Effects Of Electric Vehicle (EV) Charging At Rest Areas

Investigating effects on the power grid and renewable energy curtailment of placing electric vehicle charging stations at highway rest areas in California.

WHAT IS THE NEED?

California policy is rapidly incentivizing adoption of electric vehicles (EV) to comply with the 2040 California Transportation Plan, which plans for increased use of zero-emission vehicles, and SB-32, which calls for a 40% reduction of greenhouse gas emissions by 2030. EV are proving to be a viable solution to mitigate greenhouse gas emissions, but charging infrastructure is currently insufficient.

Additional electric charging stations are needed in both rural and urban settings throughout the state of California. While many entities have prioritized construction of charging stations in urban area, there are still many rural areas that lack such infrastructure.

This research sets out to identify the rest areas that are the most optimal to place EV charging stations. At the selected rest areas, the effects on the power grid will be investigated. The research team aims to make long distance and inter-city travel using EV possible.

WHAT ARE WE DOING?

The first step is gathering the necessary data for a thorough analysis. The data includes:

- Travel demand data to gauge the number of vehicles that currently have the potential to utilize rest areas,
- Transmission and electricity usage data to understand how the grid and transmission systems are currently functioning in the vicinity of the rest areas, and
- Financial data to estimate costs of adding needed electrical infrastructure to support EV charging.
The next step is customizing a California specific energy-dispatch model, which was developed at University of California, Davis - Institute of Transportation Studies, for this study using the gathered data. The data will be processed to consist of 8760 time slices that are 1 hour long, spanning the entire year of 2018.

The last step is running the model. With the high-level detail contained in the model, it allows an in-depth analysis of the optimal EV charging station locations, as well as the effects on the electric grid in these locations.

Additionally, the researchers will conduct future analyses, assuming the number of EVs on the road increases in coming years to accomplish the State’s greenhouse reduction goals by 2050.

WHAT IS OUR GOAL?

The goal is to produce a report identifying the optimal rest areas to install EV charging infrastructure, the number of chargers at these locations, the anticipated impacts on the grid for the additional electricity demand, and the impact on curtailment and increased renewable energy use.

WHAT IS THE BENEFIT?

The research results would provide a roadmap for California Department of Transportation to implement a state-wide EV charging stations system at highway rest areas in the most optimal way.

Furthermore, realizing the results of this research means that California will be able to reach the high goals that it has set for mitigating climate change by dramatically reducing the amount of greenhouse gas emissions from the transportation sector.

WHAT IS THE PROGRESS TO DATE?

Currently the researchers are collecting data and creating the model. On the one hand, the electricity usage at rest areas and transportation demand data took several weeks to collect, and some is still being sought after. On the other hand, the research team collected most of the electricity generation data, processed and entered it in the model.

The next steps include processing the transportation demand data which will be put into the model. Moreover, the researchers will work with utility suppliers in the State to secure the energy usage data for the highway rest areas, as well as cost estimates for electrical infrastructure upgrades.

IMAGES

Figure 1: All 87 Highway Rest Areas in California. The colors correspond to the type of roadway served by the rest area: Blue: Interstate; Green: California State Route; Grey: U.S. Route
Figure 2: California is divided into 5 service regions in the model: **Blue**: California North (CALN), **Purple**: Los Angeles Department of Water and Power (LADWP), **Green**: Southern California Edison (SCE), **Red**: San Diego Gas & Electric (SDGE), and **Yellow**: Imperial Irrigation District (IID).