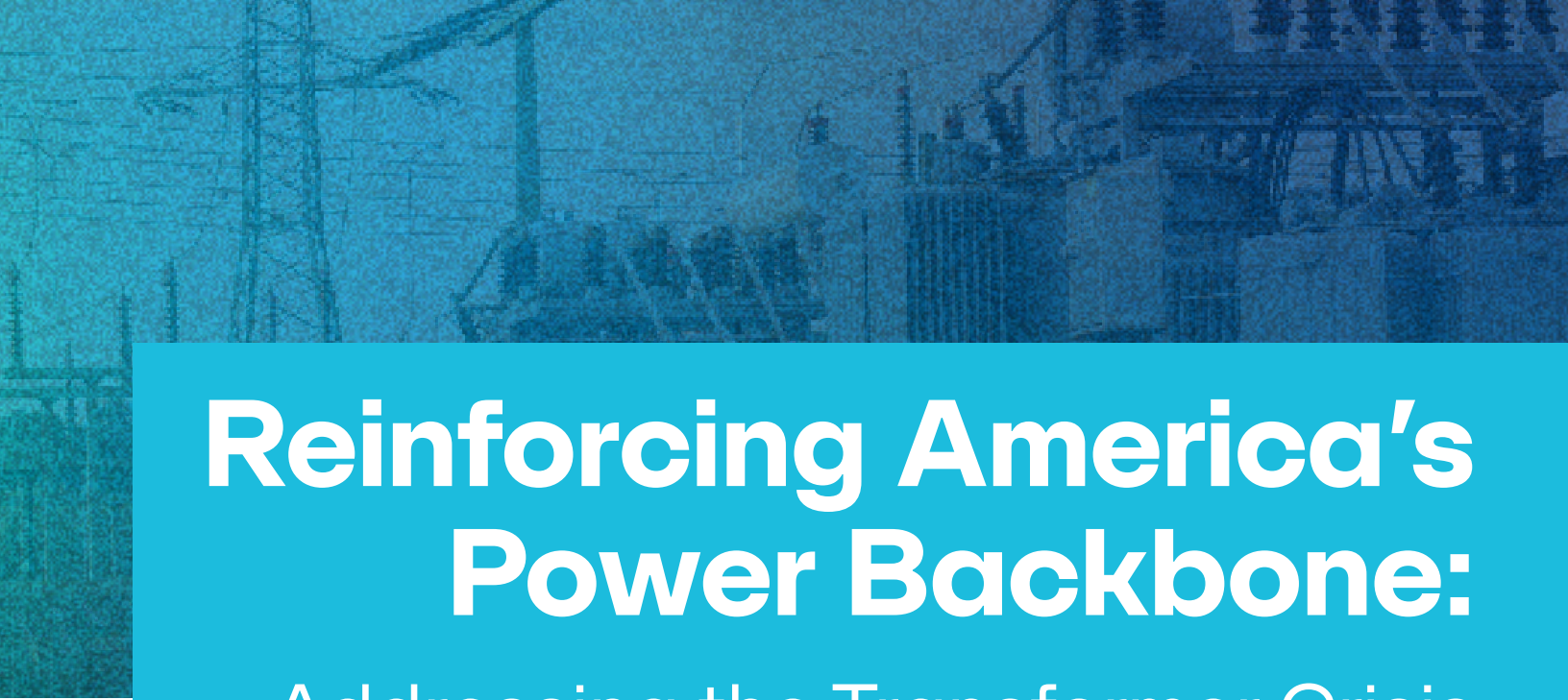




Reinforcing America's Power Backbone:

Addressing the Transformer Crisis and Building a Smarter Grid

Executive Summary

Transformer shortages, supply chain delays and lack of sustained domestic manufacturing capacity are straining America's aging electrical grid at a time when electrification and distributed energy demand are rapidly growing. The U.S. depends heavily on overseas production and legacy infrastructure, leaving utilities vulnerable to disruption. We explore the condition of the U.S. grid, the challenges around transformer availability, and Emotiv's approach to building a smarter, more resilient energy backbone. Built using automotive-grade manufacturing and designed for domestic production, Emotiv's solution aims to restore resilience, enable smart grid expansion, and meet the power needs of the future.

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The Current State of the Grid

The U.S. power grid was once a model of engineering strength. Today, more than 70% of the nation's transformers and transmission lines are over 25 years old. Much of this infrastructure was never built to handle the demands of modern electrification, including electric vehicles, energy storage, and distributed renewables.

Federal and state modernization programs are underway, but momentum is challenged by physical limitations and long timelines. Many utilities are still reliant on equipment that lacks the efficiency, intelligence, and durability needed to operate in a distributed and data-driven energy future.

“Much of the U.S. electric grid was built in the 1950s and 1960s and was not designed for today’s demands.” — DOE Grid Modernization Initiative



The Challenges We Face

The transformer shortage is not theoretical. Lead times for key transformers can stretch up to 39 months. More than 80% of large transformers are sourced overseas, and many domestic refurbishment centers are facing backlogs. These delays are impacting project timelines, inflating costs, and threatening reliability.

“Utilities report pad-mounted transformer lead times exceeding 24 months, with some orders quoted at 39 months.” — Grid Strategies, The Transformers We Need Now (2023)

Data from Grid Strategies highlights a 50% increase in grid-related outages over the last decade, with transformer availability cited as a core factor. The North American Electric Reliability Corporation (NERC) also classifies transformer constraints as a high-priority risk to grid resilience.

Utilities aren't just waiting longer—they're paying more and taking on greater risk.



The Transformer Bottleneck

At the heart of this issue are the pad- and pole-mounted transformers that serve as the final connection points in power distribution. These units are small but essential. Without them, no home, business, or EV charging station gets powered.

“Transformers are critical to electrification—yet the designs haven’t changed meaningfully in decades.”
— Emotiv Strategic Insight

As demand surges from electrified transportation, distributed energy resources (DERs), and microgrid projects, the need for reliable, modern transformers has never been higher. Yet production capacity remains constrained, innovation has lagged, and utilities are forced to choose between waiting for inventory or compromising on quality.



A New Domestic Approach

Emotiv is bringing a new perspective to this challenge. By applying advanced automotive manufacturing principles to transformer production, we're introducing a line of pad- and pole-mounted units that prioritize quality, speed, and reliability.

These new transformers are:

- Built in the U.S. using proven automotive-grade processes
- Designed to exceed Department of Energy energy efficiency standards
- Engineered for durability, minimizing failure rates over time
- Prepared for future smart grid integration through sensor-ready design

"By leveraging automotive-grade production, we're unlocking efficiency and scale the grid has never seen before." — Emotiv Engineering

And because they're made here, they reduce dependency on global supply chains, shortening lead times and helping utilities get projects back on track.

"The U.S. imports 80–90% of the large transformer components it relies on." — National Renewable Energy Laboratory (NREL)

Product Snapshot: What Sets Emotiv Apart

Emotiv's transformer initiative is more than a response to a supply chain challenge—it's a blueprint for grid innovation.

Our pad- and pole-mounted transformers are being developed from the ground up, using a blank-page design approach that merges automotive-grade durability with emerging energy technologies. The goal: modernize this "old world" component for a smarter, more resilient grid.



Product Snapshot: What Sets Emotiv Apart

Key Technical Highlights:

- **Automotive Manufacturing Discipline:** Robust quality systems and production discipline enhance durability and reduce long-term failure rates.
- **Energy Efficiency:** Designed to meet or exceed the U.S. DOE's next-generation transformer efficiency standards.
- **Smart Technology (Phase 2):** AI-powered monitoring enables predictive maintenance and real-time transformer diagnostics, reducing outage risk and accelerating recovery times.
- **Refurbishment Capability:** Integration of new tech into existing field units extends lifecycle and reduces waste—supporting utility sustainability goals.

Target Applications:

- Residential and small commercial power distribution
- Grid upgrades in high-growth and electrifying regions (e.g., Michigan, Southeast U.S.)

Prototype & Development Timeline:

- **Final prototype build:** Q4 2025
- Validation, assembly, and testing with global partner
- UL/CL certification planned (not required by customer, but included in mitigation scope)
- Cost and lead time reduction strategies in development

“We’re designing a transformer that doesn’t just meet the needs of today’s utilities—it anticipates tomorrow’s grid.” — Tony Tomczak, Energy Strategy Lead



Recommendations for Utility Leaders

Utilities need more than a supplier. They need strategic partners who can deliver on performance, reliability, and innovation. As modernization efforts accelerate, the most resilient utilities will be those who:

- Reevaluate sourcing strategies to prioritize domestic manufacturing
- Incorporate lifecycle cost and lead time into procurement decisions
- Explore smart transformer pilots to enable predictive maintenance and operational efficiency
- Align with manufacturers who can scale production without sacrificing quality

Emotiv stands ready to support those priorities.

The Road Ahead

Emotiv's first prototype units will be completed in Q4 2025, with production scaling in 2026. Early partnership opportunities are available for utilities interested in pilot deployments or joint development efforts.

**"Domestic manufacturing isn't just an economic benefit—it's an energy security imperative."
— Emotiv Mobility**

Grid modernization requires bold action. By combining the rigor of automotive production with a deep understanding of power distribution, Emotiv is helping build the infrastructure America needs to meet the energy demands of tomorrow.

