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Permalink
https://escholarship.org/uc/item/1740g5tq

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Publication Date
2021-03-01

DOI
10.7922/G247484K

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Charging Forward: Deploying Electric Vehicle Infrastructure for Uber and Lyft in California

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Project Objective

The objective of this study is to investigate how to deploy electric vehicle charging infrastructure to meet the electricity demand coming from electric vehicles (EVs) on ride-hailing services such as Uber and Lyft in California.

Problem Statement

The recently passed Clean Miles Standard in California will require ride-hailing companies such as Uber and Lyft to transition the vehicles operating on their platforms to electric cars. One of the unique features of vehicles driving for these services is that they travel substantially more than the average driver (see Figure 1), which also means that many charging stations will need to be installed to meet their charging demands. A quantitative analysis of the demands and corresponding infrastructure locations and types is needed to help with the planning process for deploying chargers.

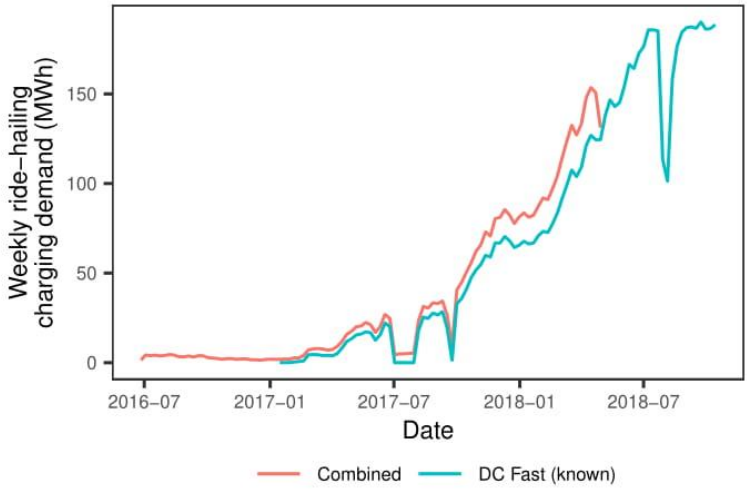

Figure 1: Growth in electricity demand from electric vehicles driven on Uber and Lyft services over time. This quantity represents demand that is over six times higher than from average electric vehicles in California.

Research Methodology

The general approach of our study is conducted in two steps: first, we simulate the charging demand from electric vehicles on ride-hailing services; second, we use the Widespread Infrastructure for Ride-Hailing EV Deployment (WIRED) model, an optimization procedure for deploying charging stations to meet demand. We describe some of the unique features of our model below.

Mobility Model

- Employs empirical trip data of ride-hailing vehicles directly from Uber and Lyft
- Can “scale-up” to any number of EVs in San Diego, Los Angeles, and San Francisco using a bootstrapping procedure

WIRED Model

- Deploys charging infrastructure while simultaneously meeting the demand requirements of ride-hailing EVs
- Considers both the amount of time it takes to travel to chargers as well as how long drivers spend charging their vehicles
- Balances between different speeds of charging (DC Fast, Level 1, and Level 2 Chargers)

Results

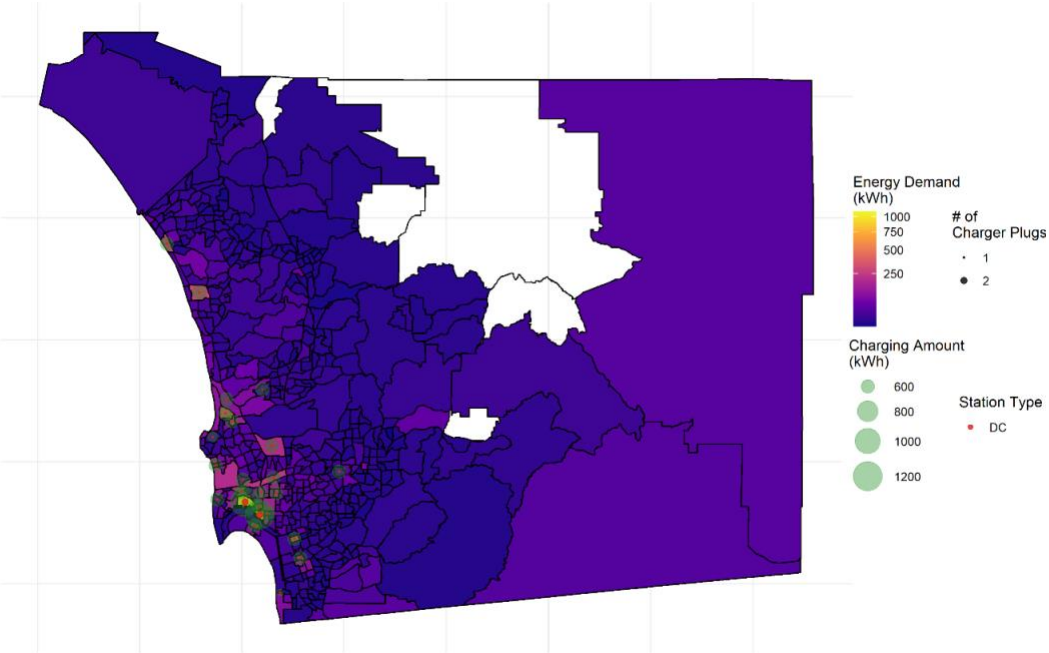

Figure 2: Sample results for charging infrastructure deployment for a fleet of 1000 EV ride-hailing vehicles in San Diego county.

The WIRED platform solves for how charging stations should be deployed to meet charging demand from electric vehicles driving for Uber and Lyft. While the current ratio of chargers to electric vehicles for the general public is about 1 slow charger (L1/L2) per 10 EVs and about 3-4 DC fast chargers per 1000 EVs. Our modeling indicates that this ratio must be approximately an order of magnitude higher for ride-hailing EVs. The vast majority of charging infrastructure suggested by the model is DC fast charging.

Our primary results are based off the assumption that EVs in ride-hailing services will charge primarily based on public charging infrastructure. We make this assumption because that is what we observe in the empirical data. However, if EVs begin to perform overnight charging at residential chargers, this can drastically decrease the number of public chargers required to meet the demand.

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