renewables and storage. Independent power producers are seizing growth in clean energy markets but face interconnection bottlenecks. Grid operators must adapt to a resource mix with low inertia and high variability – driving new forecasting and market tools. Commercial customers increasingly procure renewable energy directly (e.g., PPAs, green tariffs) to meet ESG goals, influencing project development pipelines. Policymakers, from state PUCs to FERC, are balancing decarbonization with grid adequacy. Equity concerns are also central: clean energy deployment must serve disadvantaged communities and lower localized pollution.

What can we expect moving forward?

The power sector is on a path toward deep decarbonization, but pace and execution are uncertain. The federal goal of 100% carbon pollution-free electricity by 2035 has catalyzed planning, though it is not yet law[8]. By the 2030s, most remaining coal plants will retire. Gas may persist longer, but only with CCS or hydrogen blending. New technologies – advanced nuclear, long-duration storage, and green hydrogen – will be key for firm clean capacity. Sector coupling could drastically cut emissions economy-wide – if powered by clean electricity. Investment in new infrastructure and policy mechanisms will determine success. The power sector's emissions decline is one of the clearest signals of climate progress – but sustaining it will require aligning reliability, affordability, and carbon goals at scale.

- 12.3 GW of capacity from electricity generators is planned for retirement in 2025, a 65% increase over 2024[9]
    - This is led by 8.1 GW of retired coal-fired capacity with the largest being the 1,800 MW Intermountain Power Project in Utah[10]
- 63 GW of new U.S. generating capacity is projected for 2025 with solar and battery storage accounting for 81% of expected additions[11]

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CHALLENGE #4: ASSET CYBERSECURITY

Problem Statement

The digitization of grid operations has introduced critical vulnerabilities, exposing energy and power infrastructure to increasingly sophisticated and frequent cyberattacks that threaten operational and national security.

Key Data

- Studies estimate that a large-scale cyberattack on the U.S. power grid could result in over $1 trillion in economic damages in a worst-case scenario
- In 2024, U.S. energy and utilities experienced a 42% rise in weekly attacks, averaging 1,577 incidents per organization
- The average cost of a data breach in the global energy sector reached a high of $5.29 million in 2024[1]

Where are we today?

The energy sector is now a top target for cyberattacks. In 2024, U.S. energy and utilities experienced a 42% rise in weekly attacks, averaging 1,577 incidents per organization[2]. Though few have caused blackouts, the 2021 Colonial Pipeline ransomware incident showed how real-world impacts can emerge quickly. Distributed energy resources (DERs) and battery storage systems – often managed via cloud platforms – expand the attack surface. Supply chain risks are also growing, with compromised hardware or software posing threats to critical infrastructure. NERC CIP covers only high-voltage assets, leaving most distribution-level infrastructure and DERs outside formal regulation[3],[4]. Studies estimate that a large-scale cyberattack on the U.S. power grid could result in over $1 trillion in economic damages based on a worst-case scenario[5].

How did we get here?

Energy systems were once analog and air-gapped—cyber threats were not a concern. That changed with digitization: SCADA systems, remote sensors, and internet-connected controls made grids more efficient but also more vulnerable. The 2010 Stuxnet attack and the 2015 Ukraine grid hack proved that adversaries could disrupt physical infrastructure via software. In response, U.S. regulators introduced mandatory cybersecurity standards for the bulk power system under the 2005 Energy Policy Act. However, many systems remain outdated, and cyber protections have struggled to keep pace with emerging threats[6],[7].

Who does this impact?

Cybersecurity is now a shared burden. Utilities invest in security operations centers, incident response playbooks, and hardened network architecture. Non-compliance with NERC CIP can result in major fines. Independent power producers must secure remotely operated plants, as forced outages can destabilize the grid. Equipment vendors are increasingly required to meet security standards, especially as vulnerabilities in common devices can affect the entire sector. Government agencies coordinate intelligence-sharing (e.g., DOE's CESER, CISA advisories), simulate attack scenarios (GridEx), and issue cybersecurity baselines for sectors outside CIP coverage.

> "To realize the full potential of these energy assets, you have to connect these modular power plants to the internet. They have to be managed and monitored that way; they have to be deployable, observable and fully commanded and controllable via the internet. And when you put something on the internet, it's a double-edged sword...Because if you can control the energizing or dissipating of that energy, so could someone else. You can imagine there are a number of nation states that would love to get their hands on internet connected energy resources."
>
> **– TRENT BOND**

What can we expect moving forward?

The threat environment will intensify as grids become more digital and adversaries more sophisticated. Utilities are adopting zero-trust architectures, machine learning–based anomaly detection, and segmentation of operational technology (OT) networks. Cybersecurity-by-design is becoming standard for DERs and storage platforms. Policymakers are evaluating expanded requirements analogous to NERC CIP for pipelines and distribution grids[8],[9]. Emergency preparedness is critical: utilities must maintain "manual resilience" to operate without digital control if compromised. The sector is evolving from compliance-driven to mission-critical cybersecurity culture – recognizing the grid as a potential national security target. Sustained investment, cross-sector collaboration, and proactive standards will be essential to prevent a digital fault from triggering a physical crisis.

- 71% of energy professionals are anticipating growth of cybersecurity investments in 2025, with 65% of such leadership indicating cybersecurity is their greatest risk[10]
  - 64% of utilities reported being targeted by cyberattacks with 84% of those being attacked multiple times over the past 12 months[11]
  - 59% of such utility cyberattacks were carried out by nation-state actors

> **"Utility companies have incredible expertise in their traditional operations, built over decades of reliable service. They're now navigating new territory with modern cybersecurity demands, which differs from their historical strengths. They recognize that grid security faces unprecedented pressure today, and that's why partnerships in this space are so valuable."** – DAVE RACKHAM

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CHALLENGE #5: AGING INFRASTRUCTURE NEARS BREAKING POINT

Problem Statement

Much of the U.S. electric grid infrastructure is nearing its designed lifespan; this is an unequivocal matter of national urgency that's not only hindering the integration of modern technologies but is increasingly contributing to systemic inefficiencies and rising failure risks.

Key Data

- Most of the modern grid was built in the 1960s and 70s, with 70% of transmission lines now over 25 years old and nearing the terminal years of their expected lifecycle
- ASCE's 2025 Infrastructure Report Card gave U.S. energy systems a 'D+,' citing systemic degradation
- IIJA allocated $73B for grid modernization; yet failure to reauthorize IIJA and IRA funding levels in 2026 could spell an industry-wide $702B investment gap by 2033[1]

> "Electrical grids in cities and regions were designed for different needs than we have today. These systems worked perfectly when built, but infrastructure naturally needs updates over time. Utilities are steadily modernizing to meet current demands. It's an enormous challenge to bridge the gap between the original designs and today's needs. It's even harder to do so quickly and without huge capital investments." – DAVE RACKHAM

Where are we today?

The consequences of deferred maintenance are now pronounced. The 2018 Camp Fire in California, caused by a 97-year-old transmission hook, underscored the deadly risks[2]. ASCE's 2025 Infrastructure Report Card gave U.S. energy systems a "D+," citing systemic degradation. Transformer procurement delays – now averaging 120 weeks – threaten project timelines and storm recovery[3]. Aging infrastructure also limits capacity: legacy systems were not designed for today's higher loads or bidirectional power flows from DERs. Efficiency losses, vulnerability to weather, and wildfire risks compound the problem. The aging grid is both a bottleneck and a liability, demanding urgent attention and modern solutions.

How did we get here?

Much of the U.S. energy infrastructure was built during post-World War II expansion, with transmission lines, substations, and pipelines operating decades beyond intended design life. By the 2000s, failures began surfacing—most infamously, the 2003 Northeast blackout traced to an untrimmed tree and outdated transmission monitoring. Still, widespread reinvestment lagged due to regulatory complexity, capital constraints, and inertia. The grid became a patchwork of aging assets straining under modern demand. Similarly, gas systems in older cities still contain cast iron pipelines from the early 20th century.[4]

Who does this impact?

Utilities face a balancing act: modernize aging assets while managing ratepayer impacts and regulatory scrutiny. Investor-owned utilities propose multi-decade "grid modernization" programs, but cost recovery often depends on state approvals. Public power and cooperatives, with fewer financial resources, rely on federal loans or grants. Energy developers face interconnection delays due to constrained or antiquated infrastructure. Industrial users may bypass grid constraints with behind-the-meter investments. Safety failures carry public and political consequences, prompting increased regulatory attention and local resistance to major rebuilds – spurring calls for permitting reform and environmental equity.

“You can’t solve this problem just by adding more transmission. We need energy assets at the distribution level—closer to where power is actually used.” **- TRENT BOND**

What can we expect moving forward?

Rebuilding and modernizing the grid is no longer optional – it’s urgent. Utilities are investing in advanced systems like self-healing networks, real-time sensors, drone inspections, and fire-hardened components. Yet, large-scale upgrades such as new transmission lines and centralized generation remain slow-moving and capital-intensive. To address growing electricity demand in a compressed timeline, many are turning to decentralized solutions like Virtual Power Plants (VPPs) and Distributed Energy Resources (DERs). These technologies provide faster, modular deployment, helping to relieve peak loads, reduce congestion, and improve resilience without the delays of major infrastructure builds. The next 5-10 years provide a critical window: without accelerated action, aging infrastructure will increasingly undermine grid reliability and efficiency, jeopardizing U.S. independence and advancement in the modern race for knowledge and energy.

- By 2030, the DOE plans to build 7,500 miles of new transmission lines, in order to expand long-distance capacity by 16%[5]
- “Tripling the current capacity of VPPs—to 80-160 GW—by 2030 could address 10-20% of peak load and save on the order of $10B in annual grid costs through avoided generation build-out, delayed power infrastructure investments, and reduced operation of expensive peaker plants”[6]
- 217 GW of distributed energy resource capacity is expected to be added to the US electrical grid between 2024 and 2028, according to Wood Mackenzie[7]
- Total energy storage connected to the US grid is projected to grow by 1,100% over the next 15 years[8]

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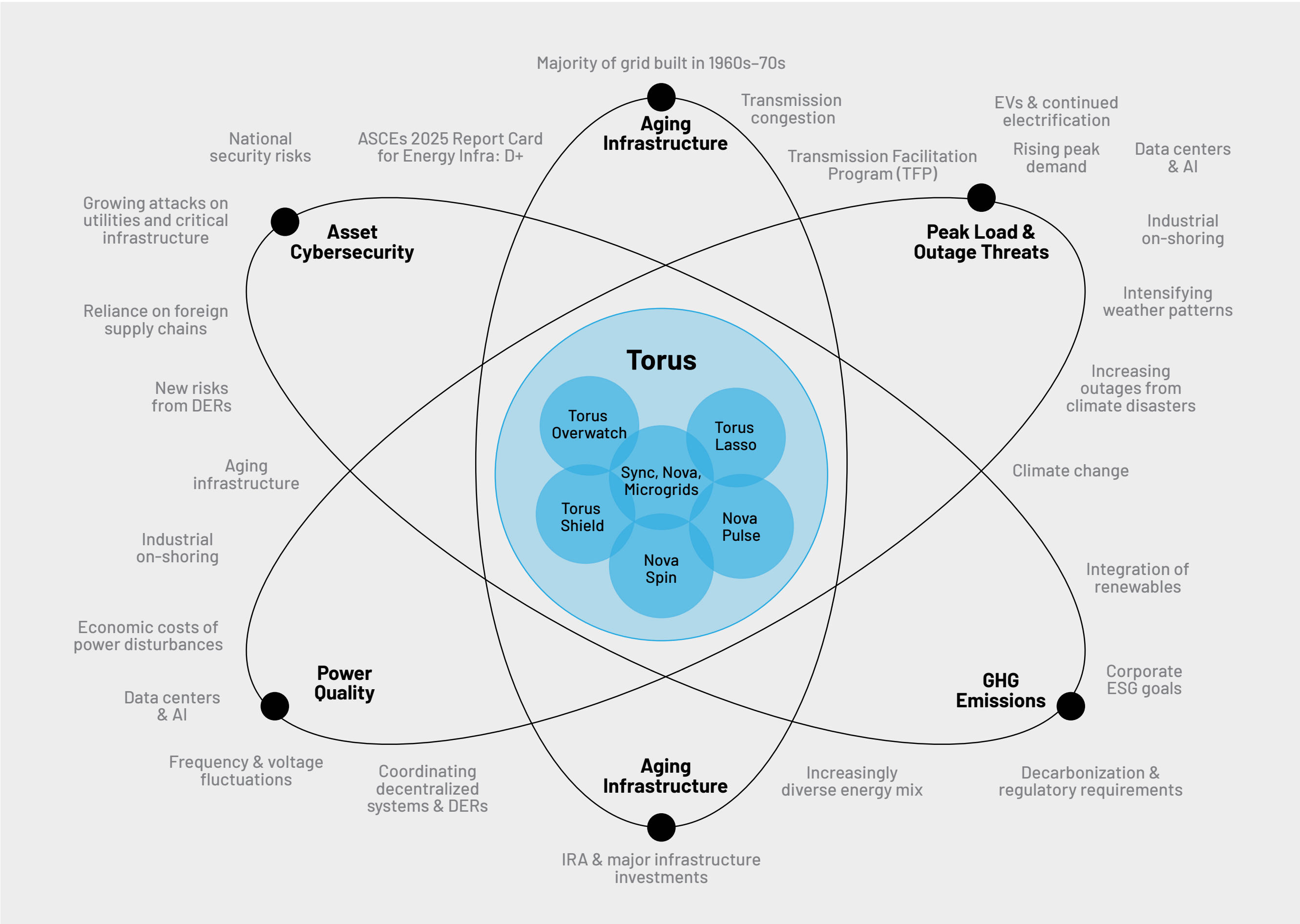
TORUS: THE NUCLEUS OF THE ENERGY EQUATION



"Every energy challenge requires the same solution: reliable, secure energy storage and management. It doesn't matter if you're looking at generation, transmission, or distribution problems. The same goes for power quality issues or carbon reduction goals. All roads lead to what Torus offers." **- DAVE RACKHAM**

"When you zoom out and you look at, what is Torus doing? We didn't just take parts and put it together. We actually built it from the ground up around the most critical problems in our energy infrastructure." **- GIL LEE**

TORUS SOLUTIONS DEEP DIVE AND TECHNICAL BRIEF

Torus Spin™

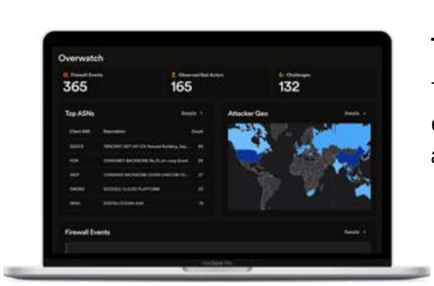
The Torus Spin™ is an innovative flywheel energy storage system that enhances grid stability and efficiency through mechanical energy storage. Recognized as one of TIME's Best Inventions of 2024, it is designed to support a cleaner and more resilient energy grid while being environmentally friendly due to its recyclable materials and extended lifespan.

Torus Pulse™

The Torus Pulse™ is a modular lithium-iron phosphate battery energy storage system designed to provide reliable and scalable base-load power for various applications. It integrates with the Torus Spin™ flywheel system to enhance energy delivery and efficiency.

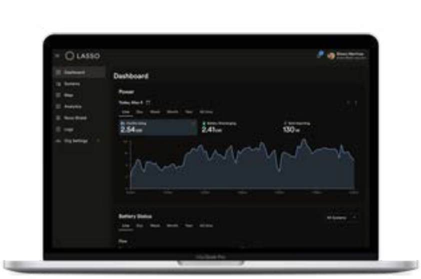
Torus Shield™

The Torus Shield™ is a sophisticated security hardware solution designed to protect energy assets from unauthorized access and cyber threats. It integrates advanced cybersecurity measures across the Torus product suite to ensure robust protection against evolving risks.



Torus Overwatch™

Torus Overwatch™ is a comprehensive suite of managed services designed to enhance security and performance of energy infrastructures through 24/7 monitoring and expert support.



Torus Lasso™

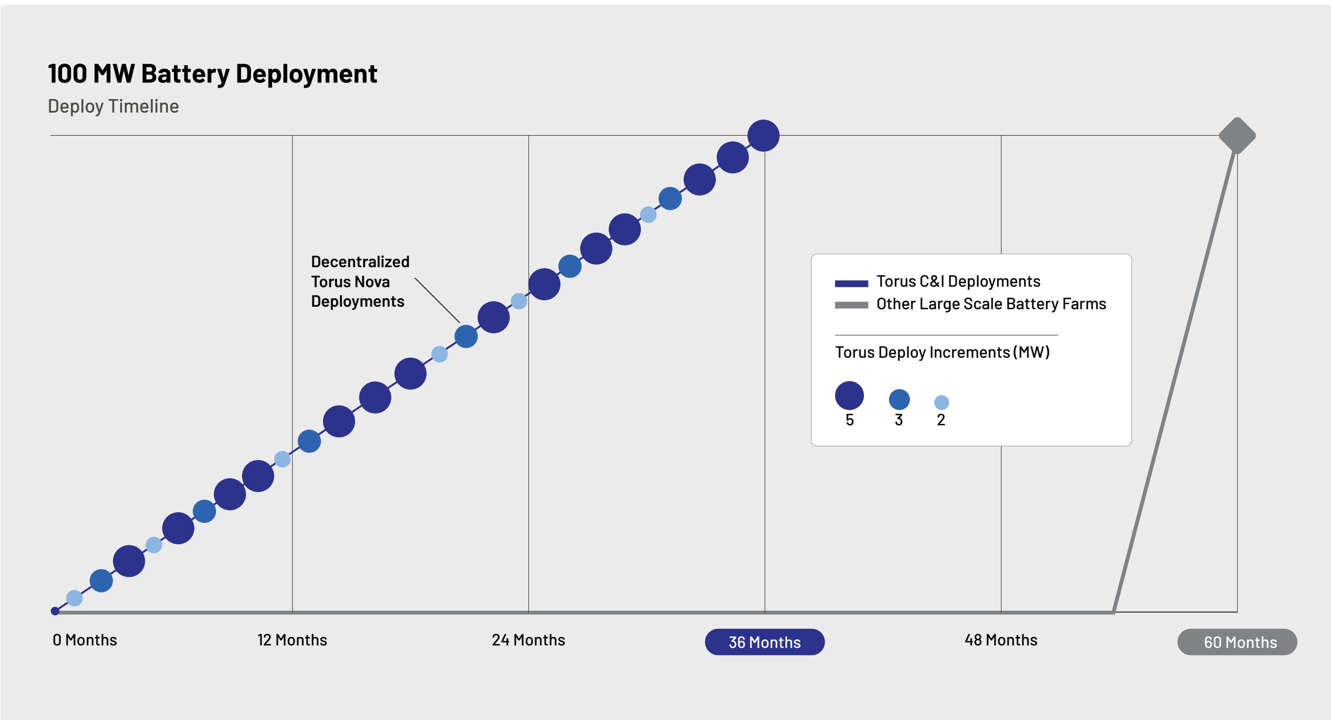
Torus Lasso™ is an AI-driven energy asset management software designed to optimize operations for utility companies and commercial customers by coordinating power flows among distributed energy resources. Its advanced capabilities enhance grid management and operational efficiency.


TORUS

CHAPTER 3

UNLOCKING VALUE THROUGH FULL-STACK, VERTICALLY INTEGRATED SOLUTIONS

In opposition to point solutions that only solve one variable in a larger ecosystem of energy challenges, Torus offers a comprehensive suite of vertically integrated energy storage and management solutions that address critical challenges in power quality, peak load, greenhouse gas emissions, and cybersecurity. Their systems enhance grid stability and operational efficiency for utilities while also benefiting behind-the-meter customers like data centers and commercial buildings. The net outcome of this two-way benefit, for both utilities and consumers, allows Torus to solve energy challenges at scale across the grid. Additionally, Torus' ability to bring quality power online in rapid succession, allows the ramp up of new energy to the grid much faster, cheaper, and with less red tape than the building of a new solar farm or another large-scale infrastructure project.



This breakthrough of both speed and scale serves as a powerful catalyst to enhance our electrical grid's quality, stability, and performance – delivering superior outcomes for both consumers and energy producers. Beyond these immediate benefits, it has the potential to be a catalyst to help resolve our national energy challenges, paving the way toward a more sustainable and reliable future. Critical elements of Torus's unique solutions include:

Full-stack technology suite

In contrast to other point solutions or solely software or hardware add-ons, Torus offers a comprehensive solution that integrates hardware, firmware, software, security, and operational support to provide robust energy solutions that are modular and scalable for various applications.

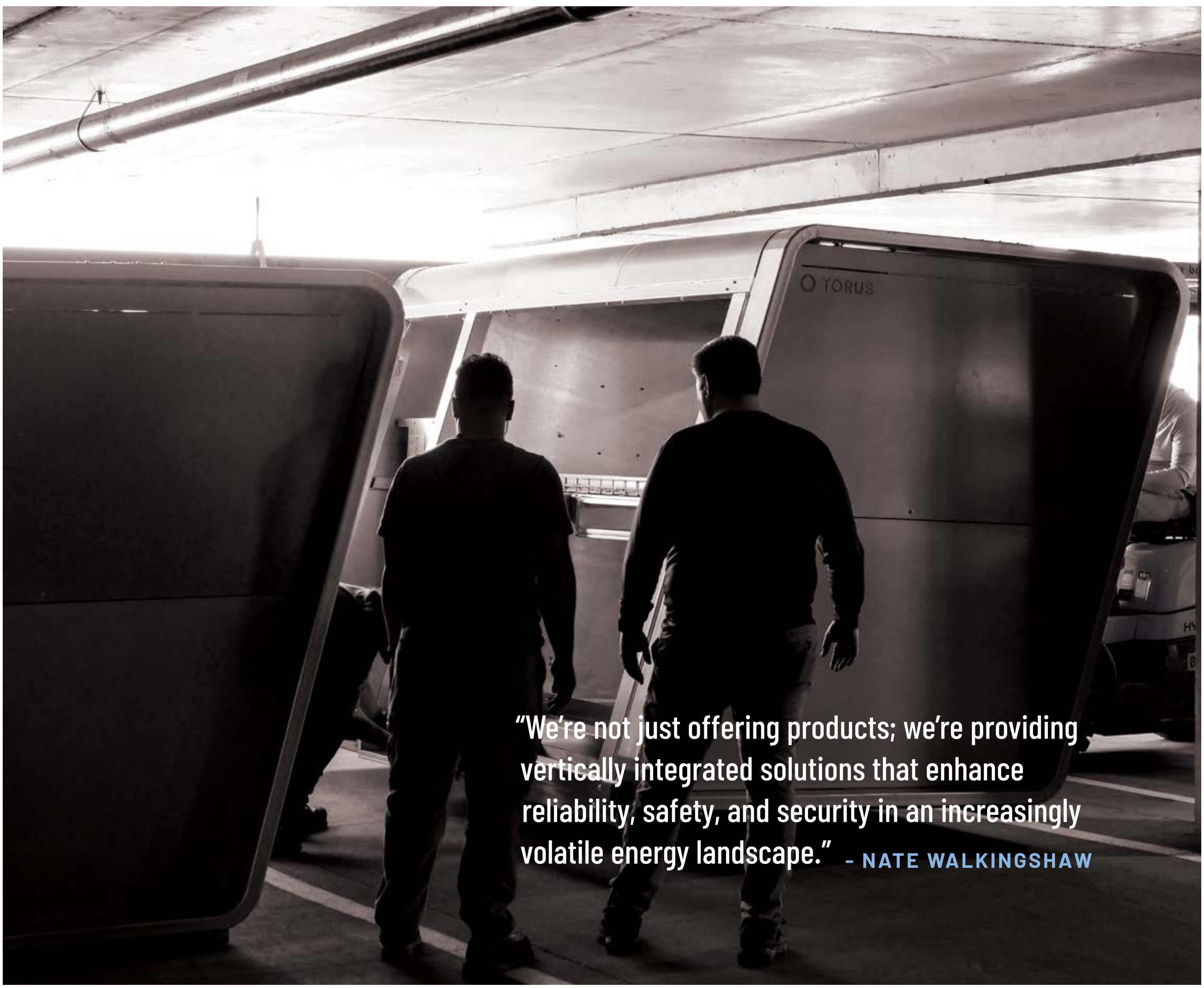
Key product offerings

The company provides three main products each designed to meet specific energy storage and grid management needs:

- Torus Spin™ — Flywheel energy storage system with advanced power conditioning
- Torus Pulse™ — Advanced battery storage system with 2x longer lifespan
- Torus Shield™ — Cybersecurity hardware that prevents unauthorized intrusions
- Torus Overwatch™ — 24/7 performance & cybersecurity monitoring with O&M support
- Torus Lasso™ — AI-powered energy asset management software

Enhanced security measures

In a world where cyber threats run rampant and are increasingly common and damaging, all Torus stations include built-in cybersecurity features and 24/7 performance monitoring, contributing to national security by protecting essential energy assets and ensuring reliability in power-dependent environments.



HOW ARE TORUS SOLUTIONS ENABLING KEY PILLARS OF U.S. GRID TRANSFORMATION?

Torus' full-stack technology and integrated offering enable four key value drivers and strategic pillars of U.S. grid modernization and transformation: decentralization, modularity, speed to solution, and grid-level scale.

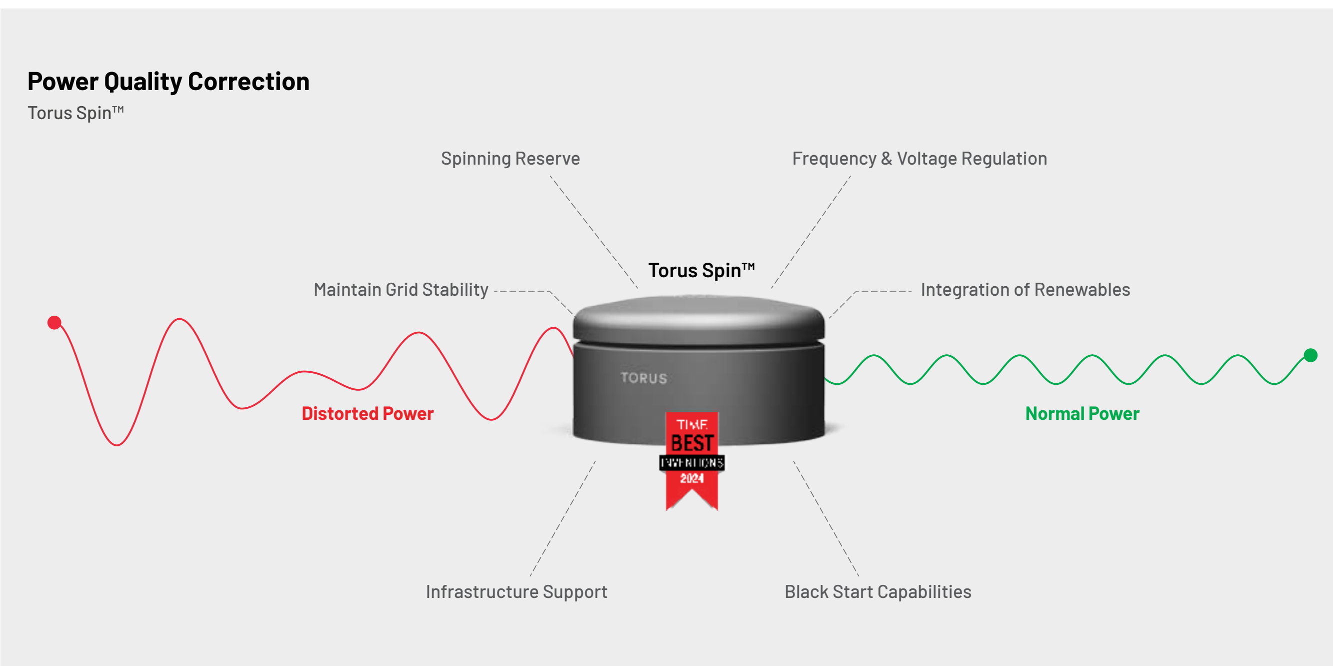
Decentralization

Torus enables a decentralized grid architecture by delivering energy storage and management solutions at the distribution level – closer to where energy is consumed. This localized model reduces transmission losses and mitigates grid congestion, while improving reliability and resilience by isolating outages and preventing cascading failures. Torus' full-stack modular power plants, capable of system-level orchestration, serve as the "connective tissue" across distributed energy resources, enabling coordinated dispatch and visibility. In an aging, centralized grid under increasing strain, Torus transforms decentralization into a strategic advantage – empowering utilities and end-users with flexible, responsive capacity at the edge.

Modularity

Unlike one-size-fits-all infrastructure, Torus' modular power plants provide targeted, inertial-based grid support while simultaneously lowering costs and improving reliability for commercial and industrial customers. Expand grid capacity and improve on-site power. Torus' full-stack technology and integrated offering enable four key value drivers and strategic pillars of U.S. grid modernization and transformation: decentralization, modularity, speed to solution, and localized grid support.

> "Our strategy is straightforward: decentralize what's been centralized for decades, and modernize what's aging. We're building the connective tissue that makes the existing grid intelligent." - **GIL LEE**



Speed to Solution

Torus dramatically accelerates grid modernization through modular, sub-20 MW deployments that bypass the regulatory bottlenecks of large-scale transmission projects. Unlike traditional battery farms that can take 5-10 years due to required interconnection studies and long permitting timelines for large generator agreements, Torus stations can be deployed in months. By leveraging small generator interconnection mechanisms and installing them at existing commercial and industrial sites, Torus avoids the need for major new infrastructure build-out. Its rapid deployment model provides utilities with immediate relief to high-strain grid segments and offers a cost-effective alternative to peaker plants or transmission upgrades.

"Decentralization is the key to scaling energy infrastructure. Virtual power plants break apart the old monolithic model—and that works for both existing infrastructure and new builds."

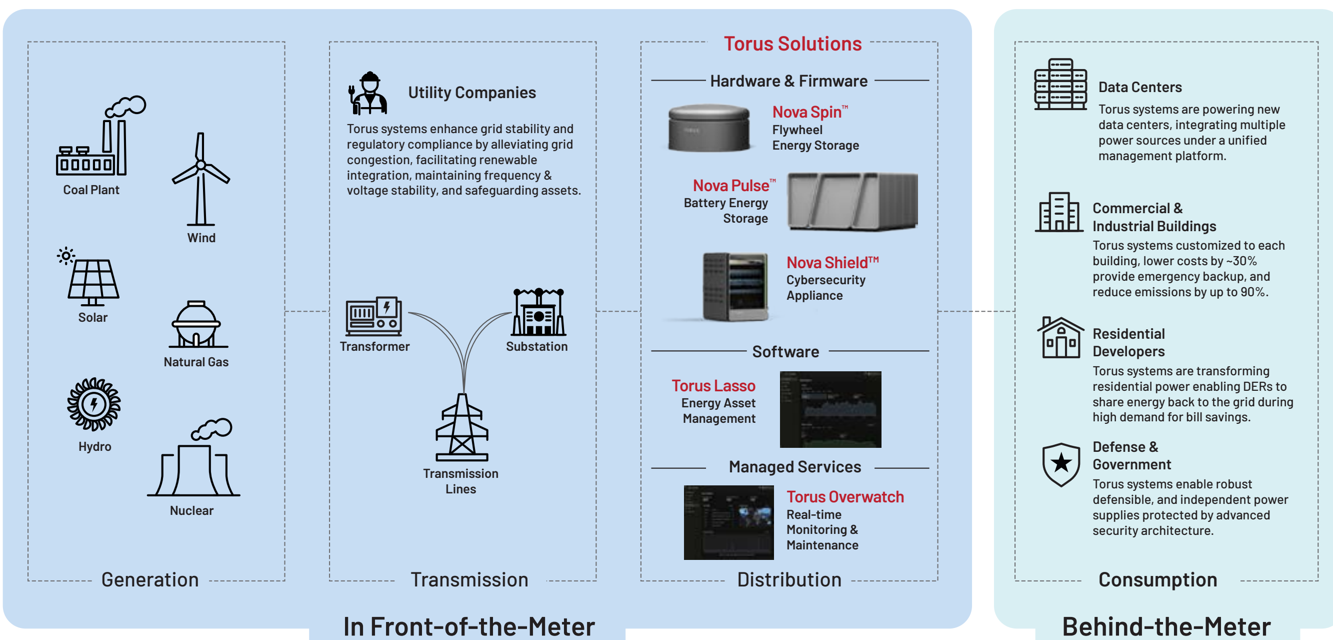
– NATE WALKINGSHAW

Grid-Level Scale

Torus is uniquely positioned to scale across the U.S. grid due to its national grid-level certifications (NERC, FERC) enabling approved participation in established utility demand response programs, such as Rocky Mountain Power's Wattsmart. As one of only two qualified commercial vendors under Tariff 114, Torus can deliver grid services under a unified programmatic framework. Its utility-integrated platform enables seamless participation in both customized PPAs and standardized tariff schedules, creating scalable pathways for growth nationwide. By tapping into existing demand response infrastructure, Torus can rapidly expand capacity by enrolling customers into approved programs – avoiding lengthy procurement processes and capital-intensive generation projects. With the DOE projecting up to 160 GW of virtual power plant capacity by 2030, Torus stands as a turnkey enabler of grid-scale transformation.

> "Probably the most important horizontal thing that we've been able to do is we have been approved and certified on the National Grid level. You can take Torus to any utility in the country, and we have checked all the NERC and FERC boxes...You can only do that if you're a vertically integrated product." **- GIL LEE**

In Front or Behind the Meter



> "When utilities install our systems, they can address congestion, generation, and power quality issues all at once—in front of or behind the meter. But the real value is freeing up capacity for new loads they're turning away today." **- GIL LEE**

WHO IS THE CUSTOMER AND HOW DOES IT HELP THEM?

Torus Solutions	Who is the customer?	How does it help?
Torus Spin™	• Utilities & Grid Operators	• Maintains grid stability by delivering reliable, high-quality power • Offsets large, sudden demand spikes, improving operational lifespans • Reduces reliance on synthetic inertia and environmental impact
	• Commercial and Industrial (C&I)	• Delivers reliable, high-quality power to ensure uninterrupted operations • Protects sensitive equipment from damage • Lowers peak demand charges and improves operational lifespans
Torus Pulse™	• Utilities & Grid Operators	• Enhances grid stability by helping relieve transmission congestion • Facilitates renewable energy integration • Meets regulatory compliance standards, while modernizing the grid
	• Commercial and Industrial (C&I)	• Improves operational efficiency • Lowers GHG emissions • Provides modular, scalable storage
Torus Shield™	• Utilities & Grid Operators	• Safeguards against heightened security risks to ensure regulatory compliance • Enables secure DER integration and energy storage system connectivity
	• Commercial and Industrial (C&I)	• Safeguards against heightened security risks to minimize operational disruptions • Enables secure DER integration and energy storage system connectivity
Torus Overwatch™	• Utilities & Grid Operators	• Bolsters system-wide and asset-specific observability, visibility, and security • Reduces operational complexity with in-house O&M services
	• Commercial and Industrial (C&I)	• Integrates 24/7 monitoring and expert O&M support to optimize systems • Ensures reliability, security, and regulatory compliance

Torus Lasso™	• Utilities & Grid Operators	• Provides advanced node-level asset controls to optimize grid operations:
		  ◦ Ease congestion with targeted support for overburdened assets
		  ◦ Minimize transmission fees

	• Commercial and Industrial (C&I)	• Orchestrates power flows between energy assets for optimized operations:
		  ◦ Bill savings
		  ◦ Emission reductions

TORUS SPIN™

Flywheel Energy Storage

The Torus Spin™ is an innovative flywheel energy storage system that enhances grid stability and efficiency through mechanical energy storage. Recognized as one of TIME's Best Inventions of 2024, it is designed to support a cleaner and more resilient energy grid while being environmentally friendly due to its recyclable materials and extended lifespan.

Product Overview

Rapid Energy Delivery

Torus Spin™ can deliver power up to 10 times faster than traditional batteries, responding to grid demands in milliseconds and enhancing power quality through features like voltage regulation and distortion mitigation.

Environmental Benefits

By reducing reliance on fossil fuel standby generators, the Torus Spin™ lowers greenhouse gas emissions, contributing to a more sustainable energy future. Its design extends the lifespan of chemical batteries, further decreasing overall storage costs.

Unique Capabilities

The system features bi-directional energy storage, high power density, and fast charge/discharge cycles, making it highly efficient and reliable with minimal maintenance needs. Its modular design allows for scalability, accommodating growing energy demands.

> "In the hardware space, we have the Torus flywheel energy storage device – that's the crown jewel. This is a giant, massive rotor spinning in vacuum, being magnetically levitated with a motor generator. And it's storing kinetic energy." – NATE WALKINGSHAW

What Torus Spin™ is Solving For

As grid demands rise, the rapid response, high efficiency, and mechanical durability of the Torus Spin™ position it as a key enabler of a more resilient, flexible, and sustainable energy future. Increasing transmission congestion, renewable integration, and stringent regulatory requirements pose grid stability challenges – modern demands which legacy systems and aging infrastructure were not designed to handle. Solving for these critical industry constraints, Torus Spin™ enables a more reliable and economical grid for all stakeholders.

Key Challenge	What we are doing to solve for this challenge
Power Quality	**Improves Power Quality** Torus Spin™ improves power quality by correcting voltage and frequency fluctuations through low voltage ride through, power factor correction, voltage regulation, and distortion mitigation
Peak Load & Outage Threats	**Facilitates Peak Shaving** Torus Spin™ facilitates peak shaving and load leveling by storing energy during low-demand periods and releasing it during high-demand periods, optimizing grid operations and reducing peak demand charges
Greenhouse Gas Emissions	**Lowers GHG Emissions** Its spinning reserve capabilities allow Torus Spin™ to lower emissions by reducing reliance on fuel-consuming standby generators that emit carbon emissions while idling
Aging Infrastructure	**Reduces Burdens on Aging Assets** Torus Spin™ reduces the burdens of aging infrastructure by improving operational lifespans. Extending the lifespan of chemical batteries by 2x lowers levelized storage costs, while also delaying the need for costly investments in upgrades or expansions to supply

Product Capabilities

The Torus Spin™ has unique capabilities inherent to its flywheel technology and inertial-based storage, including energy storage and retrieval, high power density, fast charge and discharge cycles, scalability and modularity, high round-trip efficiency, and maintenance and reliability.

Bi-Directional Energy Storage and Retrieval: As a flywheel system, Torus Spin™ stores energy through high-speed rotor motion, maintains it in the form of kinetic energy, and acts as a generator when discharging the energy. This allows for seamless transitions between storage and retrieval modes, supporting grid flexibility and instant availability.

High Power Density: Due to the mechanical nature of energy storage, the Torus Spin™ can deliver large amounts of power over short durations and responds in just 250 milliseconds – ideal for applications requiring immediate energy demand.

Fast Charge and Discharge Cycles: Not only can the Torus Spin™ support rapid energy delivery, but it is also well-suited for high-frequency use without significant degradation. It can quickly ramp up to full power and is designed to handle hundreds of thousands of charge-discharge cycles.

Scalability and Modularity: Its modular design allows operators to add more flywheels in parallel to increase energy storage capacity or power output.

High Round-Trip Efficiency: From small installations to utility-scale storage systems, Torus Spin™ achieves round-trip efficiencies of 88% with low standby losses (250W per hour) attributable to vacuum-sealed chambers and the use of low-loss bearings.

Maintenance and Reliability: The mechanical design of Torus Spin™ produces a durable solution with fewer maintenance requirements and consistent performance, unaffected by temperature fluctuations in any environment.

Key Stats	System Certifications
• 25-Year Lifespan with 50,000+ Power Cycles • 10x Faster Charging & Discharging • 250-ms Response Time • 85% - 95% Round-Trip Efficiency (website) • 88% Round-Trip Efficiency (MRD – data room) • 95% Recyclable • 100 kW – 5 MW Power Rating of scalable modules	• IEEE 1547-2018, IEEE 1547.1-2020, IEEE 1547.4-2011 • UL 9540, UL 1741 • ISO 9001, ISO 14001 • IEC 61850, IEC 62351

TORUS PULSE™

Chemical Battery Storage

The Torus Pulse™ is a modular lithium-iron phosphate battery energy storage system designed to provide reliable and scalable base-load power for various applications. It integrates with the Torus Spin™ flywheel system to enhance energy delivery and efficiency.

Product Overview

Steady Power Supply

Torus Pulse™ delivers consistent baseload power for long-duration applications, supporting energy demands from hundreds of kilowatt-hours to multiple megawatt-hours. Its modular design allows for adaptability in grid applications.

Advanced Safety Features

The system includes a high-performance battery management system (BMS) that monitors cell voltages and currents in real-time, ensuring safety and longevity while managing thermal risks.

Grid Independence

Torus Pulse™ enables microgrids to operate autonomously during outages, providing backup power and enhancing grid stability for utilities and commercial settings.

What Torus Pulse™ is Solving For

The Torus Pulse™ is a secure, grid-responsive storage solution that plays a critical role in addressing key grid reliability challenges faced by utility companies and C&I buildings. It adapts to growing energy demands, providing stable, cost-effective power at any scale.

Key Challenge	What we are doing to solve for this challenge
Peak Load & Outage Threats	**Reduces Peak Load Demands** Torus Spin™ facilitates peak shaving and load leveling by storing energy during low-demand periods and releasing it during high-demand periods, optimizing grid operations and reducing peak demand charges
Peak Load & Outage Threats	**Lowers GHG Emissions** Torus Pulse lowers GHG emissions by maximizing renewable utilization and substituting fossil peakers

Product Capabilities

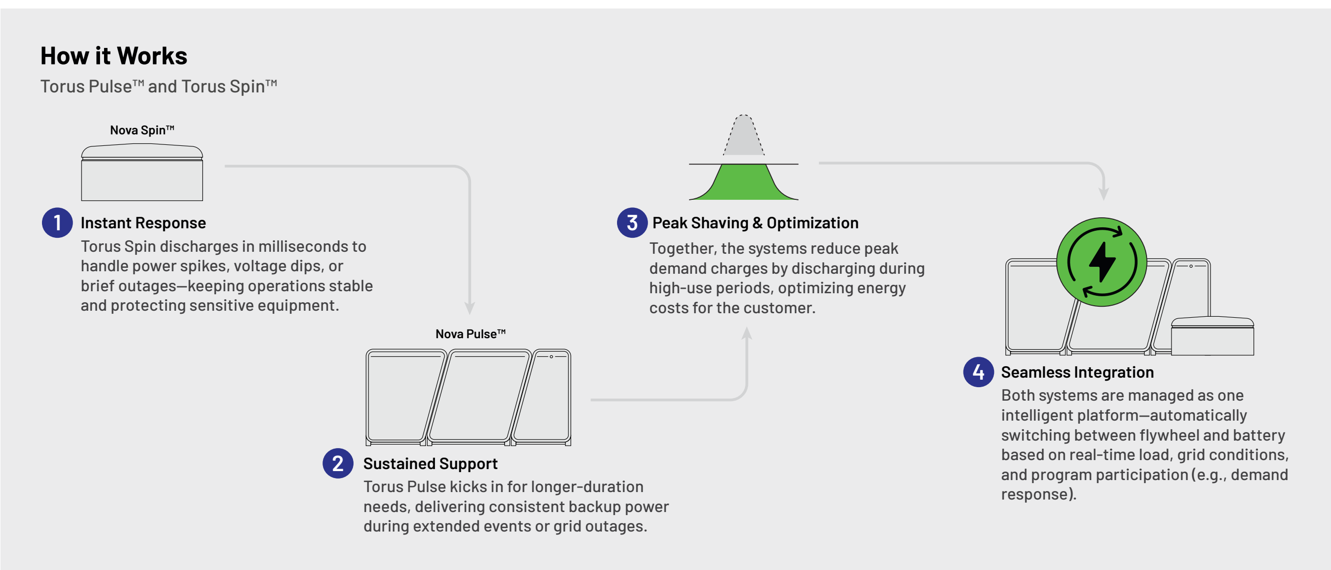
Torus Pulse™ is designed to provide sustained energy delivery, offering long-duration energy storage for load shifting and peak shaving applications, with flexible discharge durations from 1 to 8 hours.

> **Advanced Battery Chemistry:** The Torus Pulse™ leverages lithium iron phosphate (LiFePO4) cells to offer superior safety, performance capabilities, and sustainability compared to traditional lithium-ion batteries, and require fewer rare earth minerals.
>
> **High Energy Density:** Torus Pulse™ is able to achieve high energy densities of 265 Wh/kg by utilizing high-performance battery cells.
>
> **Scalability and Modularity:** The Torus Pulse™ modular architecture enables capacity expansion to meet varying needs, while standardized battery modules facilitate installation and ease of maintenance.

Torus Pulse™ has several advanced control features enabling real-time optimization and adjustments. A dynamic dispatch feature monitors real-time grid conditions and market signals to appropriately adjust output, and integration with the Torus Lasso™ EMS introduces predictive scheduling capabilities, dispatch optimization, and improved energy management.

> **Battery Management System (BMS):** The BMS ensures safe and optimal operation of Torus Pulse™ assets through real-time monitoring of cell voltages and currents. Advanced balancing algorithms equalize state of charge (SoC) across cells to extend battery life.
>
> **Thermal Management System:** Torus Pulse™ is designed with active cooling systems to maintain optimal operating temperatures, enhancing performance and longevity, while redundant cooling units prevent thermal runaway.

When paired with the Torus Spin™, the hybrid system leverages the strengths inherent to each – capitalizing on high energy density from BESS and high-power density from FESS – to offer a flexible, cost-effective approach to enhancing grid stability.



Key Stats	Additional Data Points
• 2x Longer Lifespan of 20 years (when paired with Torus Spin™) 　• >7,000 Cycles at 80% DoD • 270 kWh – 2.2 MWh Scalable Modules (expandable to 40 MWh) • 90-95% Round-Trip Efficiency (MRD – data room) 　• 93% Round-Trip Efficiency (website) • 265 Wh/kg Energy Density	• 250-ms Response Time; 40x Faster than an online generator • 25-35% Bill Savings compared to diesel generator total cost of ownership

TORUS SHIELD™

Cybersecurity & Intrusion Prevention

The Torus Nova Shield™ is a sophisticated security hardware solution designed to protect energy assets from unauthorized access and cyber threats. It integrates advanced cybersecurity measures across the Nova suite to ensure robust protection against evolving risks.

Product Overview

Advanced Security Architecture

The Torus Shield™ employs a multi-layered defense mechanism based on the Purdue Reference Model, utilizing modern firewalls and intrusion detection systems (IDS) to monitor and filter network traffic effectively.

Zero Trust Principles

Implementing a zero-trust architecture, it requires verification for all users and devices, ensuring that local network access is strictly controlled and monitored, thereby minimizing exposure to remote attacks.

Risk Management Features

The system includes continuous vulnerability scanning, multi-factor authentication, and compliance with encryption protocols, reinforcing its capability to safeguard communications and data

Resilience and Redundancy

Designed for operational continuity, the Torus Shield™ features fail-safes, disaster recovery protocols, and secure software updates, positioning it as a critical asset for utilities and energy integrators facing heightened cybersecurity threats.

> "We have full intrusion detection prevention at every asset; we can literally look for and see if there are attacks coming at that very system. We also do constant risk assessment, risk management, and vulnerability scanning of the infrastructure that we have deployed." **- TRENT BOND**

What Torus Shield™ is Solving For

Rising energy demands in a rapidly transforming industry welcome an increased need to protect energy storage systems from security threats. The critical nature and growing interconnectivity of energy systems makes them prime targets for cyberattacks. Disruptions can have wide-reaching consequences, from operational downtime to compromised data, demanding robust approaches to ensuring grid stability.

Key Challenge	What we are doing to solve for this challenge
Asset Cybersecurity, Grid Stability	**Bolsters Asset Cybersecurity** Torus Shield™ bolsters asset cybersecurity by providing a dedicated, hardened defense layer for all deployments. It ensures critical assets are equipped to withstand growing threats, minimize potential disruptions, and comply with regulatory compliance

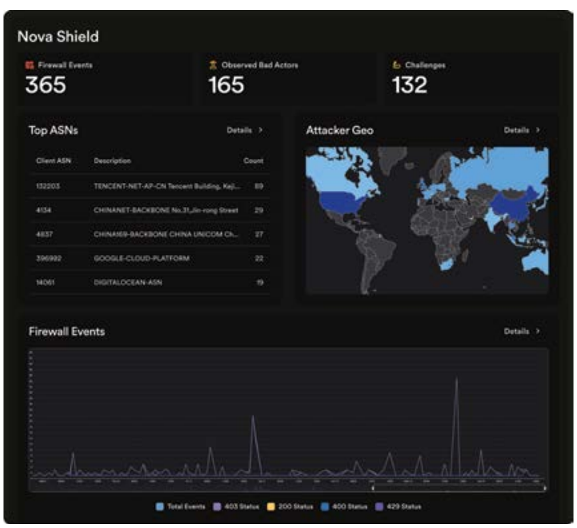
Product Capabilities

The key functionalities of Torus Shield™ – all to ensure assets are safe and secure – include real-time monitoring and alerts, automated threat response, authorization policies, network segmentation, firmware and software updates, risk management, and resilience & high availability.

24/7 Asset Surveillance: It's equipped with 4K PTZ night vision cameras, SCADA performance telemetry, ICS cybersecurity event collection (including firewall logs, intrusion detection, camera events, and asset inventory updates), enabling comprehensive asset surveillance 24/7.

Dashboard Visibility & Real-Time Alerts: The system is equipped with a dashboard interface that provides a centralized view of security status and system health and pushes customizable alert notifications (via web-app, email, SMS) for various threat levels and events, simplifying monitoring and continuous visibility to protect critical energy assets.

Automated Threat Response: Upon threat detection, automated response protocols immediately isolate affected components and quarantine suspicious traffic for further analysis.



Network Segmentation: The system uses virtual LANs (VLANs) and access control lists (ACLs) for network segmentation, minimizing lateral movement of threats.

Authentication and Authorization: Access control is tightly enforced through multi-factor authentication (MFA) and integration with existing authentication systems, while authorization policies provide granular control across users, roles, and devices. To protect the authenticity of updates, the Torus Shield™ has firmware and software in place to ensure integrity and allow users to revert to previous versions if necessary.

Key Stats	Regulatory & Compliance Standards
• 24/7 Asset Surveillance • 4K PTZ night vision cameras	• NERC CIP & NIST SP 800-53 and 800-82 Controls (security and privacy) • TLS 1.3 for Data in Transit (secure communication) • AES-256 for Data at Rest (stored data encryption) • IEC 62443 for Security of Industrial Automation and Controls • FIPS 140-2 for Cryptographic Module Validation

TORUS OVERWATCH™

24/7 Performance & Cybersecurity Monitoring with O&M Support

Torus Overwatch™ is a comprehensive suite of managed services designed to enhance security and performance of energy infrastructures through 24/7 monitoring and expert support.

Product Overview

Integrated cybersecurity and O&M platform

Torus Overwatch™ combines advanced cybersecurity measures with Operations & Maintenance support to monitor and secure energy systems, ensuring compliance and optimizing performance.

Multi-layered security architecture

The system employs a robust security framework, including firewalls, Intrusion Detection Systems (IDS), and strict access controls, to protect against cyber threats while ensuring data integrity and privacy.

Seamless integration with systems

Torus Overwatch™ supports various energy protocols and provides APIs for easy integration with third-party platforms, allowing utilities to monitor grid assets without disrupting legacy systems.

Predictive maintenance and analytics

The platform uses machine learning for predictive maintenance, optimizing schedules and enhancing asset longevity while providing real-time performance tracking and compliance reporting.

What Torus Shield™ is Solving For

As the energy industry evolves, so do the needs for asset monitoring, protection, and maintenance. The Torus Overwatch™ addresses key challenges through an integrated platform to enhance security, optimize performance, and ensure compliance.

Key Challenge	What we are doing to solve for this challenge
Aging Infrastructure, Outage Threats	**Extends Asset Lifespans and Reduces Downtime** Torus Overwatch™ extends asset lifespans and reduces downtime through optimized asset maintenance and performance made possible through predictive analytics and real-time monitoring
Asset Cybersecurity, Grid Stability	**Safeguards Against Security Threats** Torus Overwatch™ safeguards against asset cybersecurity threats with 24/7 asset surveillance and real-time tracking of millions of points of telemetry across Nova assets

> "Overwatch is our command center—it's the real-time monitoring and control of distributed energy assets across the entire network." – **TRENT BOND**

Product Capabilities

Torus Overwatch™ has a wide range of functionalities, ranging from predictive maintenance to data backups and failover systems.

24/7 Real-Time Monitoring, Control & Alerts: Its real-time monitoring and control capabilities provide live visualizations of current system operations and enable operators to issue control commands directly to devices and systems. Users receive timely asset notifications pushed via web-app, email, or SMS.

Predictive Maintenance: Predictive maintenance tools leverage advanced failure prediction models to analyze sensor data, forecast equipment degradation, and establish maintenance schedules that minimize environmental impact.

Energy Optimization: Overwatch™ also seeks to minimize impact through load balancing and demand response practices, in which energy is distributed efficiently across systems and operations are adjusted based on energy pricing and availability.

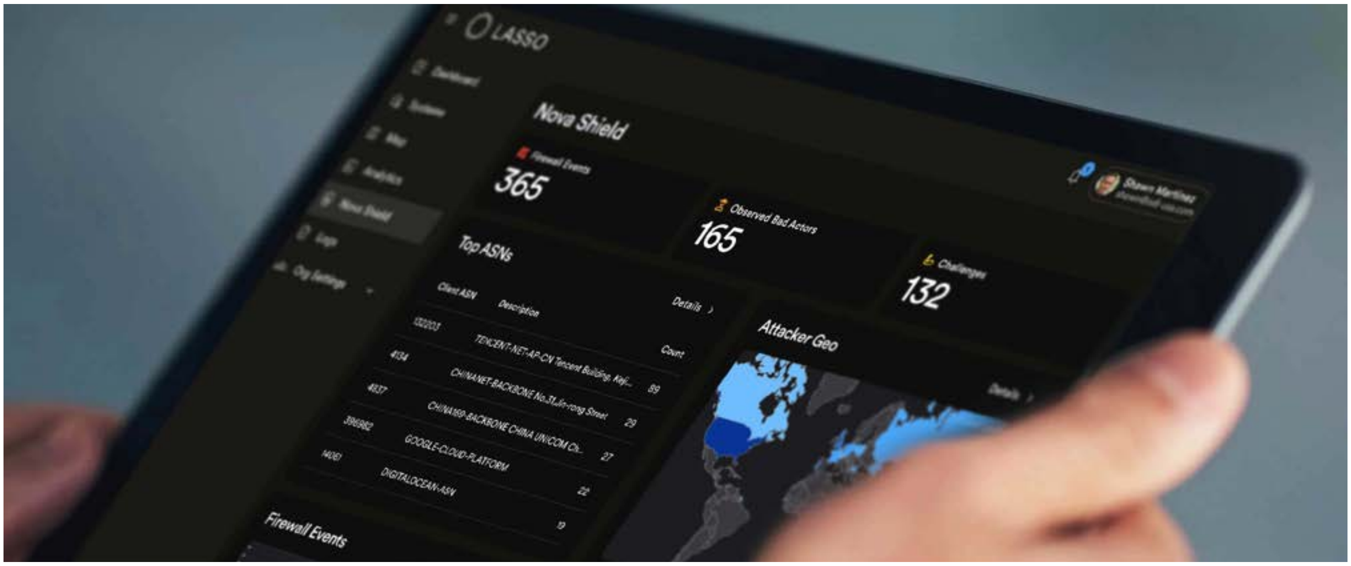
Regulatory Reporting: The platform also simplifies regulatory reporting with automated report generation (for standards like NERC CIP and IEC 62443), complemented by compliance dashboards that visualize regulatory status in real time.

Disaster Recovery: For disaster recovery, Overwatch™ includes regular data backups with verification protocols and automated failover systems that automatically switch to backup systems if failure is detected.

Incident Response: Incident response automation is built into the system, with predefined actions programmed to trigger in response to security or operational events.

Key Stats	System Certifications
• 24/7 Real-Time Monitoring • Millions of Telemetry Datapoints gathered per day on Torus assets	• NERC CIP & FERC Standards • IEC 62443 (guidelines for industrial communication networks) • NIST 800-53 (information security standard) • Encryption protocols: NIST 800, TLS 1.3, AES-256 • Industry protocols: Modbus, DNP3, IEC 61850, and OPC UA

TORUS LASSO™



AI-powered Energy Asset Management Software

Torus Lasso™ is an AI-driven energy asset management software designed to optimize operations for utility companies and commercial customers by coordinating power flows among distributed energy resources. Its advanced capabilities enhance grid management and operational efficiency.

Product Overview

AI-Powered Management

Torus Lasso™ utilizes AI for real-time performance optimization and asset management across fleets of distributed energy resources, improving grid stability and compliance with regulations.

Advanced Features

Key features include scheduling and dispatch, support for ancillary services, interoperability with existing systems, and robust cybersecurity measures, ensuring efficient and secure operations.

Data Analytics and Insights

The platform offers advanced data logging, analysis, and AI-driven insights, allowing users to monitor asset health and predict failures, enhancing maintenance and operational longevity.

System Resilience

With a fault-tolerant architecture and strict compliance with security standards, Torus Lasso™ ensures continuous operation and data protection against potential threats.

> "The reason why we call our software Lasso is because it gives utility operators the ability to pinpoint, very precisely, the specific areas of the grid that need support. Or, they can actually go ahead and schedule the power dispatch that needs to occur against some other energy market need that they might have." **- DAVE RACKHAM**

What Torus Lasso™ is Solving For

The growing complexity of grid management demands an advanced energy management solution. The Torus Lasso™ unique value proposition lies in intelligent asset management and real-time performance optimization.

Key Challenge	What we are doing to solve for this challenge
Power Quality, Grid Stability	**Improves Grid Stability** As the integration of intermittent renewable sources, such as wind and solar, introduces variability and unpredictability, Lasso™ provides a sophisticated tool for real-time balancing and stability
Peak Load, Aging Infrastructure	**Enables DER Integration & Asset Coordination** Torus Lasso™ enables DER integration and multi-asset coordination which maximizes peak shaving and efficiency and further reduces strain on aging grid infrastructure.
Greenhouse Gas Emissions	**Reduces GHG Emissions** Through optimized dispatch, Torus Lasso™ helps reduce carbon emissions by maximizing use of clean energy and displacing higher-carbon sources when possible.

Product Capabilities

The advanced features and capabilities of Torus Lasso™ make it a secure and efficient product designed to meet evolving market needs.

Dynamic Scheduling and Dispatch: It uses advanced scheduling and real-time dispatch capabilities to adjust schedules to unexpected demand spikes or outages, optimizing overall system performance. By considering factors such as state of charge (SoC), degradation rates, regulatory compliance, and maximum charge/discharge limits, Lasso™ ensures safe, strategic, and compliant operations.

Support for Ancillary Services: Lasso™ supports a comprehensive suite of ancillary services including frequency regulation, voltage support, spinning and non-spinning reserves, and black start capabilities.

Advanced Data Analytics & Forecasting: Through sensors and IoT devices, Lasso™ collects real-time data on health parameters like temperature, pressure, vibration, and electrical characteristics. It also takes electricity prices, demand forecasts, asset availability and constraints, while leverages machine learning algorithms to predict failures, schedule proactive maintenance, detect anomalies, and flag suspicious behavior.

Dashboard Visibility: A customizable dashboard reflects KPIs and tracks asset performance overtime, providing insights into product health and degradation patterns, improving asset maintenance and longevity.

Integrated AI Support: Torus Lasso™ has integrated AI tools, such as a GPT-like interface and adaptive learning models that provide actionable recommendations for dispatch, maintenance, and market participation, improving prediction accuracy and operational efficiency over time with system use.

System Resilience and Redundancy: Lasso™ features a fault-tolerant architecture with redundant hardware, automatic failover, and distributed disaster recovery. Load balancing and self-healing capabilities ensure service continuity, protecting against downtime and data loss.

Key Stats	Regulatory Compliance & Operational Standards
• 99.9% Uptime of all Lasso-controlled assets • 4x Faster Response of Lasso-controlled assets than grid requirements • 250-ms Updates on Lasso-controlled assets	• NERC CIP Compliance: Meets Critical Infrastructure Protection standards for cybersecurity • ISO/IEC 27001 Certification: Adheres to international standards for Information Security Management Systems (ISMS) • GDPR Compliance: Ensures data privacy and protection in line with the General Data Protection Regulation where applicable • IEEE and IEC Standards: Complies with relevant standards for power system operations and communications. • FERC Requirements: Aligns with Federal Energy Regulatory Commission regulations for energy trading and reporting.

TORUS' INTEGRATED SOLUTIONS ENABLE KEY COMPETITIVE ADVANTAGES

Torus Solutions vs. Large-Scale Battery Storage

What are the limitations of large-scale battery storage and how is Torus differentiated?

Traditional large-scale energy storage typically involves fields of containerized lithium-ion batteries – such as Tesla Megapack farms or Fluence grid-scale BESS – which provide bulk energy storage for utilities. These systems are achieving impressive scale with a record 18.2 GW of additional capacity growth from battery storage forecasted in 2025,[1] as they facilitate integration of renewables. However, they also face limitations in lifespan, speed, and grid support capabilities that Torus's hybrid solutions are designed to overcome.

Torus' differentiation from large scale battery storage providers boils down to a strategic focus on building vertically integrated, full-stack solutions that address key challenges in both energy storage and management at the sub-transmission and distribution layer of the grid.

Core Competencies in Energy Storage and Management

Torus' vertically integrated, full-stack solutions reflect a framing of challenges as not only an energy storage problem, but more importantly, an energy management problem. Unlike companies like Tesla and BYD – whose core competencies in electric vehicles and auto manufacturing have been leveraged to develop adjacent storage capabilities – Torus' systems have been engineered from the ground up with core competencies in both energy storage and management.

Nationally Certified by NERC and FERC

Leading battery storage players in the North American market (including Tesla, Fluence, and Sungrow) lack the required capabilities and technologies for certification to interconnect regionally or participate in utility-scale demand response programs, such as Rocky Mountain Power's Wattsmart Program.

Targeted Sub-Transmission and Distribution Layer Focus

Grid-scale battery storage is becoming an increasingly congested market with many players competing at the main transmission level. Torus diverges from conventional battery storage players by targeting the underserved sub-transmission and distribution layer of the grid. This unique positioning allows Torus to provide value to both front-of-the-meter and behind-the-meter stakeholders.

> "We're focused on a market opportunity that other players are overlooking. Even if they pivot toward this space, they'll discover that managing thousands of distributed energy systems is fundamentally more challenging than operating one large facility. This requires deep expertise across hardware, power electronics, firmware, data, and software – investments we've been making for years. Our growing market traction proves we're on the right path."
>
> **– DAVE RACKHAM**

How does Torus provide a better solution?

Torus' strategic positioning and unique solutions in the market present a compelling alternative to traditional large-scale battery storage with faster deployment, improved power quality, optimized longevity and lifecycle costs, as well as greater control and security.

Modular deployment increases capacity faster

Installing smaller, decentralized systems at the sub-transmission and distribution level increases grid capacity faster, while providing targeted relief to sections of the grid experiencing the most strain. Large transmission-related projects and battery farms can take 5+ years to come online, whereas Torus can deploy modular units in months. This speed and agility are crucial as the grid needs solutions now to alleviate congestion and capacity issues.

Real inertial power enhances grid quality

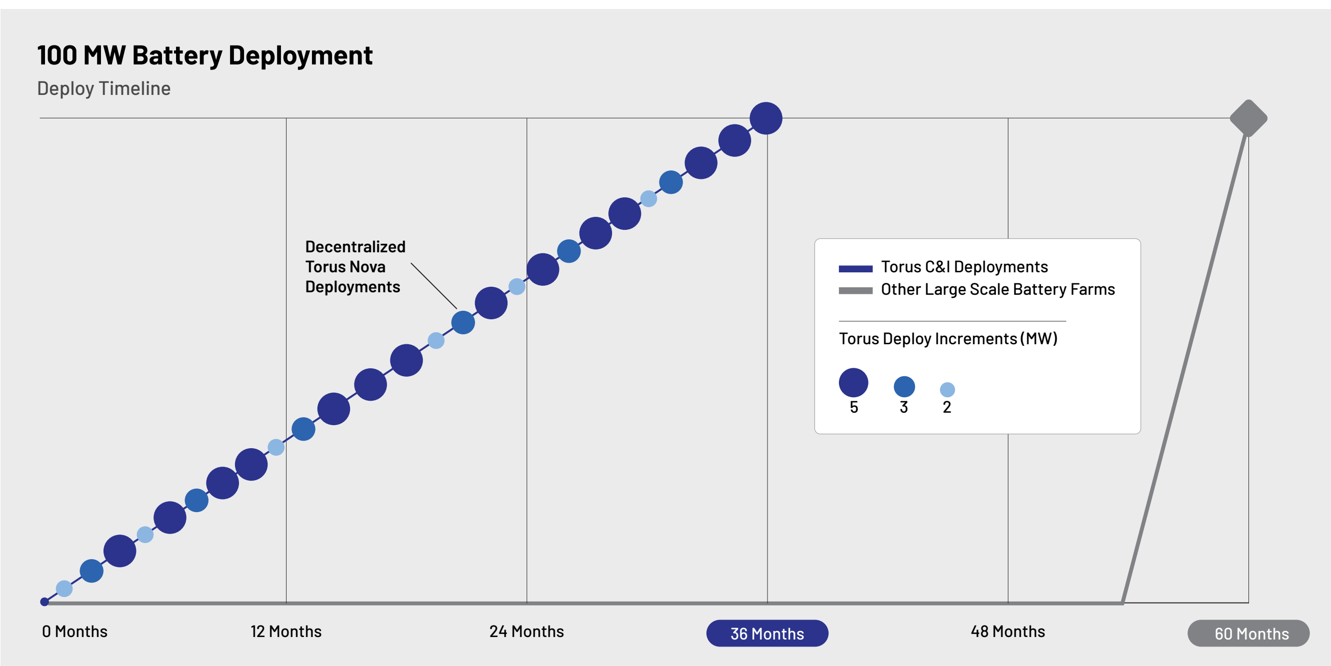
Torus' flywheel system provides real inertial power compared to synthetic inertial power from inverters tied to chemical batteries. Responding virtually instantaneously to disturbances, Torus' solutions can provide voltage and frequency stabilization more effectively than a typical battery farm – addressing a gap in many large BESS deployments. AC synchronous power also enables greater resilience with Torus stations through black-start capabilities.

Hybrid configuration optimizes longevity and lifecycle costs

The hybrid energy storage configuration – leveraging high-energy capacity of BESS and high-power output of FESS – results in an increased number of cycles and slower degradation curves compared to traditional battery storage systems. Flywheels exceed the typical cycle life of lithium-ion batteries by 2x, reducing replacement costs and lowering levelized cost of storage.

Greater control and security through vertical integration

Through a vertically integrated offering – from hardware and firmware to software and O&M support – Torus solutions provide an increased level of battery and node control to grid operators and building managers. Unlike large-scale battery operations which rely on third-party integrators or generic industrial control systems for security, Torus has made cybersecurity a core, built-in feature.



1. U.S. Energy Information Administration, "Solar, Battery Storage to Lead New U.S. Generating Capacity Additions in 2025," https://www.eia.gov/todayinenergy/detail.php?id=51437.

TORUS SOLUTIONS VS. DIRECT COMPETITORS

Torus is the only US-based company targeting vertically integrated, hybrid energy storage and management solutions with a domestic supply chain.

Currently, no other competitor offers the exact solution mix and capabilities that Torus does: a hybrid flywheel-battery, with integrated AI management and cybersecurity, targeting both behind-the-meter and front-of-meter applications. As the U.S. energy sector continues to modernize, these combined features position Torus as a promising player offering something not readily available from incumbent energy storage solutions.

One of only two U.S. flywheels for long-duration storage: Torus Spin™ is among just two commercially available flywheel systems in the U.S. that support discharge durations over 30 minutes, and one of fewer than five globally in either production or development.

Only flywheel with a fully domestic supply chain: Torus Spin™, comprised of 172 unique components, stands alone as the sole flywheel technology to have an entirely U.S.-based supply chain.

Only U.S. company offering vertically integrated hybrid FESS+BESS: Torus is the only U.S. firm developing a fully integrated hybrid flywheel and battery energy storage system, with only one other global player—UK-based Dumarey Flybird—entering the space via a 2024 BESS acquisition.

Differentiated design approach: The Torus Spin™ visually distinctive design breaks from the industry norm of containerized or industrial enclosures, offering a recognizable, innovation-forward aesthetic.

Integrated control for superior management: Fully integrated software and service architecture provides enhanced control over battery performance and node-level operations, benefiting both building owners and grid operators.

> "We, at Torus, are hyper-focused on our bill of materials and supply chain. And so you think about a flywheel energy storage device that has 172 different components on it...at Torus, that bill of materials is within 150 miles of our facility, cradle to grave."
>
> **- NATE WALKINGSHAW**

Company	HQ	Storage (In-Front)	Backup (UPS)	Grid Serv.	Hybrid Battery	Micro grid	EVs	C&I	Military	Renew. Energy
Amber Kinetics	USA	✓	✓	✓		✓		✓		
Quinte Q	Nether-lands				✓	✓		✓	✓	
RevTerra	USA					✓	✓			✓
Zooz	Israel						✓			
Rotor Vault	USA	✓	✓	✓						
Terra Loop	Finland	✓	✓	✓	✓		✓			✓
Adaptive	Germany				✓	✓	✓			
D. Flybird	UK				✓			✓		✓
Levistor	UK						✓	✓		
Piller Group	Germany		✓							
Active Power	USA		✓							
Beacon Power	USA			✓		✓				✓
Vycon	USA		✓			✓				✓
Helix Power	USA			✓		✓				
PowerThru	USA							✓		
Stornetic	Germany	✓	✓	✓	✓	✓		✓		✓
S4 Energy	Nether-lands				✓					
Torus	USA	✓	✓	✓	✓	✓	✓	✓	✓	✓

CHAPTER 4

GRID-SCALE SYNERGY

HOW THE TORUS–ROCKY MOUNTAIN POWER PARTNERSHIP IS SHAPING UTAH'S ENERGY FUTURE

Overview

In an era where climate resilience, infrastructure modernization, and energy independence have become critical, strategic partnerships are essential. Torus, a Salt Lake City-based leader in energy storage and grid solutions, has partnered with Rocky Mountain Power (RMP) to deliver one of the most ambitious energy demand response and energy reliability initiatives in Utah's history. This partnership will add 70 MW of demand response capacity, which is enough to power 20,000 homes. This collaboration, rooted in cutting-edge technology and shared mission alignment, exemplifies how cooperative innovation can unlock transformative grid solutions at scale.

Torus CEO & Co-founder, Nate Walkingshaw and RMP President, Dick Garlish, sign MOU to deliver 70 MW of demand response capacity powering approximately 20,000 homes with Torus Station technology, supporting Utah's Operation Gigawatt initiative during Utah Tech Week, 2025.

> "Enhancing and expanding the Rocky Mountain Power system is the key to meeting Utah's energy future. Collaborating with innovative leaders in technology and energy, like Torus, is essential to meet the goals of Operation Gigawatt." – **DICK GARLISH, PRESIDENT, ROCKY MOUNTAIN POWER**

Key Stats
• 70 Megawatts of commercial-scale distributed energy storage to be deployed under the MOU.
• 100+ Sites expected to participate across Utah and surrounding areas.
• 1 to 2 Megawatts per Site—typical system size for participating commercial and industrial facilities.
• 4–8 Hours of Duration for most installations, combining flywheel + battery storage.
• <250 Milliseconds response time from Torus Spin™ flywheel for real-time grid support.
• 25-Year design life for flywheel storage systems.
• Up to 10 Years of performance-based program compensation available to participating customers.
• 15-Year Agreement duration with options to extend under Wattsmart Battery program.
• 20%+ Peak Demand Reduction potential for many participants based on historical modeling.
• 100% Dispatchable assets managed directly by Rocky Mountain Power via Torus Lasso™

How Does the Partnership Function?

In February 2025, Torus and Rocky Mountain Power formalized a memorandum of understanding (MOU) to integrate the Torus suite of products, including the Torus Spin™ and Torus Pulse™, innovative energy storage systems into the acclaimed RMP Wattsmart Battery Program.

The Wattsmart Battery program enhances grid reliability to ultimately support Operation Gigawatt, Utah's statewide initiative to double electricity production within the next decade. The battery-specific arm of this RMP's Wattsmart program focuses on enrolling customer-sited batteries into a virtual power plant (VPP) network.

> "This technical implementation demonstrates how our relationship with Rocky Mountain Power will deliver both grid resilience and energy security. Demand response programs are crucial for managing grid challenges while reducing costs."
>
> **- NATE WALKINGSHAW**

Customers – commercial, or industrial – install eligible battery systems and enroll them in the program. In return, Rocky Mountain Power gains limited, utility-controlled access to discharge or charge the batteries during high-demand events. Participants receive upfront incentives (to help offset battery purchase/installation costs) and/or ongoing bill credits for allowing RMP to use their storage assets. Wattsmart enrolled batteries are used to reduce strain on the electrical grid by load shifting (charging during low demand, discharging during peak demand) and frequency regulation. Furthermore, customers who participate receive additional benefits like backup energy and can reduce energy costs through voltage support and peak shaving.

By storing energy when it is available and tapping into energy reserves (batteries) when the grid is strained, we can more effectively balance electricity supply with electricity demand without adding more electricity generation. This relationship represents more than a vendor-client engagement—it's a joint mission to accelerate clean, flexible, and secure energy solutions across the state.

Who Benefits from the Partnership?

Utah Communities benefit from enhanced energy security, less energy waste, and increased resilience – especially important for data centers and industrial operations relying on uninterrupted power.

Rocky Mountain Power gains robust, agile storage assets to better manage peak loads, support renewable integration, and stabilize grid operations—crucial to managing Utah's rapid economic expansion.

The National Grid Ecosystem stands to gain insights from a DOE-recognized VPP model that sets the stage for broader deployments across the U.S.

Torus accesses one of the most progressive utility platforms in the western U.S., proving its technologies under real-world, grid-scale conditions.

What Does This Mean for Communities Outside of Utah?

The Torus–Rocky Mountain Power partnership stands as a model of collaborative infrastructure innovation. By pairing advanced storage systems with utility-grade operational integration, the partnership enables Utah to meet its growing energy demands sustainably and securely. As a recognized contributor to the Department of Energy's VPP Liftoff initiative, this relationship doesn't just serve Utah – it offers a blueprint for the national energy transformation.

"We partner closely with utilities like Rocky Mountain Power's Wattsmart program to deliver solutions that benefit both utilities and commercial customers. We keep critical equipment online, reduce service calls to the utility, and create value for everyone." **– PATRICK REEDY**

"Designing for peak demand is expensive for utilities. By helping offset that peak – both for utilities and their customers – we enable better use of existing infrastructure. That, in turn, allows utilities to grow their rate base and serve new loads like data centers and manufacturers that they'd otherwise have to turn away due to capacity constraints. We help unlock bottlenecks within the grid." **– PATRICK REEDY**


TORUS
TORUS

HOW TORUS AND GARDNER GROUP ARE ADVANCING ENERGY RESILIENCE THROUGH DISTRIBUTED STORAGE

Overview

In a rapidly evolving energy landscape, commercial real estate developers are increasingly challenged to balance economic performance with environmental stewardship and energy reliability. With growing grid instability, spiking utility costs, and the demand for sustainable practices, the stakes are high for organizations seeking energy resilience. For Gardner Group, one of the Intermountain West's leading commercial real estate developers, the answer came in the form of a strategic collaboration with Torus – a clean energy company offering cutting-edge distributed energy storage solutions.

Torus and Gardner Group recently announced a landmark agreement to deploy 26 megawatt-hours (MWh) of distributed energy storage across a portfolio of commercial properties. This initiative is now among the largest commercial and industrial (C&I) energy storage deployments in the Intermountain West. The deal exemplifies how innovative technology and financial models can deliver scalable sustainability and economic value for the real estate sector.

How are Torus Solutions being applied?

This application is made possible through the integrated Torus Station product suite, including:

Torus Pulse™: Chemical Battery that Lasts 2x Longer than Comparable Batteries (when paired with the Torus Spin™)

Torus Spin™: Flywheel Battery (with a less than 250ms response time)

Torus Shield™ and Torus Overwatch™: Powerful Security Hardware and O&M Platform

Torus Lasso™: AI Powered Energy Management Software

These Torus products are installed onsite at each Gardner Group property and connected through Torus Lasso™, a centralized software platform that enables real-time energy analytics, demand forecasting, and system optimization. This intelligent network not only reduces operational costs through peak shaving and time-of-use arbitrage, but also enhances energy resilience with backup power capabilities in the event of outages.

How does Torus add value?

The project is expected to create significant cost savings for the Gardner Group over the agreement's term, while also contributing to grid stability throughout the region. Additionally, the system's distributed nature enhances resilience at each location, ensuring critical operations can continue even in times of disruption.

Reflecting on the strategic partnership, Gardner Group CEO Christian Gardner emphasized the broader value of the project:

> "We are committed to adopting innovative solutions that drive sustainability and operational efficiency. Partnering with Torus allows us to optimize our energy management, reduce our carbon footprint, and provide enhanced value to our tenants. We look forward to the positive impact this project will have on our properties and the broader community." – CHRISTIAN GARDNER, CEO GARDNER GROUP

Key Stats
• 26 MWh of distributed energy storage being deployed
• <250 ms response time with Torus Spin™
• Multi-site deployment across Gardner Group's commercial real estate portfolio
• Reduced operational costs through peak shaving & time-of-use arbitrage
• Increased resilience with integrated backup power capabilities
• Grid support through distributed infrastructure during instability or demand spikes


TORUS

LA DIANA MARKET LIGHTS THE WAY: HOW A SALT LAKE GROCER BECAME A BEACON OF COMMUNITY ENERGY RESILIENCE

Overview

In Salt Lake City, a family-run grocery store is rewriting the narrative of energy resilience and sustainability. La Diana Market, a long-time local staple, has taken a transformative step into the clean energy future – one that not only benefits its business but uplifts the surrounding community as well.

As cities across the U.S. explore ways to decarbonize and localize their energy systems, the La Diana project offers a scalable and replicable blueprint. It is a shining example of how clean energy isn't just about electrons—it's about people, place, and the power of small businesses to lead the way.

How are Torus Solutions applied?

As part of a visionary partnership with Torus, La Diana Market now operates as a self-sustaining energy hub. Outfitted with solar panels and a Torus Station energy storage system, the small grocery store has effectively become a mini power plant: generating, storing, and intelligently managing its own electricity.

How does Torus add value?

But this project isn't just about clean energy – it's also about resilience. For a business like La Diana, where refrigeration and energy continuity are critical, even short power outages can be devastating. The new system ensures that backup power activates within 250 milliseconds, keeping essential systems running without disruption. It's a solution that delivers peace of mind alongside energy savings.

The initiative is a result of the Salt Lake Solar Powered Communities project, a program led by Salt Lake City's Sustainability Department in collaboration with Utah Clean Energy. Backed by a grant from the Urban Sustainability Directors Network (USDN) and augmented by federal tax credits and rebates, the project demonstrates how public-private cooperation can bridge the gap for small businesses seeking access to next-generation energy technology.

But the most innovative part of the La Diana deployment lies in its community impact. Torus Community™ enables residential and commercial customers to share clean power with their wider community when the grid is in need. This means that the market doesn't just store energy for its own use – it shares surplus power with other nearby businesses during times of peak demand. It's a decentralized model for grid support, in which energy independence and local cooperation go hand in hand

> "By bringing our advanced energy storage and solar solution to La Diana, we're helping a valued local business reduce operating costs while strengthening our community's energy resilience." – **NATE WALKINGSHAW**

Key Stats
• 24/7 Backup Power for essential grocery and refrigeration systems. • First-of-its-Kind commercial flywheel installation at a Salt Lake City market. • <250 Millisecond Response Time from Torus Spin™ ensures seamless power continuity during grid events. • Hybrid System: Combines flywheel (Torus Spin™) + battery (Torus Pulse™) storage. • No Diesel Generators needed—clean, quiet, low-maintenance solution • Grid Participation Enabled via Wattsmart Battery program with Rocky Mountain Power. • Daily Power Quality Improvement through harmonic smoothing and voltage support. • Community Resilience Boosted by keeping food, refrigeration, and POS systems running during outages. • Locally Manufactured in Salt Lake City, Utah with U.S.-based supply chains.

CUTTING DEMAND, POWERING RESILIENCE: HOW A STEEL FABRICATOR USED TORUS STATION TO REINVENT ENERGY EFFICIENCY

Overview

Steel fabrication is an energy-intensive industry, where massive machinery, heat treatment processes, and constant energy consumption lead to high energy expenses and high energy demand peaks. For one such facility, these demand spikes were translating into substantial demand charges, significantly driving up operating expenses. Seeking a solution to this expense, the facility turned to Torus.

The success of Torus' product suite in optimizing energy consumption for a steel fabrication facility highlights its potential for transformative applications across various energy-intensive industries. Sectors such as manufacturing, chemical processing, data centers, and even large-scale commercial facilities face similar challenges with demand peaks, power factor penalties, and high operational costs tied to energy consumption. By implementing Torus' advanced energy management technologies, these industries can not only reduce their energy costs, but also enhance resilience and sustainability.

For industries with critical uptime requirements, such as data centers or medical facilities, the ability to access hours of backup power introduces a layer of operational security that mitigates risks associated with grid instability. Furthermore, the environmental benefits are substantial, as spreading energy consumption more evenly reduces strain on regional grids and decreases the carbon footprint of operations.

How are Torus Solutions applied?

Before implementing Torus technology, the steel fabricator regularly experienced power surges of up to 250 kilowatts during monthly intervals. These peaks triggered costly demand charges and power factor penalties from the utility provider – an issue that was difficult to manage given the variable nature of the facility's fabrication operations.

To mitigate these challenges, Torus deployed its product suite of products, including Torus Spin™ (flywheel battery) and Torus Pulse™ (chemical battery) systems. These technologies work with the Torus Shield™ and Overwatch (powerful security hardware and monitoring platform), and Torus Lasso™ (an AI-powered energy management software).

The Torus station enabled the facility to shift energy use away from the grid during high-demand periods. Instead of pulling directly from utility power during peak loads, the system automatically tapped into stored battery energy—resulting in a smoother, more predictable energy consumption profile. Torus' innovative flywheel and chemical battery combo allow shifts from the grid to battery storage to be completely seamless, with no disruption to operations.

How does Torus add value?

The implementation of the Torus product suite had a transformative impact with over $25,250 in annual savings by reducing demand charges and improving power factor and $132,725 in cumulative savings over five years, allowing reinvestment in operations or capital upgrades. Beyond immediate savings, the shift to a battery-augmented energy model introduced newfound resilience, with over 4 hours of emergency backup power, ensuring continuity during grid outages. In an industry where downtime can have a cascading impact on production schedules and customer delivery, the system's backup capabilities add a critical layer of security.

Moreover, by spreading energy consumption more evenly, the facility not only reduced utility costs but also improved its sustainability profile – lowering peak demand strain on the regional grid and reducing the environmental footprint of its operations.

As global energy demands continue to rise and sustainability targets become more ambitious, the deployment of smart energy technologies like Torus' product suite represents a strategic advantage. This steel manufacturer not only benefited from immediate cost reductions but was also able to position themselves as leaders in sustainable and resilient energy consumption.

"Helping energy-intensive industries like steel fabrication lower costs and increase resilience is exactly why we built Torus. This project proves that smart, hybrid energy systems don't just stabilize the grid—they unlock real operational value on the ground. It's a win for business, for sustainability, and for the future of American manufacturing." – **NATE WALKINGSHAW**

Key Stats
• 250 kW Peak Demand reduced during critical usage windows • $25,250 Annual Savings from reduced demand charges and power factor penalties • $132,725 Projected 5-Year Savings—freeing capital for reinvestment • 4+ Hours of Backup Power to maintain uptime during outages • Zero Operational Disruptions during energy shifts from grid to storage • <250 Millisecond Response Time via Torus Spin™ flywheel for instant peak coverage • Sustainability Boost by lowering carbon footprint and easing regional grid strain

CHAPTER 5

EMPOWERING ADVANCED COMMUNITIES WITH AMERICAN-MADE ENERGY SOLUTIONS

THE TORUS MISSION

Torus is driven by a simple yet ambitious mission – to empower communities to become their own sustainable energy providers, by making clean, intelligent energy solutions both accessible and reliable. Led by this North Star of energy independence and localized resilience, its mission is brought to life through a combination of advanced energy storage technology, full-stack integration, and U.S.-based manufacturing that reinforces community empowerment in a race for knowledge and energy. Torus' approach is not just about solving energy problems – it's about redefining the way power is generated, stored, and used at the on a local, national, and global scale. Its focus on American innovation and local economic impact distinguishes it in a rapidly evolving energy landscape, and aligns deeply with national priorities in decarbonization, job creation, and energy independence.

Innovation is central to how Torus delivers its mission: The Torus Spin™ flywheel, capable of charging and discharging 10x faster than chemical batteries, provides grid-stabilizing power quality and extends battery life. Torus' hybrid system uniquely combines speed, durability, and sustainability, providing the necessary technology to help democratize access to clean, reliable power.

Full-stack integration bolsters system security and performance: Torus provides a complete solution – hardware, firmware, software, cybersecurity, and O&M – that is optimized to work together seamlessly. This unified approach delivers higher reliability and efficiency, while simplifying deployment and reducing complexity for customers.

U.S.-based manufacturing reinforces community empowerment: All Torus products are designed, engineered, and built in Utah using domestically sourced materials. Local production ensures quality, supports regional jobs, and aligns with the company's mission of building energy independence from the ground up – one community at a time.

Strong alignment with national priorities: Torus' mission and strategic model are deeply aligned with America's goals for decarbonization, job creation, and energy independence. As the country modernizes its grid and accelerates clean energy adoption, Torus is well positioned to be a critical enabler of this transformation.

"We're not building Torus for us. We're building it because energy infrastructure will determine humanity's future, and that future depends on getting this right."

- NATE WALKINGSHAW

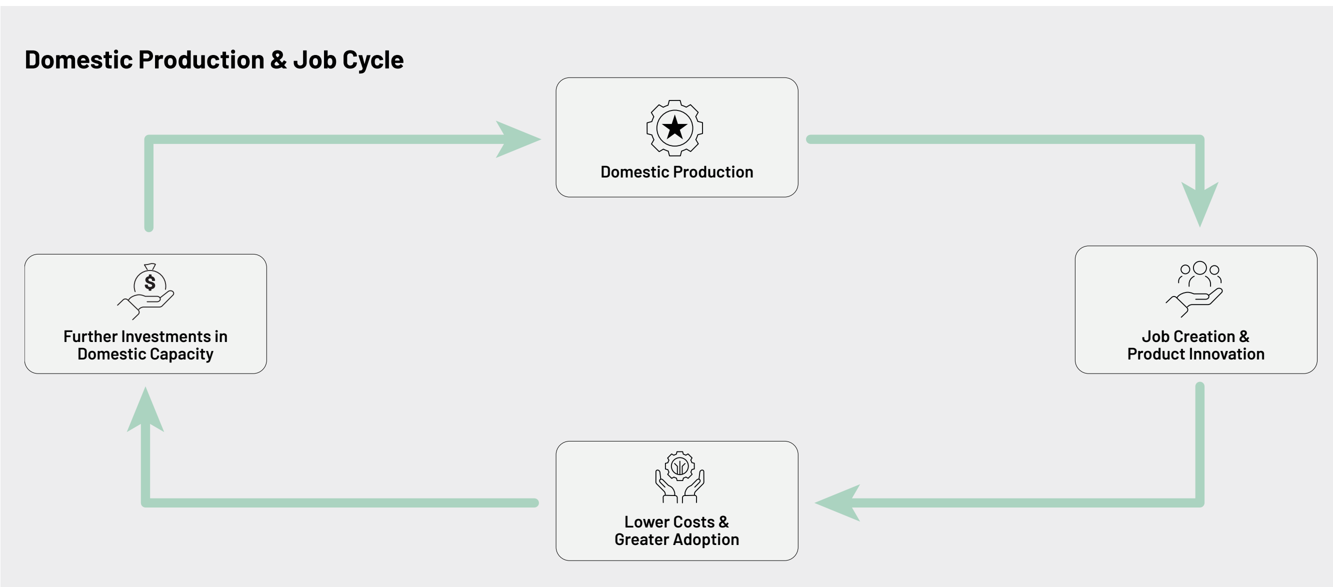
DOMESTIC PRODUCTION & JOB CREATION

Crucially, Torus' mission is intertwined with a commitment to U.S.-based manufacturing. As federal policy and private investment accelerate the clean energy transition, companies like Torus are playing a critical role by establishing and expanding U.S.-based operations. Rather than outsourcing production overseas, Torus builds its energy storage systems on American soil – a choice rooted in the company's community empowerment ethos, supporting local communities through economic growth, industrial revitalization, and resilient infrastructure. Its efforts align with a national trend that is reshaping America's industrial base and creating opportunities in communities across the country. These investments not only benefit the clean tech workforce but also deliver lasting economic and supply chain advantages.

Torus' Utah facilities directly contribute to U.S. job creation: The company operates a 44,000 square foot manufacturing facility in South Salt Lake, employing nearly 100 people across engineering, production, and operations.[1] By keeping fabrication, assembly, and software development in-house, Torus supports a high-tech domestic workforce, creating a new source of middle-class jobs.

Local production offers customer and regional advantages: Torus' U.S.-based manufacturing ensures tighter quality control, faster delivery, and closer customer support. It also stimulates regional economic activity through supplier partnerships and community-level spending.

Torus is part of a virtuous cycle of domestic reinvestment: U.S.-based production drives adoption through better service and resilience, which in turn attracts further investment and job growth. By scaling locally, Torus contributes to a clean energy ecosystem that strengthens American industry.

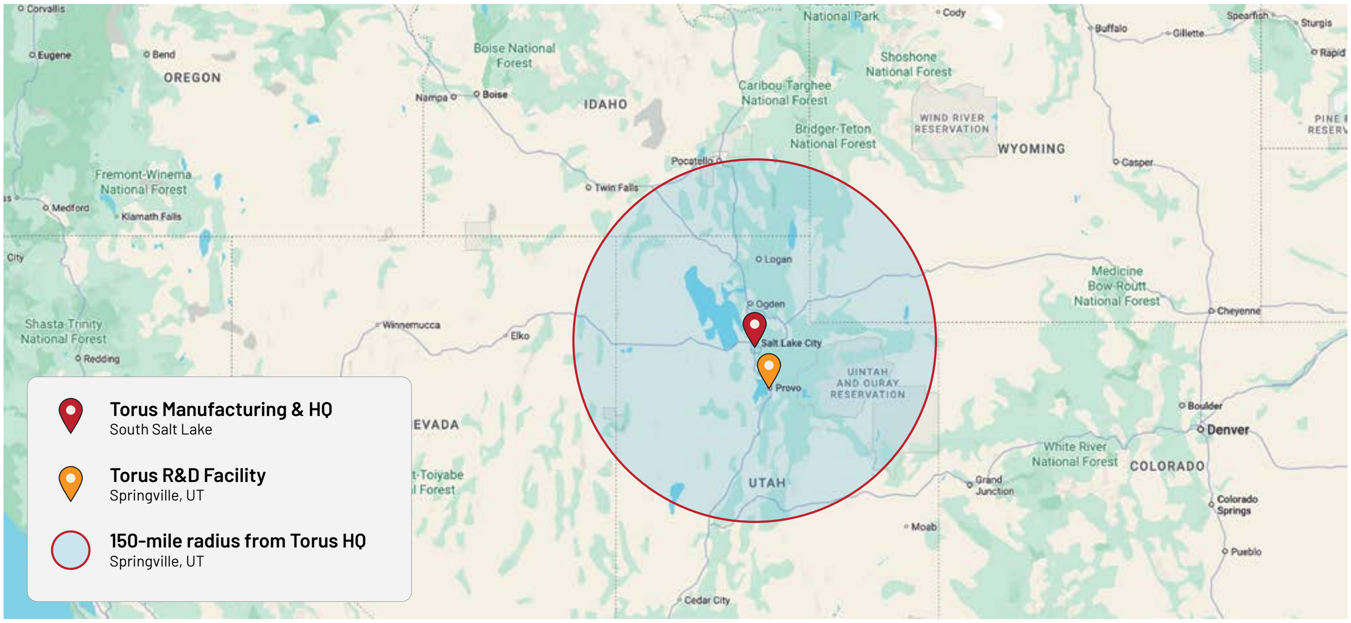


American-made solutions position Torus as a strategic energy partner: With domestic production and secure supply chains, Torus helps reduce dependence on foreign technologies and improves system availability. This is critical for utilities, commercial users, and government entities seeking resilient infrastructure.

> "We're bringing manufacturing home and making it better—using advanced automation to build the most sophisticated energy systems in the world."
>
> **– PATRICK REEDY**

SUPPLY CHAIN RESILIENCE & NATIONAL SECURITY BENEFITS

Torus Supply Chain & Production Sources[1]



Building clean energy solutions in the United States is not only an economic and environmental priority – it's a matter of national security. The U.S. currently relies heavily on foreign suppliers, particularly China, for critical energy storage components, which exposes the grid to significant geopolitical and supply chain risks. Currently, China dominates over 75% of the global battery supply chain – this concentration creates a single point of failure for essential components[2].

Torus' domestic production and localized supply chain aligns with US policy and priorities aimed at reducing dependency and safeguarding access to critical infrastructure. This strategic commitment is enabling greater control, faster deployment, and enhanced resilience. This approach is further reinforced by secure software and hardware development practices, ensuring reliability and cybersecurity across all systems. In an increasingly volatile global landscape, Torus' model offers a dependable, secure, and American-made energy solution.

Torus helps mitigate against foreign supply chain dependence: By manufacturing in Utah and sourcing key components domestically, Torus reduces exposure to international shipping delays, tariffs, and component shortages. This ensures faster turnaround, better quality control, and more reliable system availability for customers.

Cybersecurity is enhanced through domestic software and hardware design: Torus develops its firmware and control systems entirely in-house, minimizing the risk of foreign interference or embedded vulnerabilities. The company's Torus Shield™ technology uses a zero-trust architecture and avoids internet-facing surfaces, making it well-suited for critical infrastructure.

Material diversification adds long-term resilience to the supply chain: Torus' hybrid flywheel-battery system reduces dependence on rare minerals like lithium and cobalt, which are often sourced from unstable or unethical supply chains. The Torus Spin™ flywheel uses recyclable U.S.-sourced steel and electromagnetic components, easing material constraints and improving sustainability.

American-made solutions position Torus as a strategic energy partner: With domestic production and secure supply chains, Torus helps reduce dependence on foreign technologies and improves system availability. This is critical for utilities, commercial users, and government entities seeking resilient infrastructure.

"If you don't have power, you don't have emergency medical capabilities; you don't have water treatment plants; you don't have data centers to run your AI models; you don't have anything. If you don't have power, you can feel the weight of that responsibility for 'critical' critical infrastructure. There's just nothing more important than protecting or making our power grid more resilient, making it more stable, more secure for our future." **– TRENT BOND**

1. Torus, "Torus Celebrates Grand Opening of Manufacturing Facility," https://www.torus.com/news/torus-celebrates-grand-opening-manufacturing-facility.
2. International Energy Agency, "The Battery Industry Has Entered a New Phase," https://www.iea.org/commentaries/the-battery-industry-has-entered-a-new-phase.

"Torus is creating a more reliable power grid that meets the diverse needs of our modern world. At its core, our vision is about building a future where energy is clean, accessible, and designed for the long term." *- Nate Walkingshaw*

"Torus embodies the convergence of advanced technology, deep knowledge, and intelligent power systems." *- Nate Walkingshaw*

CONTINUED RACE FOR KNOWLEDGE AND ENERGY

"We're in the largest race between knowledge and energy since the Industrial Revolution. Energy systems will need to support artificial intelligence that matches and then exceeds human cognitive capabilities." *- Nate Walkingshaw*

"Advanced AI will function like a central nervous system—networked agents working together to replicate and eventually surpass human cognitive networks. *- Nate Walkingshaw*

"Today's AI is just the beginning. We're building toward systems that replicate not just human intelligence, but the entire neurological network—the full cognitive and physical capabilities of the human nervous system." *- Nate Walkingshaw*

"As AI systems become more sophisticated, cybersecurity must evolve from reactive monitoring to proactive intelligence—systems that can anticipate and organize defenses faster than threats develop." *- Nate Walkingshaw*

ADVANCED & AUTOMATED MANUFACTURING IN THE U.S.

"Advanced manufacturing requires data center-level power quality. Automated machining equipment demands the same electrical precision as the most sensitive computing systems." *- Nate Walkingshaw*

"We machine rotor axles to ten-thousandths of an inch—precision that requires perfect power quality. Only nine of these vertical turning lathes exist in the U.S., and we have one. That's the future of American manufacturing." *- Nate Walkingshaw*

"With advanced automation, we can iterate hardware as fast as software. That's why we built the full stack—to have every component optimized together." *- Nate Walkingshaw*

SEAMLESS EXPANSION ACROSS THE GLOBE

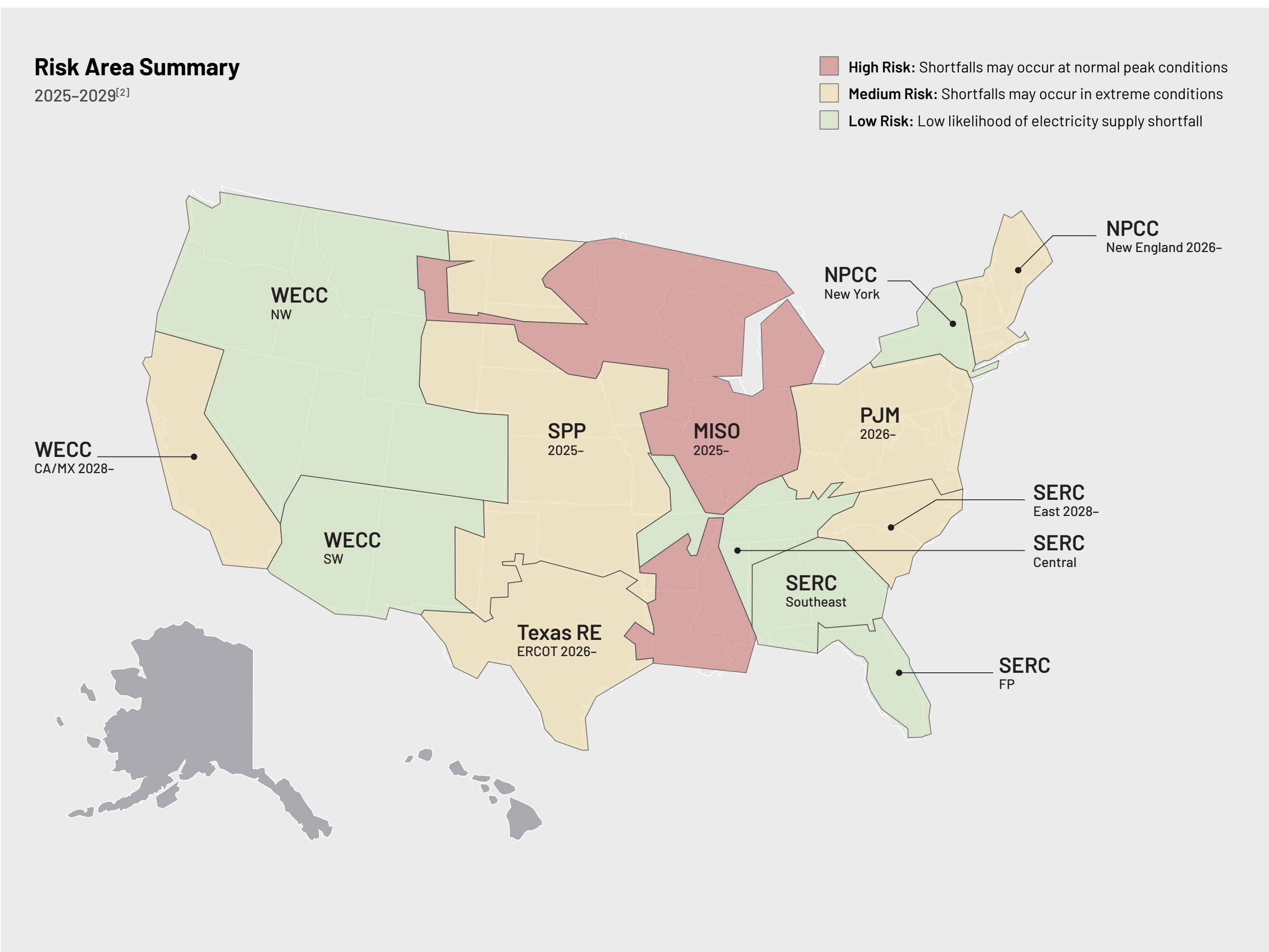
"Global expansion is built into our architecture. Switching from U.S. markets (60 Hz) to European markets (50 Hz) is just a firmware update over the air. We can enter new markets overnight." *- Nate Walkingshaw*

"Our deployment process is simple: we analyze a building's power patterns for 30 days, develop a custom peak-shaving algorithm, and deliver a fully configured system within a month." *- Nate Walkingshaw*

US NATIONAL EXPANSION

As aging infrastructure and traditional grid models are being strained, large swaths of the country at elevated (orange) or high (red) risk of capacity shortfalls during peak conditions[1]. This picture underscores the urgent need for Torus' solutions to bolster grid reliability and flexibility throughout the country. In particular, parts of the Midwest and South(MISO) face "high risk" of electricity supply deficits under normal peak demand, while others in the Northeast and Southeast are at "elevated risk" under extreme conditions. Torus' expansion into these critical regions – the Southeast, Midwest, and Northeast – enables a national footprint tailored to regional and localized community needs.

> "Now we're going into six other states and the West. We keep constantly getting pulled into the Northeast and Southeast and Midwest...everybody has this problem." **- GIL LEE**



TORUS EXPANSION INTO THE SOUTH AND SOUTHEAST

The South and Southeast are experiencing rapid solar growth but remain heavily reliant on centralized fossil generation, with grid reliability increasingly challenged by extreme weather and outdated infrastructure. Torus can empower the region to modernize through resilient microgrids, virtual power plants, and battery-backed renewables – ensuring power stays on during hurricanes and demand surges. With Torus, the Southeast can build a cleaner, more distributed, and storm-resilient grid without sacrificing reliability or economic growth.

- **Resilient Microgrids for Extreme Weather Vulnerability:** As severe weather events increasingly disrupt power across the region – such as widespread outages from Hurricane Irma (64% of Florida affected with 100k residents in the dark after a week),[3] or rolling blackouts during Winter Storm Elliott[4] – Torus microgrids provide instant islanding and backup power. These capabilities ensure continuity for emergency response centers and critical infrastructure, reducing downtime and enhancing public safety.
- **Advanced Storage to Stabilize Renewable Integration:** With Southeast solar capacity projected to double to ~44 GW by 2027, aging grid infrastructure will struggle to handle variable power and bidirectional flows[5]. Torus' advanced batteries and hybrid storage systems – storing excess solar energy and dispatching it during demand peaks – enables a smoother, more reliable integration of renewables, while reducing dependence on gas peaker plants.
- **VPPs to Offset Fossil Buildout:** Projected demand from new data centers – totaling over 32.6 GW in states like VA, NC, SC, and GA – is prompting utilities to plan 20 GW of new natural gas plants by 2040[6]. Torus' virtual power plants (VPPs) provide a solution – aggregating distributed energy resources to supply new loads, reducing reliance on fossil fuel infrastructure while supporting decarbonization goals.

TORUS EXPANSION INTO THE MIDWEST

The Midwest is phasing out aging coal plants and rapidly adopting wind energy, but grid congestion, fossil fuel dependency, and aging infrastructure continue to strain reliability. Torus supports this transition with distributed, flexible solutions that allow communities and industries to generate and manage power locally – reducing curtailment, supporting decarbonization, and enhancing system resilience. With Torus, the Midwest can modernize its grid while sustaining economic growth and energy independence across its vast geography.

- **Distributed Assets to Bridge Capacity Gaps:** With NERC projecting a 2.7 GW summer capacity shortfall by 2029 due to retiring fossil plants,[7] Torus deploys fast-acting distributed microgrids and batteries that provide local capacity buffers – mitigating outages and reducing dependence on emergency fossil backups.
- **Hybrid Storage to Reduce Wind Curtailment:** Facing challenges in effectively integration renewables, MISO curtailed over 3.8 million MWh of wind energy from 2021 to 2023 due to grid congestion and operational rigidity[8]. Torus' flywheels and battery storage offer dynamic, short-duration storage that absorbs excess wind energy and stabilizes the grid during fluctuations.
- **Microgrids to Support Loads for Industrial and Rural Resilience:** The electrification of transportation and heating in industrial hubs like Ohio and Michigan is increasing and shifting peak demand in uncertain ways; Torus modular microgrids help manage these localized surges while ensuring uptime, and reduced downtime costs, for manufacturers, farms, and rural community infrastructure.

TORUS EXPANSION INTO THE NORTHEAST

The Northeast is advancing some of the most ambitious clean energy goals in the U.S., but faces mounting grid strain from aging infrastructure, rising winter demand, and the integration of offshore wind and electrified systems. Torus addresses these challenges head-on by enabling resilient, bidirectional energy networks powered by localized microgrids, advanced storage, and real-time energy orchestration. With Torus, the region can achieve a carbon-free future while maintaining reliable service – even during the harshest winter storms.

- **Localized Microgrids to Relieve Urban Congestion:** Dense metros like New York and Boston face infrastructure bottlenecks that require ~$1B+ in annual upgrades;[9] Torus urban microgrids reduce transmission strain by generating and managing power at the city and community level – relieving grid congestion, bolstering reliability, and aiding storm preparedness.
- **Modular power plants to Manage Winter-Peaking Loads:** Electrification is shifting the region to a winter-peaking grid, with ISO-NE projecting demand could exceed 55 GW by 2050[10]. Torus' modular power plants can help optimize building loads and coordinate battery discharge during extreme cold snaps to shave peaks and maintain grid stability.
- **Hybrid Storage to Firm Offshore Wind Integration:** As the Northeast brings large offshore wind projects online, Torus' flywheel and hybrid storage systems capture intermittent output and ensure steady delivery – even during lulls – maximizing renewable utilization, reducing peaker plant reliance, and improving policy compliance.

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1. North American Electric Reliability Corporation, "2024 Long-Term Reliability Assessment," December 2024, https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2024.pdf.
2. Ibid.
3. U.S. Government Accountability Office, "Electricity Grid – Opportunities Exist for DOE to Better Support Utilities in Improving Resilience to Hurricanes," GAO-23-105441, March 2023, https://www.gao.gov/products/gao-23-105441.
4. Southern Alliance for Clean Energy, "Winter Storm Blackouts – Reflections from a Year Later," https://cleanenergy.org/winter-storm-blackouts-reflections-from-a-year-later/.
5. Southern Alliance for Clean Energy, "Solar in the Southeast: Seventh Edition Report," https://cleanenergy.org/solar-in-the-southeast-seventh-edition/.
6. Institute for Energy Economics and Financial Analysis, "Data Centers Drive Buildout of Gas Power Plants and Pipelines in the Southeast," https://ieefa.org/articles/data-centers-drive-buildout-gas-power-plants-and-pipelines-southeast.
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8. Sustainable FERC Project, "Wind Curtailment in MISO: A Comprehensive Analysis," https://sustainableferc.org/wind-curtailment-miso-comprehensive-analysis.
9. Utility Dive, "New England Could See Resource Adequacy Troubles Even With Billions in Investments," https://www.utilitydive.com/news/new-england-resource-adequacy-troubles-billions-investments/.
10. Clean Air Task Force, "Building to 2050: A Comprehensive Approach to Decarbonizing Buildings," https://www.catf.us/resource/building-to-2050/.

VISION FOR SUSTAINABLE ENERGY

Looking beyond the immediate regional and national needs, Torus's mission is ultimately global and transformative. The company's forward-looking vision is a world without energy poverty where every community – from a rural village to a major metropolis – can enjoy reliable, affordable, and clean energy. This underscores the reality that energy access, reliability, and sustainability is ultimately a global problem that must be solved regionally, country by country. Achieving this vision means scaling Torus's solutions and partnering across the energy ecosystem to drive the broader trends of the clean energy transition, grid modernization, and distributed energy integration.

- **Community Autonomy and Resilience:** Torus enables 'prosumer' communities that generate, store, and share electricity locally, reducing strain and dependence on an aging grid and improving reliability during disasters.
- **National Transition and Surging Demand:** Torus's platform scales with U.S. electrification and renewable goals, enabling 24/7 clean power through widespread DER coordination, and providing an innovative solution for unlocking capacity in the face of surging load growth.
- **Solving Global Access and Energy Poverty:** Torus's vision addresses one of humanity's core challenges: providing universal access to electricity while combating climate change, as some 750 million people worldwide still lack access to electricity[1] While traditional grid expansion alone has struggled to reach the most remote or impoverished communities, Torus microgrids offer modular power systems to electrify communities worldwide, improving healthcare, education, and economic outcomes.

"Right now, we're focused on solving America's energy challenges, and there's plenty of work to do. Between data centers, EVs, and electrification, demand is exploding while our supply chains remain foreign-dependent. Once we solve it here, we can help other nations facing the same challenges." – GIL LEE

"We will be the world leader for this technology going forward, and how we build resilient electrical grids that benefit communities of people throughout the United States and throughout the world. But we have to do it very efficiently here first." – TONY WORTHEN

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1. International Energy Agency, "SDG7 Data and Projections: Access to Electricity," https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity.


TORUS

EXECUTIVE SUMMARY

INDUSTRY & MARKET CONDITIONS

History of Electrification & Grid Infrastructure in the US

"I always think about the last 100 years…we grew energy at 100x, but population only grew 6x. If you think about the next 100 years, that's going to seem pretty small. Because it's going to grow by 1000x over the next 100 years, and 60% of that growth is going to happen in the first 30 years." - *Nate Walkingshaw*

ENERGY INDUSTRY OVERVIEW AND STRUCTURE

Working with Utilities

"The Public Utility Commission mandates that utilities deliver reliable power to customers at the lowest possible cost. That's their directive – affordability and reliability. But there's growing tension as utilities face aging infrastructure and rising costs, making it increasingly difficult to meet that mandate" – *Patrick Reedy*

"The reason utilities offer incentives is because it's more cost-effective to drive down energy demand than to build new infrastructure. Energy efficiency and demand response are considered a least-cost resource – cheaper than building a new solar or gas plant, or even a new transmission line." – *Patrick Reedy*

"Designing for peak demand is expensive for utilities. By helping offset that peak – both for utilities and their customers – we enable better use of existing infrastructure. That, in turn, allows utilities to grow their rate base and serve new loads like data centers and manufacturers that they'd otherwise have to turn away due to capacity constraints. We help unlock bottlenecks within the grid." – *Patrick Reedy*

"If you think about the laws of constraint right now for a current utility, the reason why when you break apart a monolith into bounded context – that means that the packaging and the pricing and the regulatory environment would need to change for the utility as well. And so, one of the things that Torus does better than anyone is what's called tariff busting, not Trump tariffs, but regulated utility tariffs." – *Nate Walkingshaw*

"Basically what happens, [a utility] builds this massive farm and then they capitalize the asset over 20 years and then enroll that into an electrical rate. The second that you look at this giant balance of load across the system and you price it with a physical good or asset, the Public Utility Commission deems a rate over the top of it and you can't move – it's unflexible." – *Nate Walkingshaw*

Macroenvironment Analysis & Demand and Supply Trends Today

"There's a New Balance factory that just got installed in Salt Lake. That New Balance factory is like two and a half million square feet and almost all automated. There are very few actual workers there. Most of that factory and end distribution centers is basically all automated and it requires a tremendous amount of energy and storage, and power to be able to do its job." – *Nate Walkingshaw*

"Trying to plan for data center load is like planning for a brand new city." – *Nate Walkingshaw*

KEY CHALLENGES

"Every energy challenge requires the same solution: reliable, secure energy storage and management. It doesn't matter if you're looking at generation, transmission, or distribution problems. The same goes for power quality issues or carbon reduction goals. All roads lead to what Torus offers." – *Dave Rackham*

"When you zoom out and you look at, what is Torus doing? We didn't just take parts and put it together. We actually built it from the ground up around the most critical problems in our energy infrastructure." – *Gil Lee*

"Regardless of political leanings or kind of world views or whatever core motivations a person has, a lot of the problems and challenges that we face societally come down to power and energy. That can be energy and power is getting too expensive; that could be, it's too carbon intensive; that could be, it's unreliable. You know, there's so many ways in which to look at these problems that are really, really valuable and important to people." – *Dave Rackham*

Power Quality

"When you get down to it, power quality has the biggest economic impact. Even when it's not hitting your bottom line directly, it's affecting your operations – imagine your manufacturing processes shutting down because of power quality problems. That's where the real costs add up." – *Dave Rackham*

"We worked with a manufacturing customer to solve a costly challenge: even minor voltage fluctuations on the grid were shutting down sensitive equipment. Each event caused up to three hours of lost production and over $10,000 in product losses—and it was happening several times a year, with increasing frequency, despite the grid operating within standard limits." – *Patrick Reedy*

"More and more commercial and industrial buildings are installing higher-efficiency equipment to lower operating costs – but that equipment is also more sensitive to fluctuations on the grid." – *Patrick Reedy*

"Energy storage provides a buffer – a place to store energy, a place to absorb energy – whether it be from renewable source or not, it applies an opportunity to push that back to the grid when the grid needs it right. Because we're seeing more and more times when resiliency, grid frequency is getting imbalanced, and it's another lever in the toolbox that utilities can use to help address challenges and imbalances on the grid." – *Patrick Reedy*

Peak Load and Outage Threats

"The utility grid is designed around peak demand – which occurs less than 1% of the year. As a result, the system is significantly overbuilt and typically operates at just 40-60% of its capacity. When peak load increases, utilities must invest in even more infrastructure to meet that higher peak, further widening the grid's efficiency gap: the system is built for a peak that keeps rising, while average demand remains relatively flat." – *Patrick Reedy*

"Designing for peak demand is expensive for utilities. By helping offset that peak – both for utilities and their customers – we enable better use of existing infrastructure. That, in turn, allows utilities to grow their rate base and serve new loads like data centers and manufacturers that they'd otherwise have to turn away due to capacity constraints. We help unlock bottlenecks within the grid." – *Patrick Reedy*

"When we see a winter vortex come across the plains…You have this really big demand for energy, and the energy resources can't keep up…You get a cascading impact, until you have widespread catastrophic outages." – *Trent Bond*

"Wildfires have now become a planned event, where in wildfire season they have to decide to either completely turn off or decommission assets, or they have to rebuild massive hundreds of miles of main transmission post wildfires. So this is a constraint that they've never had before. I mean when you deliver power, it's like delivering the mail. You do not, not deliver mail; you deliver power at all costs. For the first time, in a wildfire scenario, we might not deliver power and so we might need to notify the public that we're going to shut down power when a wildfire occurs. So like those dynamics are changing a lot." – *Nate Walkingshaw*

Asset Security

> "Utility companies have incredible expertise in their traditional operations, built over decades of reliable service. They're now navigating new territory with modern cybersecurity demands, which differs from their historical strengths. They recognize that grid security faces unprecedented pressure today, and that's why partnerships in this space are so valuable." – *Dave Rackham*
>
> "I don't know if we really know what a wide-scale cyberattack on the grid might look like, because we haven't really experienced that quite yet. But I think we get some pretty good glimpses as to what that might feel like…You'd absolutely have widespread catastrophic disruption that we have not seen on a large scale. I know that sounds really bleak, but it's also why I think there's probably nothing more important than us worrying about trying to protect our grid." – *Trent Bond*
>
> "To realize the full potential of these energy assets, you have to connect these modular power plants to the internet. They have to be managed and monitored that way; they have to be deployable, observable and fully commanded and controllable via the internet. And when you put something on the internet, it's a double-edged sword…Because if you can control the energizing or dissipating of that energy, so could someone else. You can imagine there are a number of nation states that would love to get their hands on internet connected energy resources. Why? It's the equivalent of a coal plant, or the equivalent of a nuclear plant that could be within their control – they would love that. So absolutely necessary to network connect energy assets but really with no room for error." – *Trent Bond*
>
> "From the beginning, we prioritized cybersecurity, knowing the grid faces significant risks and remains a high-value target for potential attacks." – *Patrick Reedy*
>
> "We're blinded as a society right now by being so focused on geopolitical distractions, and also the reorganization of potentially the global economy is allowing us to look at cyber risk and threat through what I'd say, like a jaded lens. I think…the current moment in time…is going to pass, but then the advancement of knowledge and energy are going to advance." – *Nate Walkingshaw*
>
> "[The current climate] is going to pass, but the advancement of knowledge and energy are going to advance. And so when you think about that relative to cybersecurity risk, cybersecurity has to be smarter than your neurological network because it has to be preventative." – *Nate Walkingshaw*
>
> "Right now, the alerting, monitoring and detection, that's just table stakes and we are so behind as an entire society. It is a very reactive point of view." – *Nate Walkingshaw*
>
> "I think cybersecurity will need to become a proactive tool that is also sensing. The alerting, monitoring, detection anomalies would need to be proactively organizing best practices. And today we're really relying heavily, heavily, heavily on humans to be able to set up a zero-trust environment." – *Nate Walkingshaw*

Aging Infrastructure

> "Electrical grids in cities and regions were designed for different needs than we have today. These systems worked perfectly when built, but infrastructure naturally needs updates over time. Utilities are steadily modernizing to meet current demands. It's an enormous challenge to bridge the gap between the original designs and today's needs. It's even harder to do so quickly and without huge capital investments." – *Dave Rackham*
>
> "The Public Utility Commission mandates that utilities deliver reliable power to customers at the lowest possible cost. That's their directive – affordability and reliability. But there's growing tension as utilities face aging infrastructure and rising costs, making it increasingly difficult to meet that mandate" – *Patrick Reedy*
>
> "The next version of [the grid] is going to get rebuilt now in our generation and it's going to pick up velocity significantly. In order for you to be able to do that…We're going to have to figure out a way you know to break apart this monolithic energy infrastructure. And it really is through an abundance mentality…it has to be every type of energy generation and storage capacity out there." – *Nate Walkingshaw*
>
> "We will not solve the problem with just putting more power in transmission. We're also going to have to get energy assets down to sub transmission, you know, distribution layers, in order for us to really solve this problem." – *Trent Bond*

UNIQUE SOLUTIONS

High-Level Overview – Full-Stack, Vertical Integration

> "We're not just offering products; we're providing vertically integrated solutions that enhance reliability, safety, and security in an increasingly volatile energy landscape." – *Nate Walkingshaw*

> "We at Torus have been showcasing our full-stack, vertically integrated product line, where we control every aspect – from hardware and firmware to software – right here in the U.S." – *Nate Walkingshaw*

> "At Torus, we're full stack. We designed the hardware from the ground up and wrote the firmware that controls how it operates. Our data and software teams take the system data and apply machine learning and large language models to answer two critical questions: first, is the system operating safely – and second, is it performing as intended? If not, why not? It's about more than just the flywheel – it's about integrating the entire energy ecosystem." – *Patrick Reedy*

> "We're a fully integrated stack – so from the hardware, you think about our flywheels, to the batteries that we have in our Torus Pulse™, all of that is vertically integrated. So all of the faults, all of the info and telemetry, we're getting at the deepest levels… And we have a patent on that whole thing; we own the whole pipeline of the vertically integrated software alert system all the way into Overwatch itself, where we have certified professionals that are monitoring 24/7." – *Trent Bond*

> "Torus at our core, we are really good at energy storage, but more importantly energy management." – *Dave Rackham*

> "We bring to bear an entire set of power quality, volt-VAR correction, reactive power, power factor improvements, all of those kinds of capabilities that live under the vision of virtual power plants, but it's just never been realized, because there's not a technology stack that really does that." – *Dave Rackham*

> "We have a fully integrated product that is actually working horizontally. The horizontal side here is that, because of our fully integrated product, you can really put us in a lot of different sectors and sub sectors. And you can't really do that if you're just focused on one part of the solution." – *Gil Lee*

> "We didn't solely focus on energy storage, and we could have, but we felt we needed to have energy management with that. We needed to build cybersecurity on top of that. And by the way, we're also solving the speed of the permitting process and the installation process; somebody else could have done that. On top of that, we're actually doing all the manufacturing here, when we could have shipped manufacturing in from somewhere. So we really are thinking about the business as a fully integrated business." – *Gil Lee*

> "The main reason why this is such a big deal is that when you install this on an existing infrastructure, [utilities] get to point and shoot at all the problems – whether it's congestion or generation or a load-based quality power issue. You can install it behind or in front of the meter and handle all those problems for the existing rate base. The coolest part though is that it frees up capacity for new things to get added. So now [utilities] can actually decentralize, and that the most beautiful part of a very deeply nuanced set of problems." – *Nate Walkingshaw*

> "What we have built, the advancement of technology and knowledge and power…Torus is the embodiment of that right now. If you build something now, build it this way; build the full stack." – *Nate Walkingshaw*

> "And the full stack is easier to build than ever before. What I can go build today compared to what I could have built a decade ago, and that is firmware and hardware are included now. And it's because automated manufacturing almost allows me to build at the rate of software…we have firmware and hardware sometimes beat software to market." – *Nate Walkingshaw*

High-Level Overview – Decentralization, Speed to Solution, Grid-Level Scale

> "We really have an aging infrastructure today, and so when you really look at what our overall strategy is, it's for decentralizing what has been centralized for many decades, and we're also modernizing what is aging. And so if you have a fragmented, aging, really non-internet energy infrastructure, we are really kind of the modern grid that is the connective tissue of the existing grid." – *Gil Lee*

> "The decentralization of the grid is one of the biggest pieces of this… virtual power plants breaking apart the monolith, in order to do scaled energy infrastructure. And that's on existing infrastructure and net new infrastructure." – *Nate Walkingshaw*

"We're helping to solve the grid's capacity constraints by enabling more efficient energy delivery and shifting how energy is used across the system. It's about reshaping energy usage to relieve pressure on an already strained grid." – *Patrick Reedy*

"We looked at flexible load programs, demand response and we built a utility-based product with utility-based pricing that can enter any one of those locked tariffs, that then is grid approved." – *Nate Walkingshaw*

"What we've done is we can enter the grid tomorrow with this asset class at tariff-based pricing and allow [utilities] to completely decentralize their grid and give them the flexibility that they need." – *Nate Walkingshaw*

"Probably the more important horizontal thing that we've been able to do is we have been approved and certified on the National Grid level. You can take Torus to any utility in the country, and we have checked all the NERC and FERC boxes…You can only do that if you're a vertically integrated product." – *Gil Lee*

"[Our systems] are 2030.5 IEEE 1547 technically compliant. So when [they] enter the grid, it's like oh this looks like a coal plant, this looks like a CNG plant, this looks like something that a grid operator trusts and the pricing of that asset is equivalent to whatever they've installed on the grid. And so when they look at the pricing, they look at the flexibility of the product and they look at the regulatory environment, this is something they can use in the grid that they never had before. Normally they'd have to build it – a massive CNG plant for 20 years – and then add that and then go back to the Public Utility Commission and recast rates again." – *Nate Walkingshaw*

"Why Torus is so uniquely positioned is…We create liquidity. We install an asset on their balance sheet for 20 years – that's utility-based pricing, right? And then it creates immediate liquidity when it's dispatched daily. And so [utilities] think about it just like an existing asset they've invested in on their grid." – *Nate Walkingshaw*

SOLUTIONS DEEP DIVE AND TECHNICAL BRIEF

Torus Spin™

"In the hardware space, we have the Torus flywheel energy storage device – that's the crown jewel. This is a giant, massive rotor spinning in vacuum, being magnetically levitated with a motor generator. And it's storing kinetic energy." – *Nate Walkingshaw*

"If you don't have a technology like a flywheel, then you have these incredibly large loads that oscillate like crazy on the grid. And, you know, grids are not designed to be able to have that degree of volatility and be able to survive from a stability perspective." – *Dave Rackham*

"And when you put it in that condition, it has the ultimate efficiency. It's going to do a similar job to a battery; it's going to store energy and send it back. But… it can do it without degrading." – *Cliff Lambarth*

"Flywheel energy storage, stores and discharges energy back to the grid in the same way we've created energy for over 100 years – in an inertial based rotating mass. And utilities are looking for inertia. They're looking for frequency response, and flywheel can really do that and provide those benefits to a utility that they really can't get anywhere else."
– *Patrick Reedy*

"The flywheel [does] the heavy lifting or the heavy shifting, right? It's the tool doing all of the work, up and down, daily cycling, taking, charging and discharging at peak power and higher power rates than we can at the chemical battery."
– *Patrick Reedy*

Torus Shield™

"We have full intrusion detection prevention at every asset; we can literally look for and see if there are attacks coming at that very system. We also do constant risk assessment, risk management, and vulnerability scanning of the infrastructure that we have deployed." – *Trent Bond*

"It turns out that security isn't and never has been a single product. It's building capabilities and programs and integrating programs into our customers programs that make it all possible. And our answer to all of that here at Torus is Torus Shield™ and Overwatch." – *Trent Bond*

"From the beginning, we prioritized cybersecurity, knowing the grid faces significant risks and remains a high-value target for potential attacks." – *Patrick Reedy*

Torus Overwatch™

"Overwatch is our observability – it's the way that we look at, monitor and manage, and do the remote command and control of these modular power plants." – *Trent Bond*

"We've built intelligence in locally to these modular power plants – they can make decisions on their own if, for some reason, that network connection centrally is severed. But there's more capability when you can look at things holistically across all those power plants and make decisions collectively, as opposed to just locally on the ground in that one place. You need that, but Overwatch gives us the ability centrally to look across all these modular power plants." – *Trent Bond*

"Our team right now of Overwatch is 32 people. They're all certified – some are master electricians, some are software engineers – but they're literally watching all this telemetry and then there's a notification alert system." – *Trent Bond*

"When you can leverage the data that we do for all of our anomaly detection – we have a very sophisticated set of machine learning and AI capabilities that we're leveraging there – that dramatically improves not only the reliability of the products, but also as the operations and maintenance provider, we're fully incentivized to not delay any maintenance, but also not do it a day sooner than it needs to be done." – *Dave Rackham*

"I think the greatest benefit of Overwatch for our customers is peace of mind; they know that Torus always has eyes on their system." – *Nate Walkingshaw*

Torus Lasso™

"The reason why we call our software Lasso is because it gives utility operators the ability to pinpoint, very precisely, the specific areas of the grid that need support. Or, they can actually go ahead and schedule the power dispatch that needs to occur against some other energy market need that they might have." – *Dave Rackham*

"The CNS is the brain behind the entire operation, most of the capabilities that we have is because of our CNS. CNS is able to collect telemetry from Torus Pulse™ and Torus Spin™, and you can see that data in Lasso. CNS can also command and control the system, which gives us the backbone for Lasso and Overwatch." – *Zahra Derafshi*

"Counter-intuitively, I'm working really hard to build a product that I hope no one uses because they get Onboarded, they understand exactly how powerful and how simple and how easy it is, and then we've made the correct decisions on how to push out to them via things like emails or text notifications, and so they have no need to come into Lasso, because we have just solved these problems so well that this becomes the thing they just never think about." – *Dave Rackham*

"You just kind of go to bed every night knowing that Torus has got your back." – *Dave Rackham*

"Look, we know that at the end of the day, when you've got a really good product that does this does day over day, [customers] aren't going to be in this product all that often, because it just does what it says it needed to do. They love it. They get all of the confidence that's like, yep, if I do need to get in here, I know I can get exactly what I need to very easily. It's super powerful, but I just want the text message to know that, like, four minutes ago, there's a power quality event, and Torus just stepped in and intervened." – *Dave Rackham*

COMPETITIVE DIFFERENTIATION

Torus Solutions vs. Large Scale Battery Storage

"We're focused on a market opportunity that other players are overlooking. Even if they pivot toward this space, they'll discover that managing thousands of distributed energy systems is fundamentally more challenging than operating one large facility. This requires deep expertise across hardware, power electronics, firmware, data, and software – investments we've been making for years. Our growing market traction proves we're on the right path." – *Dave Rackham*

"We will not solve the problem with just putting more power in transmission. We're also going to have to get energy assets down to sub transmission, you know, distribution layers, in order for us to really solve this problem." – *Trent Bond*

"Being vertically integrated makes a big deal from a software standpoint, but it also makes a big deal from a cyber standpoint. I think this is another big differentiator between us and other products, including Tesla, or any of these other battery manufacturers out there. You know, they can slap a firewall on anything or whatever, but what have they really done with that information, that data? Are they really protecting? Are they really monitoring cybersecurity of these large battery deployments? We are." – *Trent Bond*

"Probably the more important horizontal thing that we've been able to do is we have been approved and certified on the National Grid level. You can take Torus to any utility in the country, and we have checked all the NERC and FERC boxes...You can only do that if you're a vertically integrated product." – *Gil Lee*

"I think the most singular difference is we're focused on a portion of the problem that people are underestimating the complexity, they're underestimating the value, and they're trying to apply capabilities that, frankly, they don't have...They can't solve that problem – why? It's easier to manage an entire energy storage farm out in the middle of the desert than it is to have to manage 1000s of individual systems. You have to be really good at software and data and firmware to be able to pull that off. Those companies just have not made that investment." – *Dave Rackham*

"Utilities are planning 20 years in advance how they're going to meet electricity load. So they're looking at, how am I going to bring on new energy storage, new energy generation assets to the grid to support load growth and maintain reliability and costs and cost optimized for my customers? One of the big hiccups there is they're planning out, and they're looking at these really large installations – so a large solar farm, large battery energy storage facility, you know, those take years to deploy...the challenge with that is that it's not fast enough." – *Patrick Reedy*

"The timeline to deploy a large-scale battery farm is six years. So five years of construction, and a year or two years to PTO, to permission-to-operate." – *Nate Walkingshaw*

"That battery farm that we just talked about is 100-megawatt, four megawatt-hours to build a four-hour battery. We're doing that same deployment, 100 megawatts, but in 2- to 5-megawatt chunks across all those buildings to equal 100 megawatts of power with 400 megawatt-hours of energy storage. But it's happening in 36 months, and that is hitting the grid very softly. And it's more of a point and shoot – the generation desk, the trading desk, they're choosing where they need that energy storage deployed in the areas in sub-transmission, distribution that they're feeling the most pain." – *Nate Walkingshaw*

"So this really is remediating a ton of pain for the utility at a faster rate of development compared to these large-scale battery farms." – *Nate Walkingshaw*

"By strategically placing energy storage and Torus stations in front of the meter...they can address particular challenges that [a specific] location has experienced." – *Patrick Reedy*

Torus Solutions vs. Direct Competitors

"We, at Torus, are hyper-focused on our bill of materials and supply chain. And so you think about a flywheel energy storage device that has 172 different components on it...at Torus, that bill of materials is within 150 miles of our facility, cradle to grave." – *Nate Walkingshaw*

USE CASES & APPLICATIONS

"Designing for peak demand is expensive for utilities. By helping offset that peak – both for utilities and their customers – we enable better use of existing infrastructure. That, in turn, allows utilities to grow their rate base and serve new loads like data centers and manufacturers that they'd otherwise have to turn away due to capacity constraints. We help unlock bottlenecks within the grid." – *Patrick Reedy*

"The vertical integration of everything that we are doing is very unique, and it solves a lot of problems for our partners. And when I say partner, if you are a commercial business today and want to get everything that we have, you have to talk to five vendors. While [our partners], they're talking to one, and if there is a problem, they're talking to one, not five, right?" – *Gil Lee*

"If I am the utility, I'm seeing all of these substations and infrastructures today. Yeah, they can see data from each of those, and they have their dashboards, but there's no way for these infrastructures to talk… We can actually have them talk with our with our energy management software and hardware." – *Gil Lee*

Key Partnerships (RMP)

"Enhancing and expanding the Rocky Mountain Power system is the key to meeting Utah's energy future. Collaborating with innovative leaders in technology and energy, like Torus, is essential to meet the goals of Operation Gigawatt." – *Dick Garlish, President, Rocky Mountain Power*

"This technical implementation demonstrates how our relationship with Rocky Mountain Power will deliver both grid resilience and energy security. Demand response programs are crucial for managing grid challenges while reducing costs." – *Nate Walkingshaw*

"When we talk about balancing the grid, and specifically the Wattsmart program that we've been participating in, the reason why that matters so much is they're leveraging Torus technology to solve a very focused and important problem in a specific moment of time." – *Dave Rackham*

"We partner closely with utilities – like through Rocky Mountain Power's Wattsmart Demand Response Program – to deliver win-win solutions for both the utility and commercial customers. We help keep customers' critical equipment online, reduce service calls to Rocky Mountain Power, and ultimately create a win-win for everyone involved." – *Patrick Reedy*

"The reason utilities offer incentives is because it's more cost-effective to drive down energy demand than to build new infrastructure. Energy efficiency and demand response are considered a least-cost resource – cheaper than building a new solar or gas plant, or even a new transmission line." – *Patrick Reedy*

Sector Applications

"Many manufacturers today have sustainability mandates aimed at reducing both energy consumption and costs. That makes them an ideal customer for us – because we can directly help them lower those costs." – *Patrick Reedy*

"We worked with a manufacturing customer to solve a costly challenge: even minor voltage fluctuations on the grid were shutting down sensitive equipment. Each event caused up to three hours of lost production and over $10,000 in product losses—and it was happening several times a year, with increasing frequency, despite the grid operating within standard limits." – *Patrick Reedy*

"More and more commercial and industrial buildings are installing higher-efficiency equipment to lower operating costs – but that equipment is also more sensitive to fluctuations on the grid." – *Patrick Reedy*

Gardner Group

"We are committed to adopting innovative solutions that drive sustainability and operational efficiency. Partnering with Torus allows us to optimize our energy management, reduce our carbon footprint, and provide enhanced value to our tenants. We look forward to the positive impact this project will have on our properties and the broader community."
– *Christian Gardner, CEO*

La Diana

"By bringing our advanced energy storage and solar solution to La Diana, we're helping a valued local business reduce operating costs while strengthening our community's energy resilience." – *Unidentified Source*

Steel Fabricator / Schaeffer Industries

"We are excited to see what the Torus station can do for reducing our power bills. And I've got neighbors here in the industrial park who are eager to follow suit..." – *Matt Schaeffer*

TORUS' MISSION & US-BASED MANUFACTURING

"At Torus, our mission is to empower communities to become their own renewable energy providers." – Nate Walkingshaw

"[Our team] wakes up, I feel like most days, thinking about working on this problem or this set of problems, because they ultimately know the outcome or the output of what happens if we're successful. And it really is not about us – it is truly about bettering society; it's about bettering humanity." – *Nate Walkingshaw*

"Customer breaks the tie is one of our guiding principles." – *Patrick Reedy*

"Our products are what will enable large scale renewables for thousands of homes, millions of homes, and so that kind of all goes back to the original idea of, if we can actually solve this for one home, we can actually solve it for the world. And so that has been our conviction." – *Gil Lee*

"When I go back to when we started this company, it wasn't just let's solve this for the U.S.; Nate and I had this conviction of let's solve it for the world." – *Gil Lee*

Domestic Production & Job Creation

"Today, about 94% of energy storage systems are manufactured outside the U.S. – even though we're one of the largest users of the technology. We're working to change that by bringing manufacturing here. That shift gives us far greater control over the product and its performance." – *Patrick Reedy*

"Only 6.4% of energy storage is manufactured in the United States." – *Nate Walkingshaw*

"It's a weird dichotomy, because it's not like the US doesn't have the resources. We have lithium, we have iron, we have phosphate, but it was just something [where the] production infrastructure was stood up in Southeast Asia, and now we're actively working to bring that infrastructure back into the United States." – *Tony Worthen*

"[We're] bringing back manufacturing and then advancing that manufacturing through highly powered, highly sophisticated, automated tools." – *Nate Walkingshaw*

"We, at Torus, are hyper-focused on our bill of materials and supply chain. And so you think about a flywheel energy storage device that has 172 different components on it...at Torus, that bill of materials is within 150 miles of our facility, cradle to grave." – *Nate Walkingshaw*

Supply Chain Resilience & National Security Benefits

"You don't have emergency medical capabilities; you don't have water treatment plants; you don't have data centers to run your AI models; you don't have anything, if you don't have power...you can feel the weight of that – what we call critical critical infrastructure. There's just nothing more important than protecting or making our power grid more resilient, making it more stable, more secure for our future." – *Trent Bond*

"You can imagine there are a number of nation states that would love to get their hands on internet connected energy resources. Why? It's the equivalent of a coal plant, or the equivalent of a nuclear plant that could be within their control – they would love that. So absolutely necessary to network connect energy assets but really with no room for error."
– *Trent Bond*

"In 2008...we shut down steel factories and shipped our steel to China – that was kind of like the first leg of the stool. The second thing was all of the inventions...We shipped all of this technology over to China and taught Foxconn how to build it all. And so, you know, we took an unskilled labor force gave them all of this innovation, all this automation, all the CPU and GPU design, and then they built on top of that. Well, the reason why it's such a big deal is Torus has to bring back manufacturing, but we have to advance it ten years ahead of China right now. And so just bringing back the status quo is not good enough. We have to bring back the status quo, and then we have to advance it against the most new and emerging technology that nobody has ever seen before." – *Nate Walkingshaw*

"So that [means] bringing back manufacturing and then advancing that manufacturing through highly powered, highly sophisticated, automated tools – to actually either beat society or manage the status quo within the most advanced society that we're working up against in our country. Frankly, in our country, we've got to do that in spades right now, like the whole country, all hands on deck in a race for knowledge and energy." – *Nate Walkingshaw*

THE FUTURE OF ENERGY WITH TORUS

"When I go back to when we started this company, it wasn't just let's solve this for the U.S.; Nate and I had this conviction of let's solve it for the world." – *Gil Lee*

"If you think about, you know, what does the energy future, the geopolitical landscape look like? What does our planet look like in the future? And, you know, always, the aspiration is leave it better than you found it." – *Nate Walkingshaw*

"Our products are what will enable large scale renewables for thousands of homes, millions of homes, and so that kind of all goes back to the original idea of, if we can actually solve this for one home, we can actually solve it for the world. And so that has been our conviction." – *Gil Lee*

"We've built a great product that performs exactly as intended – and the potential is enormous. Even if it never changed, it would continue to deliver exceptional value to our customers and to the grid as a whole. And yet, we're just getting started – we're continuing to evolve the product to do even more." – *Patrick Reedy*

"Understanding the customer journey and their evolving needs is what shapes our product roadmap – and that's what makes it exciting. There's still so much to discover." – *Patrick Reedy*

"One of the most exciting parts of what we do is that we're constantly evolving. Every time we talk to a new customer, we uncover a new problem set—and those insights directly shape our next design." – *Patrick Reedy*

"The other thing is automated manufacturing...in order for us to build the future of things, the quality of power that's needed to integrate with advanced machining equipment and automated machine equipment requires the same level of sophistication as a data center. One good example of this is we machine and axle for a rotor to ten thousandth of an inch. In order for you to machine an axle to 10,000th of an inch, you have to have the highest power quality. Only 9 of these vertical turning lathes live in the US today and we have one of those machines. That's kind of what the future of this is going to look like." – *Nate Walkingshaw*

"We're essentially in the largest race between knowledge and energy, probably very akin to what happened back in the industrial revolution." - *Nate Walkingshaw*

"When I say a race for knowledge and a race for energy – energy is going to have to build a knowledge worker that's as fast, first phase, and then more advanced than the human brain. That's what we're doing today." – *Nate Walkingshaw*

"If you think about what advanced knowledge looks like – it's a collection of agents all working together as a central nervous system, taking over the human capacities like the neurological network." – *Nate Walkingshaw*

"What's interesting about today is that people are just seeing the reaction of a single GPT agent prompt. That's it. But if I were to give you basically the entire faculties of not only the human brain and its intelligence, plus the physical like neurological network and synapse of the human body – that's essentially what's going to be delivered over the next 100 years." – *Nate Walkingshaw*

"Automated manufacturing allows me to do that; artificial intelligence allows me to do that; firmware operating systems allow me to do that, and it's all cybersecurity detected. That is the nutshell – what we have built, the advancement of technology and knowledge and power…Torus is the embodiment of that right now. If you build something now, build it this way."
– *Nate Walkingshaw*

US National Expansion

"Now we're going into six other states and the West. We keep constantly getting pulled into the Northeast and Southeast and Midwest…everybody has this problem." – *Gil Lee*

Vision for Sustainable Energy

"Torus is creating a more reliable power grid that meets the diverse needs of our modern world. At its core, our vision is about building a future where energy is clean, accessible, and designed for the long term." – *Nate Walkingshaw*

"At this stage, we are helping solve our own national problems, and that is enough for us to try and solve today. Because when you look at where we are trending with data centers and EVs, and just overall electrification, we are far from that. And what is actually making this even worse is we don't have our supply chains in place; we don't do our own manufacturing in the US; we're reliant on other countries. And so we need to solve this U.S. problem, but it doesn't preclude us from thinking, 'Oh, this is actually a problem for many nations in the world.' Eventually, we will solve that problem for others." – *Gil Lee*

"There are two standards in the world – 60 hertz and 50 hertz power. U.S. is 60 hertz and the rest of the world, most of the rest of the world, is 50 hertz…and a whole host of other things technically that we had to solve. But from the very beginning, we were designing, architecting, engineering the products to work for anywhere in the world." – *Gil Lee*

"I eventually want to bring this back to the Philippines…to solve a lot of the energy poverty areas there. I lived there…in some remote islands, and some of these towns didn't have power in the evening because it was just too expensive, and so by 6pm it was just pitch dark. And the problem there was that the kids who needed to learn and needed to study at night just didn't have the capabilities; I mean, they were doing it by candlelight. Have you tried reading by candlelight, day-in and day-out, or night-in and night-out? It's just impossible. So you really see where energy poverty is not only a disadvantage economically, but for a lot of these kids, it's just really their ability [to learn]." – *Gil Lee*

"When we talk about sustainability, we are talking about our posterity. And so it's not a problem that we can only begin to solve it in our generation, but we have to be taking the right steps so our posterity can have the benefit of sustainable energy." – *Tony Worthen*

"We will be the world leader for this technology going forward, and how we build resilient electrical grids that benefit communities of people throughout the United States and throughout the world. But we have to do it very efficiently here first."
– *Tony Worthen*

"What's interesting about today is that people are just seeing the reaction of a single GPT agent prompt. That's it. But if I were to give you basically the entire faculties of not only the human brain and its intelligence, plus the physical like neurological network and synapse of the human body – that's essentially what's going to be delivered over the next 100 years."
– *Nate Walkingshaw*


TORUS
good energy
good energy
TORUS
MOAB
good energy

KEY INDUSTRY TERMS

Key Term	Description
Behind the meter	Refers to all energy systems installed on the customer's side of the utility meter, often used to reduce grid consumption or provide backup power
Black Start	The ability of generators or systems to restart independently without relying on the external electric grid, enabling the recovery of power after a major outage or grid failure
Capacity	The maximum amount of electric power (electricity) that a power plant can supply at a specific point in time under specific conditions
Curtailment	The reduction of output from renewable energy sources - like wind or solar - due to grid constraints or over-supply, even when those resources are capable of generating power
Demand Response	A strategy that involves reducing or shifting energy usage during peak periods in response to signals from a grid operator or utility, helping balance supply & demand while lowering system stress and costs
Distributed energy resources	Small-scale electricity generation or storage technologies - such as solar panels, batteries, or fuel cells - located close to the point of use and capable of feeding power back into the grid
Distribution	The lowest-voltage portion of the grid, responsible for delivering electricity from substations to homes, businesses, and other end-use consumers
Electrification	The process of replacing technologies that use fossil fuels with electric alternatives to reduce emissions and increase efficiency
Flywheel energy storage	A mechanical energy storage system that uses a spinning rotor to store kinetic energy and then releases it as electricity when needed, offering fast response and high cycling durability
Front-of-the-meter	Refers to all energy generation and storage systems connected directly to the grid on the utility side of the meter, often providing services like load shifting or frequency regulation
Full-stack system	A comprehensive solution that integrates hardware, software, and services into a unified platform, enabling end-to-end functionality such as monitoring, control, and optimization
Generation	A measure of electricity produced over time
Grid inertia	The natural resistance to changes in frequency, typically provided by the rotating mass of conventional generators, which helps stabilize the grid during sudden disturbances or changes in demand
Grid-tied assets	Energy systems or devices that are connected to and synchronized with the public electric grid
High voltage alternating current	The most common form of electricity used for long-distance transmission in the grid
Hybrid energy storage	A system that combines two or more types of energy storage technologies - such as flywheels and batteries - to leverage the strengths of each and deliver optimized performance across multiple use cases
Interconnection	Local electricity grids interconnected to form larger networks
Inverter	An electronic device that converts direct current (DC) electricity into alternating current (AC) for use in the grid
Islanding	A condition where a section of the grid, typically a microgrid, continues to operate independently and maintains power even when disconnected from the main utility grid
Kilowatt	A standard unit for measuring electricity, equal to 1,000 Watts
Kilowatt-hour (kWh)	One kilowatt (kW) of electricity generated or used for one hour
Lithium-ion batteries	Rechargeable batteries widely used in grid storage, known for their high energy density, rapid response, and scalability
Load leveling / Load balancing	The process of ensuring that electricity supply matches demand across the grid in real time, redistributing or adjusting power flows as needed

Key Term	Description
Low voltage direct current	A form of electrical power delivery that uses direct current at low voltages, often used in applications where stable, efficient power is required
Low voltage ride through	The capability of certain energy systems, particularly inverters and generators, to remain connected and continue operating during temporary drops in voltage, supporting grid stability during disturbances
Main transmission	The high-voltage backbone of the electric grid that moves large amounts of electricity over long distances from power plants to substations
Microgrid	A localized energy system that can operate independently or in parallel with the main grid, integrating DERs to serve a specific area such as a facility school, or neighborhood
Modular power plants	Small-scale, localized generation systems - often based on renewable energy and storage - that provide electricity to specific buildings, campuses, or communities, and can operate independently or in support of the main grid (also known as microgrids)
Node-level control	The ability to manage and optimize power flows at individual points, or "nodes," on the grid such as buildings, substations, or distributed energy resources
Peak load	The highest level of electricity demand experienced by the grid over a specific time period, usually during extreme weather conditions or high-usage times of day
Peaker plants	Power plants, typically run on fossil fuels, that are used only during periods of peak electricity demand
Power factor	A measure of how efficiently electrical power is converted back into usable work output, with a value of 1.0 indicating perfect efficiency and lower values signaling greater energy losses
Power quality	A measure of how stable and reliable the electricity supply is, accounting for factors like voltage fluctuations, frequency deviations, harmonics, and interruptions that can affect equipment performance and grid reliability
Purchase Power Agreement	A long-term contract between an electricity generator or aggregator and a utility to purchase electricity at a fixed rate
Round-trip efficiency	The percentage of energy retrieved from a storage system compared to the energy initially used to charge it, representing the total energy losses during both charging and discharging cycles
Sales	The amount of electricity sold to end-use consumers, accounting for most U.S. electricity consumption
Spinning reserve	Backup generation capacity that is online and synchronized with the grid, ready to increase output in response to sudden losses of supply or surges in demand
Sub-transmission	An intermediate layer of the grid that operates at lower voltages than main transmission and serves to carry electricity from high-voltage transmission lines to regional or local distribution networks
Telemetry	The remote collection and real-time transmission of data - such as voltage, current, or frequency - from energy systems or grid components to control centers for monitoring and operational decision-making
Transformer	An electrical device that changes the voltage level of electricity - either stepping it up for transmission or stepping it down for distribution - enabling efficient power delivery across the grid
Utility-scale market	Refers to large energy projects, typically greater than 1 megawatt (MW) that are designed to produce electricity for sale to utilities or wholesale markets
Utility tariff	A structured pricing mechanism approved by state regulators that outlines how a utility charges its customers for electricity service, including rates, terms, and conditions of service
Vertical integration	Business structure in which a company controls multiple stages of the value chain - from manufacturing to software to deployment - enabling greater coordination, efficiency, and control over product quality and delivery
Virtual power plants	Aggregated networks of distributed energy resources that are coordinated through software to function like a single power plant, providing grid services or market participation
Voltage sag	A short-term reduction in voltage, typically 10% or more below the normal or recommended level, lasting from half a cycle to a minute (aka voltage dip)
Watt	A measure of energy named after the Scottish engineer James Watt

KEY ACRONYMS

Acronym	Meaning
AC	Alternating Current
ACL	Access Control List
AES	Advanced Encryption Standard
API	Application Programming Interface
ASCE	American Society of Civil Engineers
BESS	Battery Energy Storage System
BMS	Battery Management System
C&I	Commercial & Industrial
CCS	Carbon Capture and Storage
CESER	Office of Cybersecurity, Energy Security, and Emergency Response
CIP	Critical Infrastructure Protection
CISA	Cybersecurity & Infrastructure Security Agency
DC	Direct Current
DER	Distributed Energy Resource
DoD	Depth of Discharge
DOE	U.S. Department of Energy
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EPACT	The Energy Policy Act
EPRI	Electric Power Research Institute
ESG	Environmental, Social, and Governance
EVs	Electric Vehicles
FACTS	Flexible AC Transmission Systems
FCM	First Colony Mortgage company
FERC	Federal Energy Regulatory Commission
FESS	Flywheel Energy Storage System
GDPR	General Data Protection Regulation
GHG	Greenhouse Gas Emissions
GRIP	Grid Resilience and Innovation Partnerships
GW	Gigawatt
GWh	Gigawatt-hour
IDS	Intrusion Detection System
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IIJA	The Infrastructure Investment and Jobs Act
IoT	Internet of Things
IOUs	Investor Owned Utilities
IPPs	Independent Power Producers

Acronym	Meaning
IRA	The Inflation Reduction Act
ISO	International Organization for Standardization
ISO-NE	Independent System Operator-New England
ISOs	Independent System Operators
kW	Kilowatt
kWh	Kilowatt-hour
LAN	Local Area Network
MFA	Multi-Factor Authentication
MISO	Midcontinent Independent System Operator
MOU	Memorandum of Understanding
ms	Milliseconds
MW	Megawatt
MWh	Megawatt-hour
NIST	National Institute of Standards and Technology
NREL	National Renewable Energy Laboratory
NYISO	New York Independent System Operator
O&M	Operations & Maintenance
OT	Operational Technology
PHMSA	U.S. Pipeline and Hazardous Materials Safety Administration
PPA	Power Purchase Agreement
PSC	Public Service Commission
PUC	Public Utility Commission
PURPA	Public Utility Regulatory Policies Act
RMP	Rocky Mountain Power
RTO	Regional Transmission Organizations
SCADA	Supervisory Control and Data Acquisition
SoC	State of Charge
TFP	Transmission Facilitation Program
TLS	Transport Layer Security
TW	Terawatt
TWh	Terawatt-hour
UL	Underwriters Laboratories
UPS	Uninterruptible Power Supply
USDN	Urban Sustainability Directors Network
VLAN	Virtual Local Area Network
VPP	Virtual Power Plant


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