Texas A&M Transportation Institute

Texas Department of Transportation

PROJECT SUMMARY REPORT

0-7169: Post-NEVI Electric Vehicle Infrastructure Research (Freight, Fleet, and Multi-family Housing)

Background

With the growing adoption of electric vehicles (EVs) in the United States and by Texans, Texas needs adequate and comprehensive coverage of EV charging infrastructure. Although EVs currently comprise just slightly more than 1 percent of all registered vehicles in Texas, many projections forecast that EVs could comprise up to 55 percent of all vehicles by 2040. This significant industry shift will require considerable and proactive efforts to support the transition, focusing on infrastructure readiness; customer experience; interregional connectivity, equity, and economic impacts; and other consequences related to the closure or repurposing of gas stations.

Texas needs to identify optimal infrastructure locations in advance of federal and local funding that will be available to build out EV charging infrastructure. Since implementation of EV charging infrastructure will occur in phases over multiple years, a long-term vision is necessary to guide the development of EV infrastructure, ensure that the Texas Department of Transportation (TxDOT) meets the needs of EV stakeholders, and maximize financial opportunities available to the state.

What the Researchers Did

Researchers reviewed the existing EV charging infrastructure state of practice to:

- Understand needs and challenges in EV infrastructure.
- Assess tools available to guide statewide EV planning analysis.
- Develop an analysis of projected EV charging demand based on adoption trends and projections.
- Develop a policy analysis of the local, state, and federal statutory landscape to identify barriers and opportunities.
- Analyze funding opportunities and develop frameworks for funding models.
- Develop strategies to improve the EV charging infrastructure system in Texas over the course of 5 to 10 years.

Researchers conducted three stakeholder workshops to assess stakeholder needs and concerns, opportunities for stakeholder coordination, and long-term EV infrastructure strategy considerations. Researchers also conducted interviews with peer states and metropolitan planning organizations. These efforts resulted in the development of a prototype EV charging demand estimation tool, a policy analysis framework, and long-term statewide EV infrastructure strategies.

What They Found

Researchers used prevalent themes that arose through the literature review, stakeholder workshops, and peer interviews to guide development of the policy analysis framework and long-term statewide infrastructure strategies. Topics identified as most important for adapting the state's multimodal transportation infrastructure to support electrified mobility included EV charging infrastructure implementation, grant program support, stakeholder coordination, information dissemination, equity considerations, medium- and heavy-duty vehicle electrification, workforce development, policies and funding opportunities, and EV charging demand estimation tools. Topics identified as significantly impacting EV infrastructure planning and decision-making at the state and federal level included freight, fleets, and multifamily housing, as well as workforce, education, and economic development.

Analysis of EV charging demand led to the development of a prototype EV charging demand estimation tool. The tool uses charging information obtained from the National Renewable Energy Laboratory that researchers aggregated to obtain hourly charging demand. The dataset was used to develop a model for Texas that provides the charging demand for different scenarios based on EV demand assumptions and other parameters. The model provides the hourly charging demands for a series of variables selectable from dropdown menus. Figure 1 shows a screenshot of the prototype tool.

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In the analysis of EV charging demand using the prototype EV charging demand estimation tool, researchers identified temperature as a critical factor in planning for EVs in Texas. Results showed the optimum charging demand occurs at an average daily temperature of 68°F. The total daily EV charging demands at the state level for 220,000 and 1 million EVs were predicted to be 2.15 and 9.56 GWh, respectively. Researchers found that charging at extreme temperatures, such as −4°F or 104°F, can cause an increase of more than 50 percent in EV charging demand compared to charging at 68°F.

Results further showed the significance of different charging strategies on magnitude and time of peak EV charging. Adding an extra load on the grid in peak hours due to EV charging demand presents a potential reliability concern. Scheduling charging during nonpeak hours is a critical component of planning for EV charging demand.

What This Means

Developing a stable and effective charging network across Texas will require policies, plans, and programs that support the development of EV infrastructure from a variety of different entities. Based on the study findings, researchers were able to identify actions, new programs, pilot projects, and additional research that would improve EV charging readiness and deployment of EV charging infrastructure in Texas. These actions or programs could be developed by TxDOT as a lead agency or jointly with other stakeholder groups.

The prototype EV charging demand estimation tool developed in this project allows users to quickly evaluate different EV charging scenarios. This tool is capable of predicting EV charging demand at different hours of the day in each zip code and county in Texas. The tool's data architecture allows for updates of the underlying data as new datasets become available. Similarly, new modules and scenarios can be added based on future research. The tool also allows for application of various temporal and spatial distributions that allocate EV charging demand to different areas. Finally, this model can be expanded to investigate EV charging demand along with other factors (e.g., demographic data) targeting specific groups and populations.

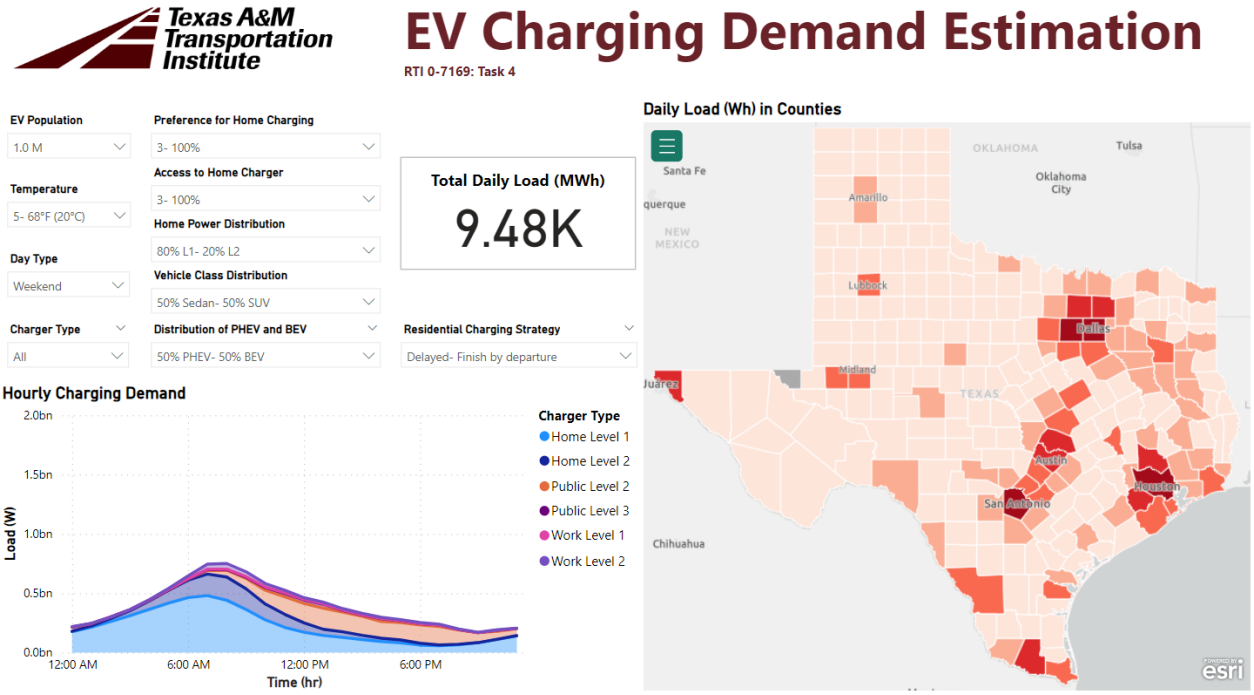

Figure 1. EV Charging Demand Model Prototype.

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