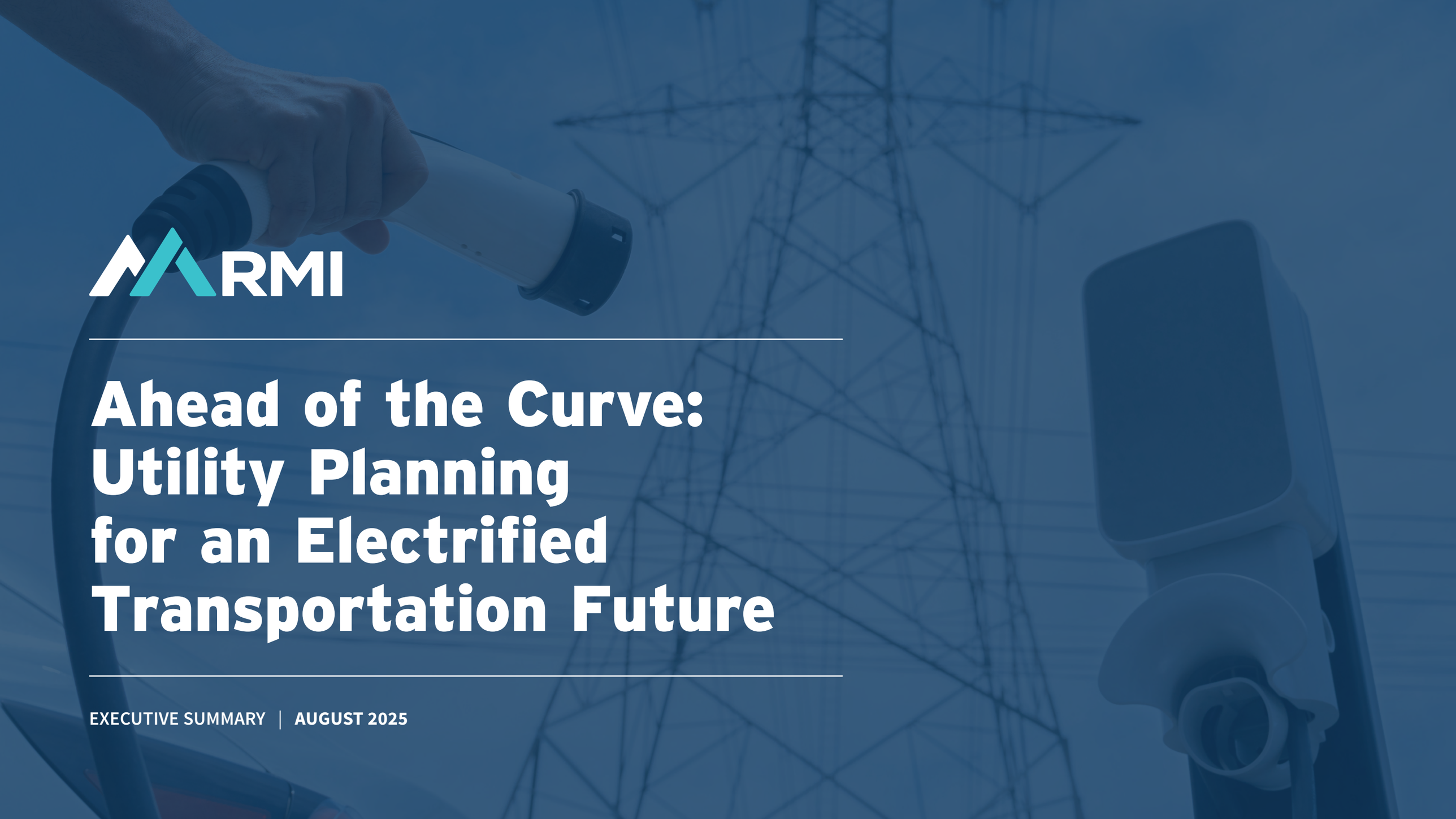


RMI

Ahead of the Curve: Utility Planning for an Electrified Transportation Future

EXECUTIVE SUMMARY | AUGUST 2025

Executive Summary

The US electricity distribution grid is at a critical inflection point. Widespread electrification—especially of transportation—is creating a surge in demand that is arriving quickly and unevenly. In key locations, such as warehouse districts, highway corridors, and dense urban zones, electric vehicle (EV) charging is poised to use significant portions of available grid capacity. Current connection speeds may delay energization, impeding access to clean mobility and utilities' ability to earn additional revenue from increased electricity sales—a missed opportunity to lower average rates.

In response, utilities and regulators are increasingly considering how to appropriately plan and upgrade the grid for a highly electrified future. Many stakeholders see targeted proactive investments — building grid infrastructure in anticipation of load growth rather than waiting for traditional triggers — as an emergent and essential way to meet this moment. Regulators and utilities are following suit, with initiatives such as the Long-Term Proactive Planning Framework requested by the New York Department of Public Service from its regulated electric utilities, the Minnesota Public Utilities Commission's Proactive Grid Upgrade Workgroup, and the California Public Utilities Commission's increased focus on "pending loads" signaling a shift. Other voices, such as the Lawrence Berkeley National Laboratory and the Environmental Defense Fund (EDF), have emphasized the importance of longer-term planning and forward-looking distribution system investments. However, analysis of the relative costs and benefits of proactive versus traditional investment approaches remains limited. A 2024 EDF-led analysis, conducted with Consolidated Edison (ConEd), CenterPoint Energy, and Black and Veatch, is among the few available comparative analyses assessing the impact of EV load growth on substations in these utility service territories. The study found that under most modeled scenarios, proactive grid investment generally yielded lower ratepayer cost outcomes relative to traditional investment strategies.

This report seeks to advance dialogue around proactive investments through two complementary analyses:

1. **A distribution asset capacity analysis** using publicly available utility data from ConEd (New York), National Grid (Massachusetts), and Xcel Energy (Minnesota), and RMI's GridUp EV load forecasting tool to model when and where future EV load may exceed available grid capacity.

2. **An investment strategy analysis** that compares ratepayer impacts of proactive and traditional distribution system investment approaches for an illustrative investor-owned utility based on real-world cost benchmarks using RMI's Optimus tool.

Key findings and implications

- **Rapid load growth from EV charging is imminent and upgrades will be necessary in some locations.** Even under relatively slow EV adoption forecasts, distribution system impacts are widespread across utility service territories. Our results indicate that a substantial number of utility assets (substations and feeders) may require upgrades due to the uptake of available capacity (or headroom) by EV loads as early as 2030, with a significant number being oversubscribed by 2035 (see Exhibit ES1).

Exhibit ES1 Utility grid assets with significant uptake of headroom, pointing to a potential need for future upgrades

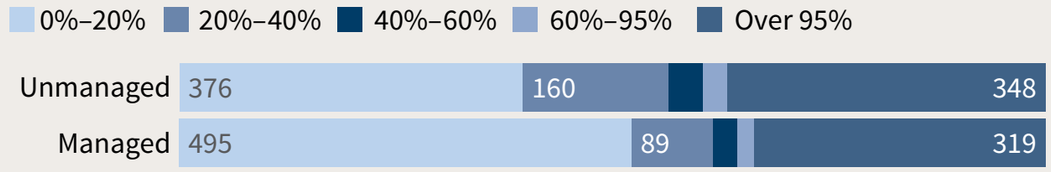
Utility	No. of Utility Assets	2025	2030	2035	Over 100% Capacity Due to EV Load By 2035
ConEd NY	63 Network Substations	0	3	18	2
National Grid MA	1,020 Feeders	8	50	180	20
Xcel MN	948 Feeders	257	355	572	348

Note: Feeders and substations where EV load will consume over 20% available headroom in 2025, 2030 and 2035. Assets are "over 100% capacity" when headroom is completely taken up by EV load.

RMI Graphic. Source: RMI analysis

- **Impacts may be mitigated through load management measures, thereby reducing or delaying the need for infrastructure investment (see Exhibit ES2).** Managed charging alone may significantly reduce the amount of capacity required to support EV charging by optimizing the use of existing and new infrastructure. The benefits of these practices scale over time as more EVs connect to the grid.

Exhibit ES2 Variation in EV load share of feeder headroom due to managed charging (Xcel Energy, Minnesota, 2035)



RMI Graphic. Source: RMI analysis

Key findings and implications, continued

- **Impacts are not uniform.** Distribution infrastructure impacts vary widely and may be concentrated in specific regions and locations based on:
  - *Scale and pace of EV adoption, given state or local policy and the presence of high-traffic or fleet-heavy areas;*
  - *Coincident load growth from other demand drivers (e.g., building electrification); and*
  - *The current available capacity of grid infrastructure to support growing load.*
- **Proactive investments can be economically beneficial to ratepayers in the long term.** Across all modeled scenarios, a proactive investment approach showed modest net ratepayer benefits in levelized costs over the 2025–35 period. Our analysis indicates that proactive investment approaches may result in upward pressure on rates in the short term but ultimately lead to ratepayer savings over time (see Exhibit ES3). Near-term rate increases can be larger if EV uptake is slower than forecast, but if EV deployment is accelerated, the rate increase risk becomes negligible, further increasing long-term savings.

Exhibit ES3 Long-term savings in levelized rates (2025–35) through proactive investment compared with traditional investment

EV Adoption Scenario	Charge Management Scenario	Traditional Approach (cents/kWh)	Proactive Approach (cents/kWh)	Savings from Proactive Approach
Baseline	Unmanaged	13.26	13.24	0.12%
Baseline	Managed	13.21	13.19	0.14%
High	Unmanaged	13.23	13.22	0.11%
High	Managed	13.17	13.15	0.20%
Low	Unmanaged	13.28	13.26	0.11%
Low	Managed	13.24	13.22	0.13%

RMI Graphic. Source: RMI analysis

- **Benefits of proactive investment are highest when certain conditions coexist**. This includes:
  - *Larger one-time upgrades made in place of smaller, incremental investments, leading to a lower per-unit upgrade cost.*
  - *A high likelihood of EV load growth, resulting in increased capacity utilization.*
  - *Demand-side management strategies, such as managed charging, resulting in deferred and smaller infrastructure investments.*

With the right tools, data-driven decision-making, and regulatory support, targeted proactive investments in the distribution grid can lower costs, improve reliability, and accelerate transportation electrification. In this moment of increasing load growth, utilities and regulators have a unique opportunity to modernize grid planning for faster, more affordable connections. We encourage:

- **Utilities** to integrate high-resolution EV load forecasting into their planning tools while making data and assumptions transparent for other stakeholders; identify near-term growth hot spots; and pursue rightsized proactive investment in these targeted areas, when justified. This should include consideration of traditional capacity investments as well as non-wires alternatives, where appropriate.
- **Regulators** to update planning frameworks and approval guidelines to allow for and encourage proactive investments where justified by robust data and analysis and to ensure transparency both in process and in data sharing to encourage an appropriate balance between advance planning and ratepayer protection.
- **Consumer advocates** to engage in data-driven grid planning discussions and dialogue in proceedings that can support both ratepayer cost savings and expanded access to charging infrastructure.
- **Local and state governments** to support transportation electrification through the use of open-access tools and to engage with utilities and regulators to encourage proactive grid investment where justified.