National Center for Sustainable Transportation

POLICY BRIEF

Expanding the UC Davis GIS Electric Vehicle Planning Toolbox Beyond California

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Plug-in electric vehicles (EVs) are quickly moving to the broader consumer market. While the home is still the primary location for recharging these vehicles, public EV charging infrastructure at workplaces, public destinations, and along travel corridors will be critical for the continued market growth of EVs. Governments will need to ensure that sufficient charging infrastructure is available at these locations to meet future demand.

Researchers at the University of California, Davis Plug-In Hybrid & Electric Vehicle Research Center previously developed a planning toolbox for public charging infrastructure based on data available in California. The toolbox, illustrated in Figure 1, is a user-friendly set of modeling tools that allows planners to anticipate the future geographic distribution of EVs and the resulting optimal locations of charging infrastructure. The toolbox is based on detailed technical knowledge of EV adoption trends, mode distributions, and charger utilization patterns. However, it is designed for use by planners with basic GIS skills who do not necessarily have EV expertise. The tools can be updated with local transportation data, and with local scenarios, policies, and technologies, if available. To date, however, the tools have only been applied in California contexts with California-specific data.

For this project, the UC Davis researchers adapted the toolbox to be used outside of California, collaborating with the Delaware Valley Regional Planning Commission to develop a case study for using this toolbox for EV infrastructure planning in the Greater Philadelphia region.

Key Research Findings

The EV Market and Charging Model provides an indication of the future geographic distribution of households owning electric vehicles. This distribution can inform where charging stations may be needed most. The tool accounts for current sales of EVs, household characteristics, and the "neighborhood effect"—the influence of peers who have adopted EVs.

The Workplace Charging Model can help predict work charging demand (Figure 2). Users can set the price of work charging as free, the same as home charging, or higher than home charging to observe how charging demand will change. When the price to charge at work is

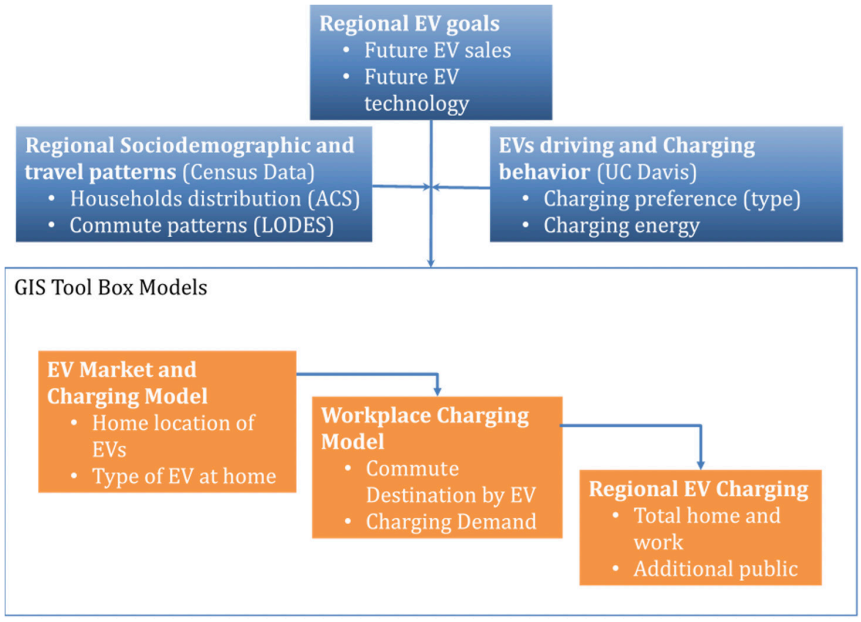

Figure 1. A conceptual model of the GIS toolbox, with data sources in parentheses (ACS is the American Community Survey and LODES is the Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics dataset from the US Census)

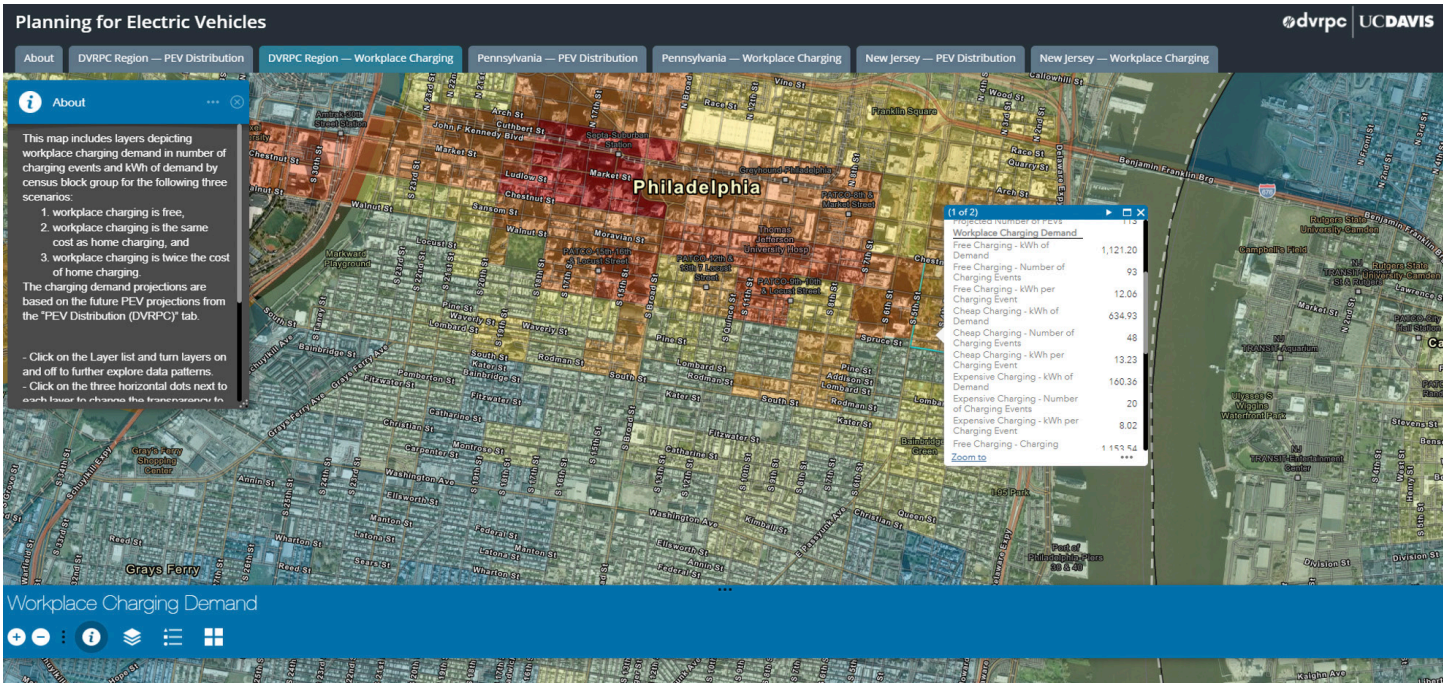

Figure 2. The projected demand for charging while at work in the Downtown Philadelphia area, with areas of higher demand shown in red and areas of lower demand shown in yellow (https://dvrpcgis.maps.arcgis.com/apps/MapSeries/index.html?appid=793fa4e10eac43b387adfc9cd2621a3d)

higher than at home, drivers will charge at work only when it is necessary to complete their commute.

The tools must be calibrated based on current number of EVs and the future EV goals for each region to create a reliable forecast. While the tool calibration will require GIS expertise, local users can use a web interface to run the models.

The models of commute patterns based on publicly available data that are used in the toolbox produce similar outcomes to the Delaware Valley Regional Planning Commission's travel demand models. The close correlation between the models helps to validate the toolbox's applicability to different regions.

Policy Implications

This project demonstrates that the GIS toolbox can be used to support planners outside of California in developing EV charging infrastructure to meet future demand. Work on the Electric Vehicle Planning Toolbox is ongoing, and researchers continue to make improvements. Planners interested in applying the GIS toolbox to their region can contact the authors.

More Information

This policy brief is drawn from "Expanding the UC Davis GIS Electric Vehicle Planning Toolbox Beyond California: The Delaware Valley Regional Planning Commission Case Study," a report from the National Center for Sustainable Transportation, authored by Gil Tal, Jae Hyun Lee, and Wei Ji of the University of California, Davis. The full report can be found on the NCST website at https://ncst.ucdavis.edu/project/expanding-uc-davis-gis-electric-vehicle-planning-toolbox-beyond-california.

For more information about the findings presented in this brief, contact Gil Tal at gtal@ucdavis.edu.

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