Written Testimony

Hearing of the Senate Budget Committee

United States Senate

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EPRI

"Charging Ahead: The Future of Electric Vehicles"

31 July 2024

Mr.Whitehouse, Mr. Ranking Member, and members of the committee, thank you for the opportunity to testify today. I am Britta Gross, the Director of Transportation at EPRI.

Background

EPRI is an independent, non-profit, global energy research, development, and deployment (RD&D) institute organized under section 501(c)(3) of the Internal Revenue Code. EPRI's experts collaborate with more than 450 companies in 45 countries, driving innovation to support clean, safe, reliable, affordable, and equitable access to electricity for the public across the globe.

EPRI brings together electric utility companies, scientists, and engineers, along with experts from academia, industry, and other centers of research to:

- Collaborate in solving challenges in electricity generation, delivery and use;
- Provide technical, scientific, and economic analyses to drive long-range research and development planning;
- Support multi-disciplinary, objective research in emerging technologies; and
- Help accelerate the commercial deployment of advanced electricity technologies for the benefit of the public.

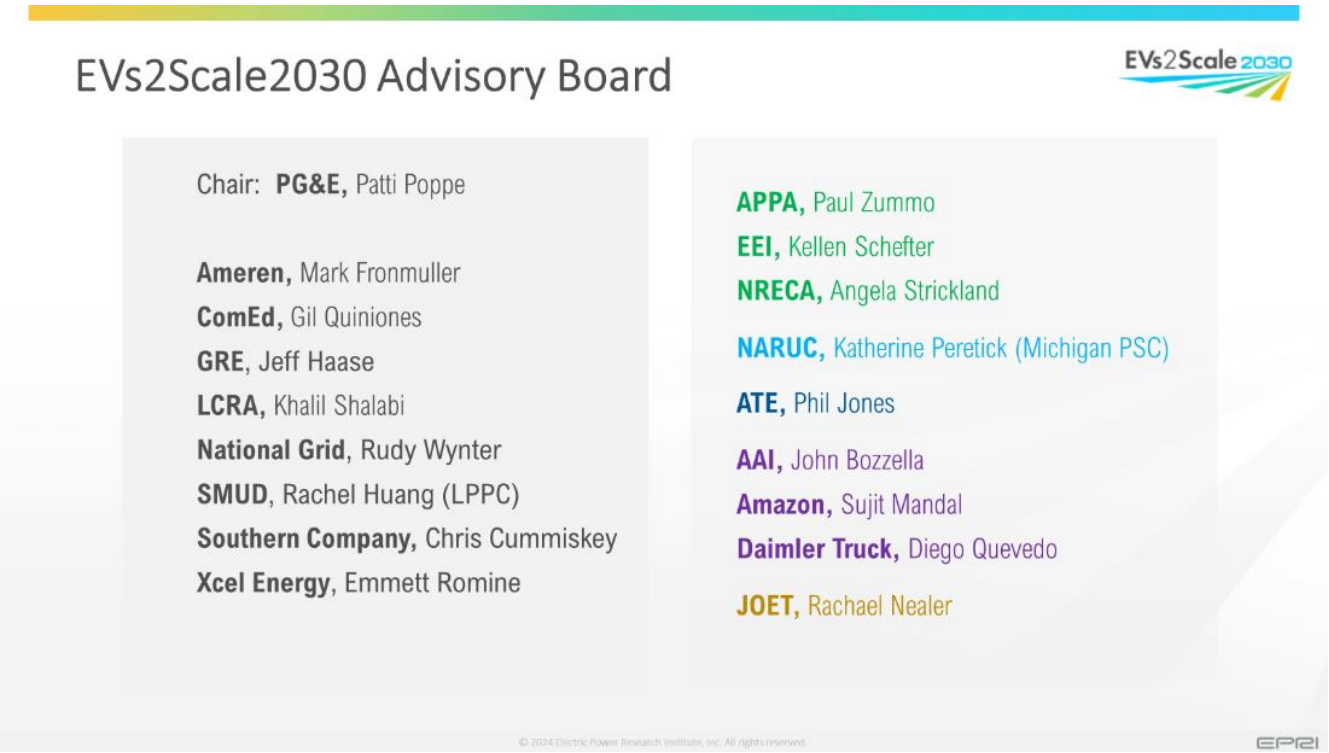
For over 34 years, **EPRI's Electric Transportation Program** has been working with utilities, vehicle manufacturers, and other key stakeholders worldwide to research, demonstrate, and assist in readying the grid for the deployment of electric vehicles and electric vehicle charging. With 5.2M+ EVs on the road in the U.S., the market transformation is underway, and while ~$5B in EV infrastructure has been installed or proposed by utilities in recent years, understanding this marketplace requires ongoing multi-faceted expertise and the ability to support a rapidly changing landscape while keeping rates low, the grid reliable

and resilient, and supporting individual and fleet customers. EPRI's Electric Transportation program gathers insights through collaboration with cross-industry stakeholders, national labs, and many others, and its research provides data, reports, tools, and easy-to-understand guides to help utilities and other public and private stakeholders expedite actions to achieve EV-related goals—whether they've recently engaged or are long-time market participants.

EVs2Scale2030 is a special three-year initiative led by EPRI that is focused on leveraging industry scale to galvanize and align critical market stakeholders as electric vehicles (EVs) are deployed at scale to achieve 2030 goals. The project aims to:

- Ensure utilities (and utility oversight bodies) are in lockstep with vehicle manufacturers, fleet operators, charging providers and consumers to build confidence in achieving 2030 goals.
- Help streamline the systems and processes needed to support the pace of activity and investment required to meet large-scale electrification by 2030.
- Develop needed tools and technologies required to enable and sustain EVs at scale and capture the grid benefits of this large and flexible load.

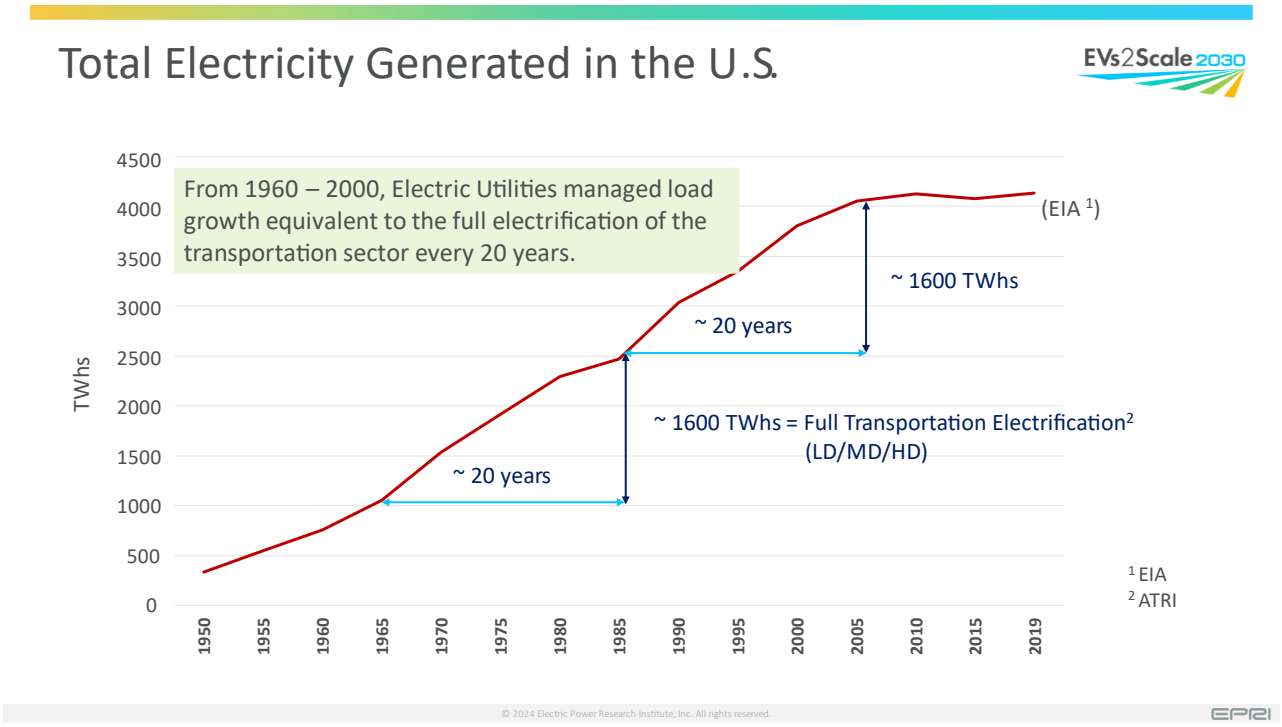
Industry collaboration is critical to the success of this initiative and the Advisory Board of EVs2Scale is illustrative of the cross-industry interest and collaboration in this project:



Current Landscape of Transportation Electrification and Grid Readiness

The electrification of the transportation sector is challenging from a grid perspective, given both the size of this load, the shorter lead-times, and the fact that cars, buses, and trucks are mobile, which means this load can appear just about anywhere on the grid.

The 5.2 million EVs on the road today have added roughly 18TWh (terawatt-hours) of energy demand – largely unnoticed. Fully electrifying the on-road transportation sector will require an estimated 1600 TWhs of energy (ATRI [2]). The following figure shows the utility industry has successfully adapted to load growth of this size at least twice before – once from 1965-1985 and again from 1985-2005. That is, in these 20-year periods, the grid has served new load that is approximately equal in size to fully electrifying the transportation sector – where the full transition of transportation is likely to take place over a period of time much longer than 20 years. The key is early planning and engagement with the utility industry, as well as industry collaboration across the vehicle manufacturers, fleet operators, and charging property developers. If the appropriate investments are enabled, the grid can support this transition.



1. Electricity Net Generation: Electric Power Sector - Microsoft Word - MER_S7 (eia.gov) [eia.gov]
2. ATRI report: ATRI-Charging-Infrastructure-Challenges-for-the-U.S.-Electric-Vehicle-Fleet-12-2022.pdf (page 16-17)

Transportation electrification is **also an opportunity** to **diversify** the load currently on the grid, which normally shows up as early morning or late afternoon load peaks. Utilities have to design for these "peak loads" to ensure electricity is reliable. If transportation loads simply add to these peak times, this could drive grid costs higher. But if utilities can take advantage of this typically flexible transportation resource, for example to charge most vehicles at night, this can help minimize new grid investments and support a more affordable transition.

Though the grid impacts of electric transportation will eventually be felt across the generation, transmission and distribution systems – the nearterm impacts, including to early fleet electric vehicle adoption, are being felt on **local distribution systems** – the wires that lead to our homes, offices, fleet depots, and charging sites.

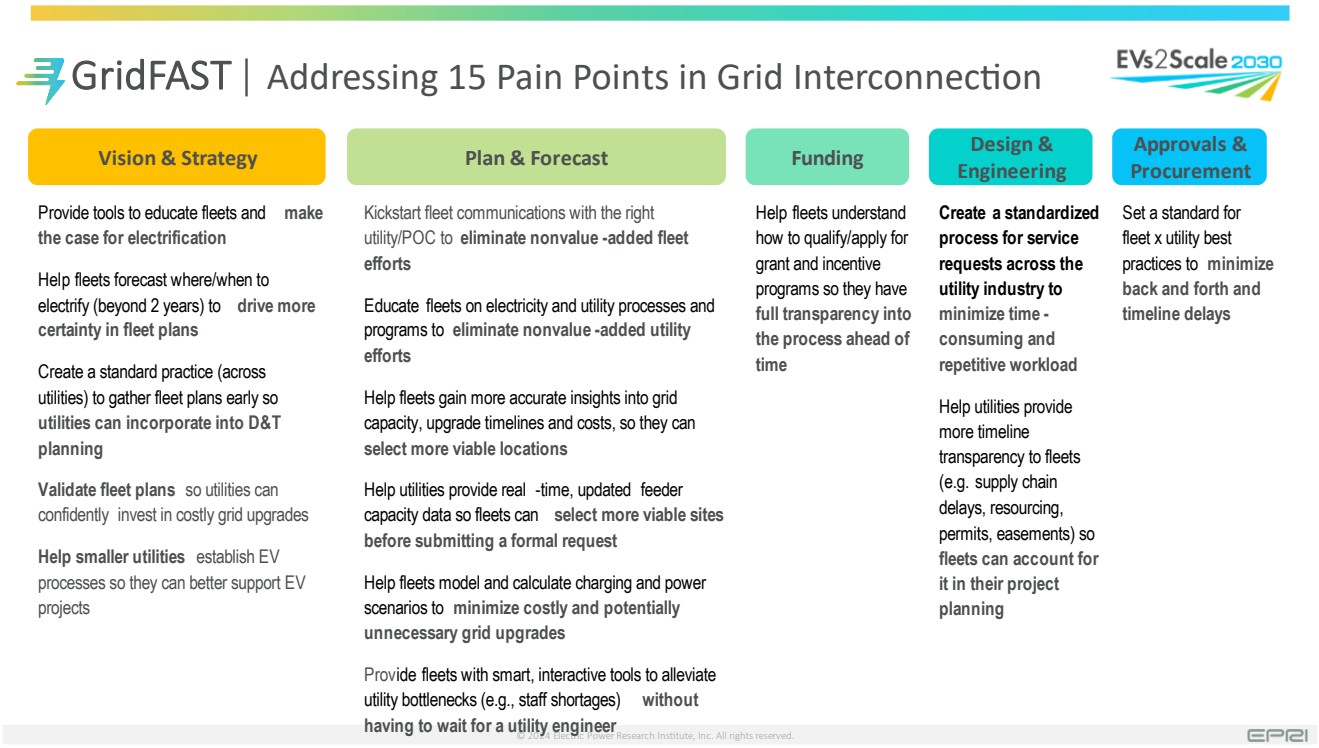
When we look at the overall grid impact of 279 million privately-owned vehicles (295 million vehicles overall) on the road today (97% of which are cars and light-duty trucks), the light-duty vehicle sector will consume by far the most energy. However, that load will be distributed across the entire grid, and its impact on a local distribution circuit is generally minimal. But heavily-concentrated fleets (such as airport car rental fleets) and trucking fleets, in particular, will bring larger loads to these local distribution systems. So in EPRI's work, though we consider all loads from light-duty to heavy-duty vehicles, we're especially focused on the impacts of fleets and trucking loads. It's worth noting, that Daimler Truck North America, Navistar, and Volvo Group North America already manufacture and sell electric medium-duty and heavy-duty trucks in the market today and are seeing these trucks deployed into fleets with local and regional short-haul routes for the movement of goods in areas such as grocery distribution and drayage operations.

Unlike building electrification, a challenge unique to transportation is the **timing mismatch** between shorter vehicle procurement times and longer grid interconnection timelines – i.e. the time it takes to make any necessary grid upgrades to bring additional power to a site. A fleet operator today can order a dozen heavy-duty electric semis and these will be delivered in four to six months, yet the time it takes to bring additional power to that site to serve vehicle charging can take anywhere from 18 months on average to multiple years if more significant grid upgrades are required. Truck manufacturers, including Daimler Truck, Navistar, and Volvo Group, flagged this issue in a recent utility proceeding in California and emphasize that sales of medium- and heavy-duty electric vehicles are dependent on the readiness of the grid to supply power to the charging sites – and that confidence in grid readiness for vehicle charging is critical for customers and has a direct impact on electric truck sales.

This "grid interconnection" time is a key focus area for EPRI, as all stakeholders are impacted by this challenge and this longer lead time for grid upgrades means the utility sector already needs to begin planning today for the transportation loads expected over the next five to ten years.

A second challenge is the **market complexity** – there are over 3,000 utilities (including investor-owned utilities, public/municipal utilities, and rural cooperatives) and tens of thousands of fleet operators who have seldom had to deal with electric utilities. This means a fleet operator or a charging property developer with hundreds of sites nationwide has to be able to identify the right utility to begin planning efforts and then figure out how to apply for service when utilities all use different processes, application forms, differing questions, and different levels of detail required in their applications.

Last year, EPRI studied the issues related to the grid interconnection process and identified 15 pain points at this intersection between transportation electrification customers and utilities. The following slide summarizes the findings of EPRI's research and has informed the design of a tool, GridFAST, that is currently in development and is part of our EVs2Scale2030 initiative.



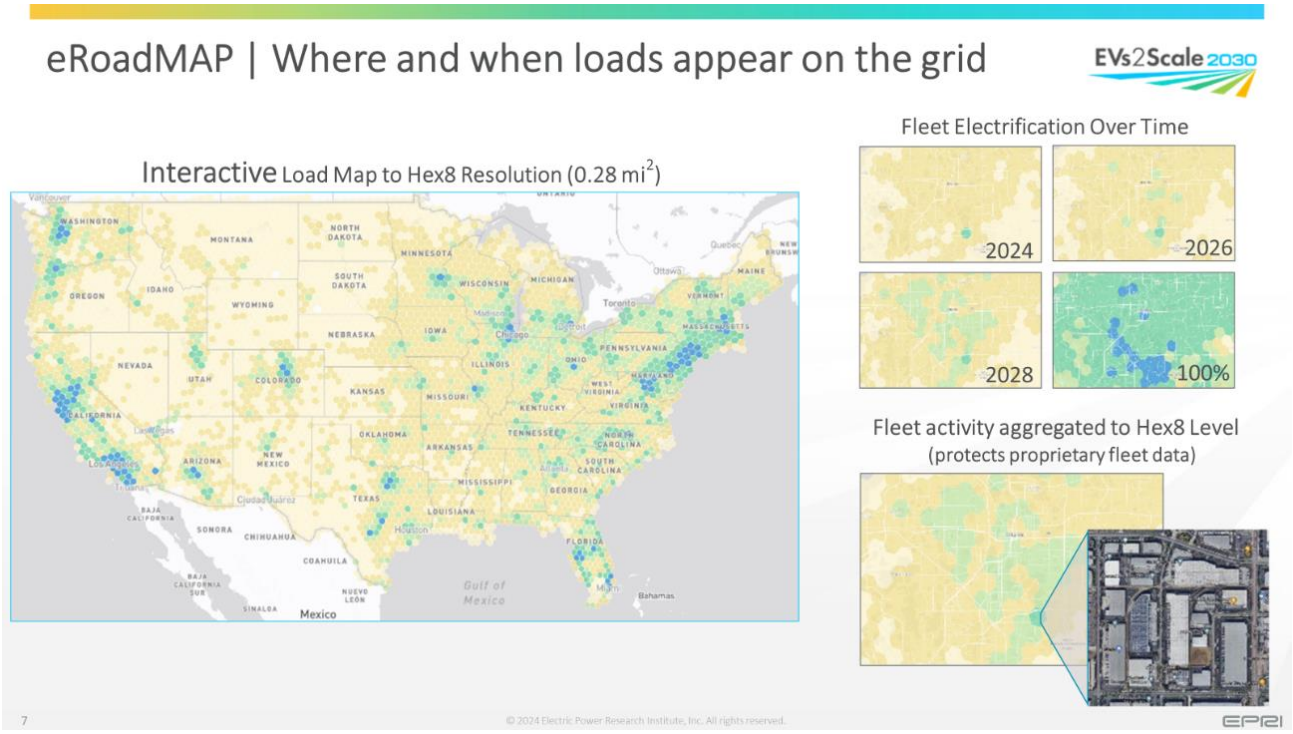
To address these transportation-specific challenges and pain points, key industries **have to work together with utilities** in unprecedented ways to share their electrification plans earlier with utilities – and utility regulators – so that there is **advance knowledge** of where and when loads will show up on the distribution system. Fleet operators and charging providers are increasingly recognizing that outreach to utilities needs to be among the first steps to install vehicle chargers.This improved leadtime is critical for investment planning and accelerating grid interconnections for customers, while utilities also balance the need to ensure they continue to provide reliable electrical service to the broader public across all loads.

Solutions EPRI is Developing

Drawing on the expertise of the utility industry, fleet operators, charging providers, and vehicle manufacturers, EPRI launched the EVs2Scale2030 initiative and identified two critical tools to address current challenges and enable industry to get to scale.

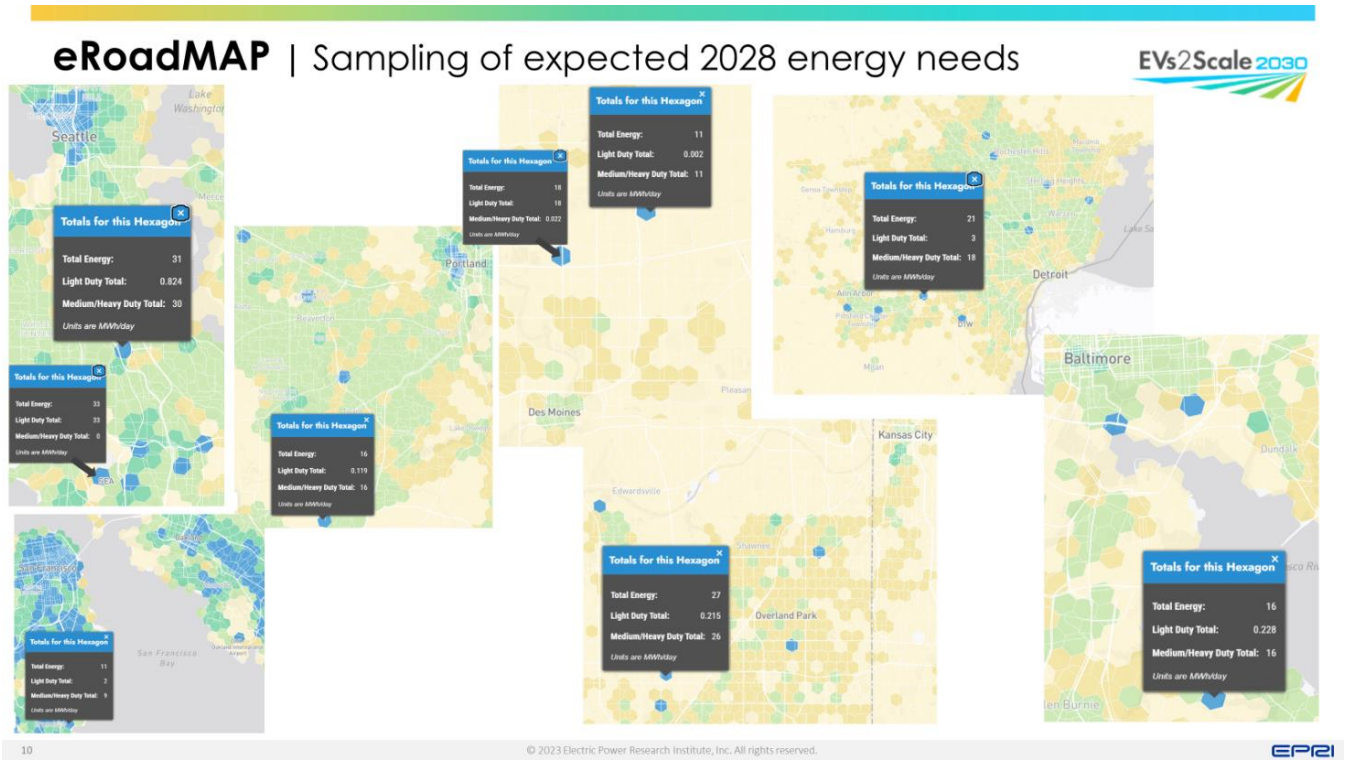
The first tool is an interactive online map available to the public called eRoadMAP™ that is based on an unprecedented data-gathering approach to drive confidence into grid investment decision-making. This mapping tool identifies where and when transportation loads (from light-duty to heavy-duty vehicles) are likely to appear on the grid at a local distribution "feeder" level. More than eight expert organizations in data analytics and more than 10 different data sources (from OEM telematics to purchased vehicle behavioral and registration data to actual national fleet electrification plans) have been integrated in a complex undertaking to identify the likely location of future transportation charging loads – emphasizing that the actual electrification plans from participants are as certain as anyone can be about where and when loads will appear. eRoadMAP will continue to provide confidence as more fleet operators and charging providers share their electrification plans – informing utilities and utility regulators where to prioritize prudent grid investments.

The following figure provides an overview of some of the data and features available in eRoadMAP. Note the simple use of color in visualizing priority hot spots, the importance of the timeline, and the ability to zoom into any area in the U.S. to see the forecasted feeder-level loads and what may be driving these loads in the satellite view. The map provides data at a “Hex8” level of resolution, where each hexagon covers an area of 0.28 mi^2. This is an important feature of eRoadMAP. Fleet operators are competitors, as are vehicle manufacturers and charging providers. EPRI and these industry stakeholders are sensitive to sharing data that one of their competitors can use to its advantage and committed to compliance with applicable law. We are able to preserve the confidential nature of the load data by aggregating the data at the Hex8 level, thereby obscuring the specific details from other fleet operators and charging providers, yet provide a resolution that is important to the utility industry and regulators, as planning and investment decisions are made at this roughly feeder level. This was a critical decision early in the planning for this tool and illustrates the trust needed between the various stakeholders. (eRoadMAP is found at https://eroadmap.epri.com/)



The following slide shows a sample from eRoadMAP of forecasted energy needs for a number of cities and surrounding areas (from Seattle to DesMoines to Baltimore) in 2028 at the most granular Hex8 level (0.28mi^2), illustrating the communicating power of this visualization tool. The examples shown here include hexes with airports, large charging hubs with already-heavy light-duty vehicle traffic, and sites with large logistics fleets planning to electrify.

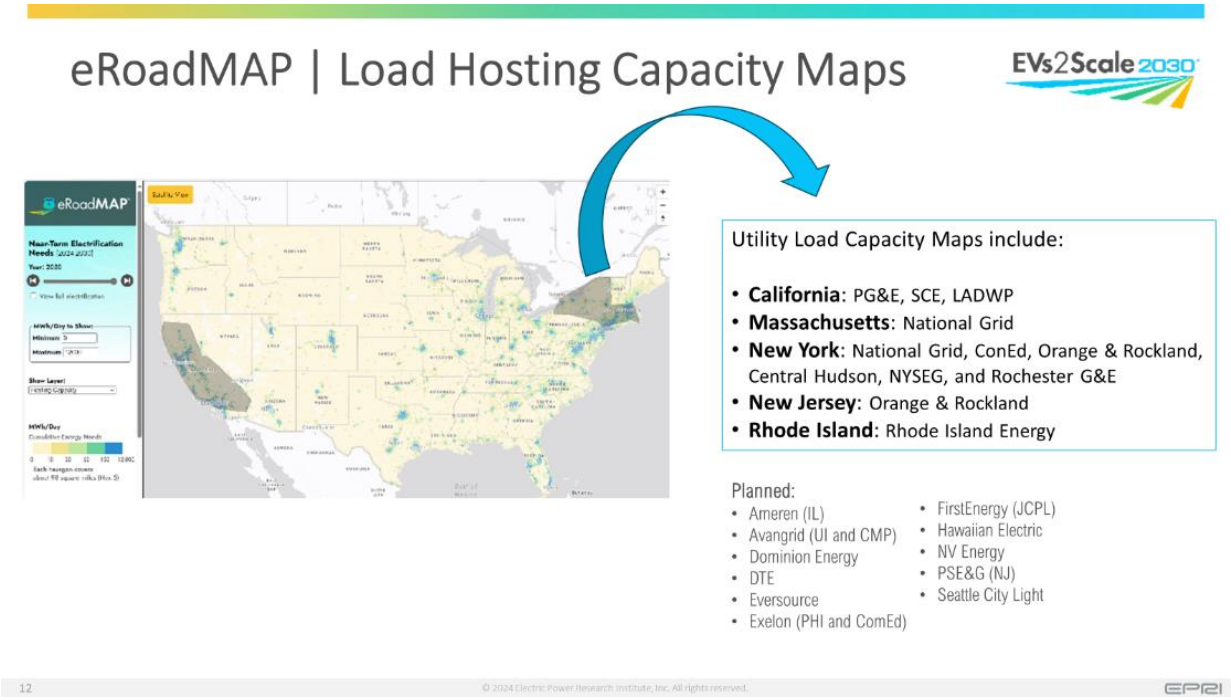
Note that all results currently display load in terms of energy (MWh), which tends to be more useful at the bulk level, for example to estimate the amount of generation required. We are in the process of converting energy to power (MW), which is a more useful measure for utility planning at the distribution level as power determines the size of equipment needed (wires, transformers, …) and ultimately the cost of serving this new load. This effort is expected to be completed in September 2024.



As described earlier, Amazon, Enterprise, Daimler Truck, Navistar, Tesla, Volvo Group, and many other stakeholders are providing vehicle telemetry and their fleet electrification plans to eRoadMAP so that this load information can be aggregated and shared responsibly with the utility industry, policymakers, utility regulators, and other interested stakeholders. The aim is to encourage fleet operators and charging property developers to move from months-ahead planning to years-ahead planning to enable utilities to plan for the grid upgrades and investment approvals much earlier than currently possible and with data that informs near-term, mid-term, and long-term planning horizons.

In addition to load forecasting, eRoadMAP is also integrating all available load hosting capacity maps from utilities across the U.S. that show the amount of power currently available on distribution feeders. **To our knowledge, this is the first time load hosting capacity maps have been aggregated in a single location and made publicly available**. Fleet operators and charging property developers can use this feature to help prioritize which sites to electrify first. For example, a fleet operator with 400 distribution centers across the U.S. can view the available grid capacity for all its sites to determine where the grid has available capacity today and where grid interconnections are likely to be faster to implement.

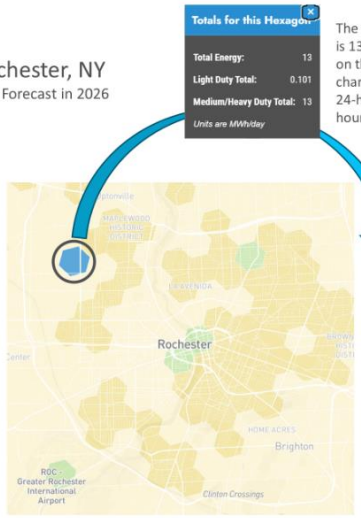
Establishing load hosting capacity maps is a relatively new utility concept – certainly relative to sharing this information publicly. Therefore, we expect it to take some time to establish a fully national capability. To date, EPRI has integrated 10 utility hosting capacity maps into eRoadMAP that cover some of the largest utility service territories across California and the Northeast, including Pacific Gas and Electric, Southern California Edison, National Grid, and ConEd. This effort continues, as we identify additional maps available from utilities – and work with the industry more broadly to communicate the usefulness of this information in accelerating electrification efforts.



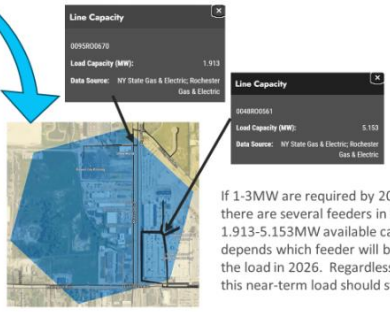
To illustrate how the load forecasting and the hosting capacity maps work together to inform planning, three examples are shown here for Rochester, NY (a 2026 case), Providence, RI (a 2030 case), and Compton, CA (a 2027 case). These are relatively typical examples for illustrative purposes. If we, however, examine the forecasted loads across every Hex8 in the U.S. and identify the number of hexagons with estimated transportation loads greater than 60MWh (~2.5-15MW) -- an arguably challenging new load on most feeders -- we find that in 2026 only 3% of hexagons exceed this level and only 7% in 2030. This highlights that concentrated local grid impacts are not ubiquitous, but that where these higher loads are expected, it is important to begin grid planning as soon as possible.

Rochester, NY

Load Forecast in 2026



The forecasted energy need in this hexagon is 13 MWh in 2026 (~1-3 MW, depending on the load shape – i.e. whether this charging would be spread out evenly over a 24-hour period or concentrated into a few hours each day)



If 1-3MW are required by 2026 and today there are several feeders in this hexagon with 1.913-5.153MW available capacity, then it depends which feeder will be used to serve the load in 2026. Regardless, planning for this near-term load should start now.

Currently available grid capacity
- 1.913MW – 5.153MW on the "black" feeders
- < 1MW on the "gray" feeders

Large companies operating in this hexagon:
- Amazon Delivery Station
- GM Components Holdings
- US Postal Service

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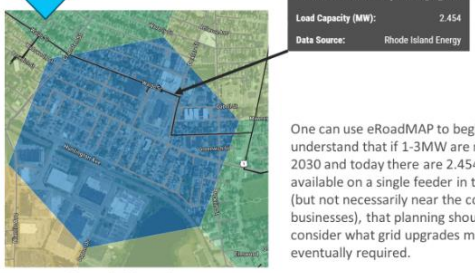
Providence, RI

Load Forecast in 2030

The forecasted energy need in this hexagon is 13 MWh in 2030 (~1-3 MW, depending on the load shape – i.e. whether this charging would be spread out evenly over a 24-hour period or concentrated into a few hours each day)



One can use eRoadMAP to begin to understand that if 1-3MW are required by 2030 and today there are 2.454 MW available on a single feeder in this hexagon (but not necessarily near the commercial businesses), that planning should start to consider what grid upgrades might be eventually required.

Currently available grid capacity
- 2.454 MW on the "black" feeder
- < 1MW on the "gray" feeders

Large companies operating in this hexagon:
- Amazon
- FedEx Dropbox
- Providence Water Supply Board
- Restaurant Supply Store
- Ximedica

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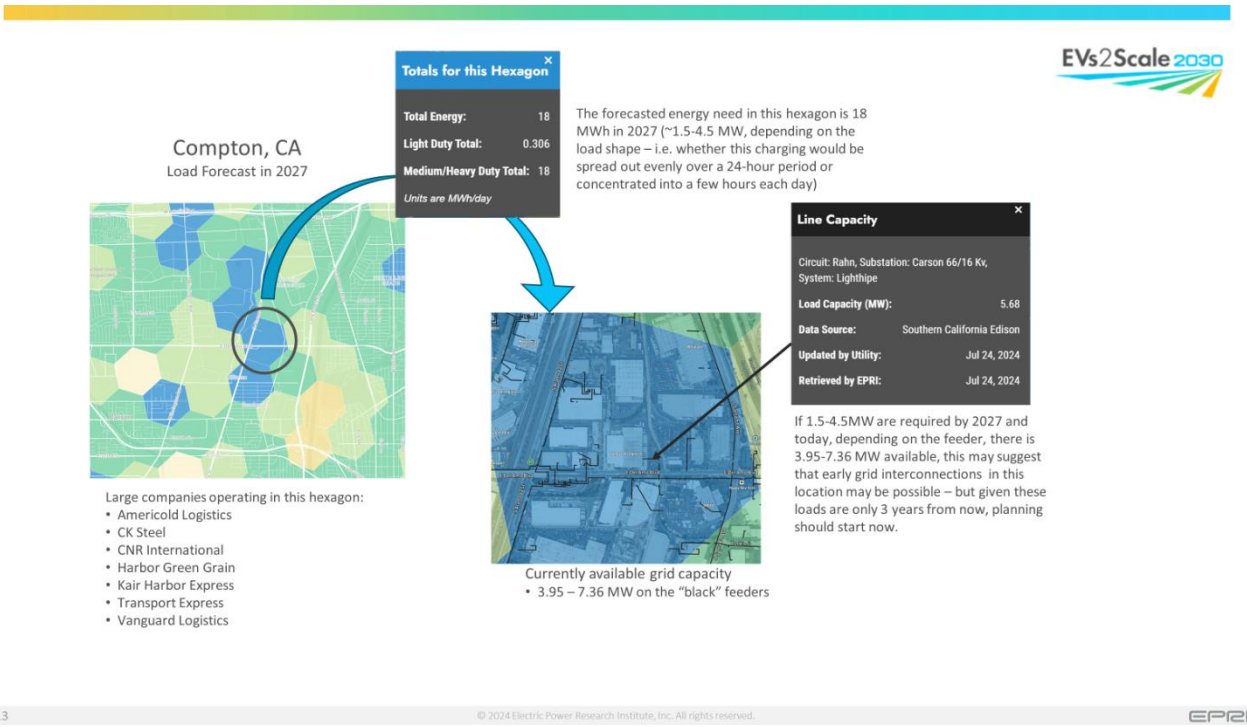
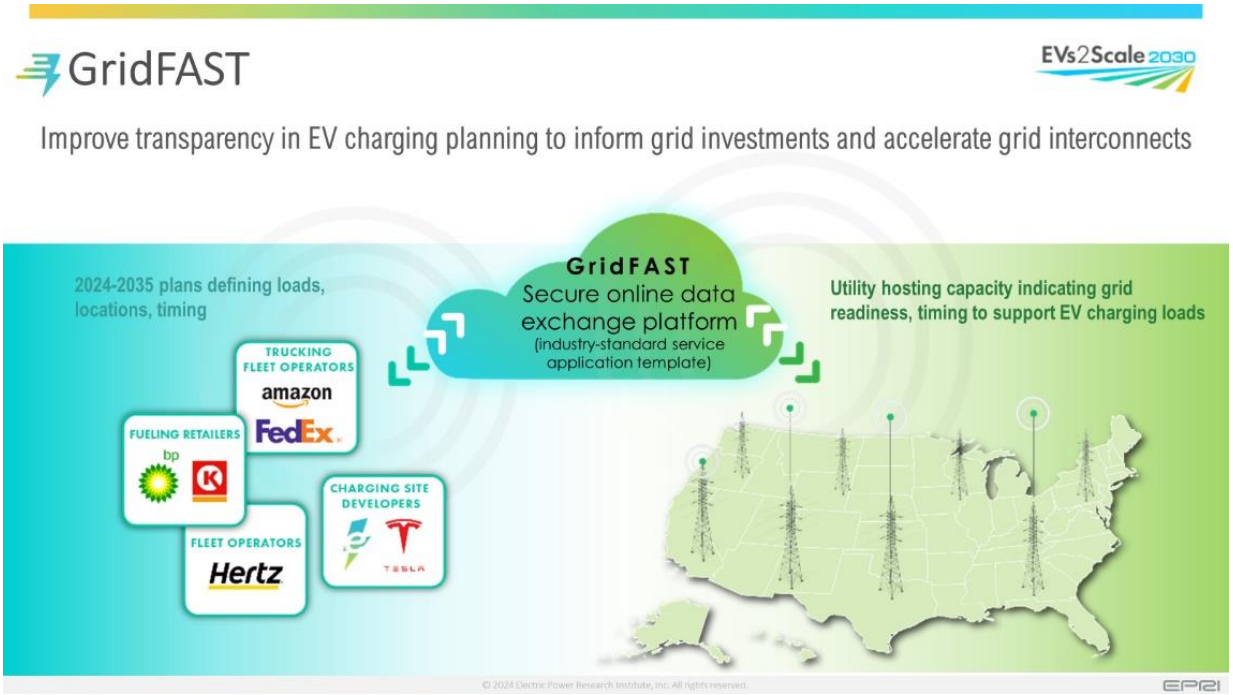


The second tool, currently in development at EPRI, is GridFAST, an online data-exchange platform that will act as a portal that all customers with transportation projects can use to automate the process of identifying and connecting with utilities to begin early project planning. The tool will identify which of the 3,000 utilities serve any community across the country, identify a point of contact at the utility, and allow utilities the ability to provide materials about their EV programs that are especially relevant to larger commercial customers.



A critical feature of GridFAST that has the support of several major utility CEOs will be a standardized “service application” template for the utility industry that will provide fleet operators and charging property developers with a common application form to request service for a charging site anywhere in the U.S. This will address one of the most-often cited pain points in the grid interconnection process and eliminate much of the time, complexity, and cost involved in reaching out to one utility at a time and providing the same information to the utilities over and over again. Much like the “College Common App” that allows college applicants to apply to multiple colleges at the same time without having to upload their resumes and provide identical transcripts each time, EPRI will include this EV Common App in its GridFAST platform. It is in development with a multi-industry steering group to include considerations of a wide range of stakeholders. In addition to the common service application questions, utilities will also be able to customize additional questions to meet their specific needs. GridFAST is planned to be available by the end of this year.

Summary

In summary, the electrification of the transportation sector is a challenging undertaking, but the utility industry has a proven record of adapting to loads of this size before. The key is early planning and engagement with the utility industry, as well as industry collaboration across the vehicle manufacturers, fleet operators, and charging property developers. More information can be found at: https://msites.epri.com/evs2scale2030 and epri.eroadmap.com

Thank you again to the Committee for the opportunity to share insights and comments on this important topic and I look forward to answering your questions.