

UCDAVIS

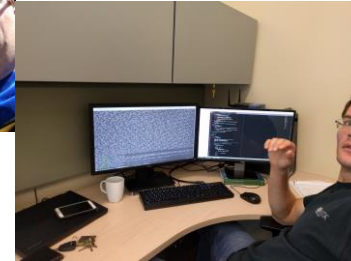
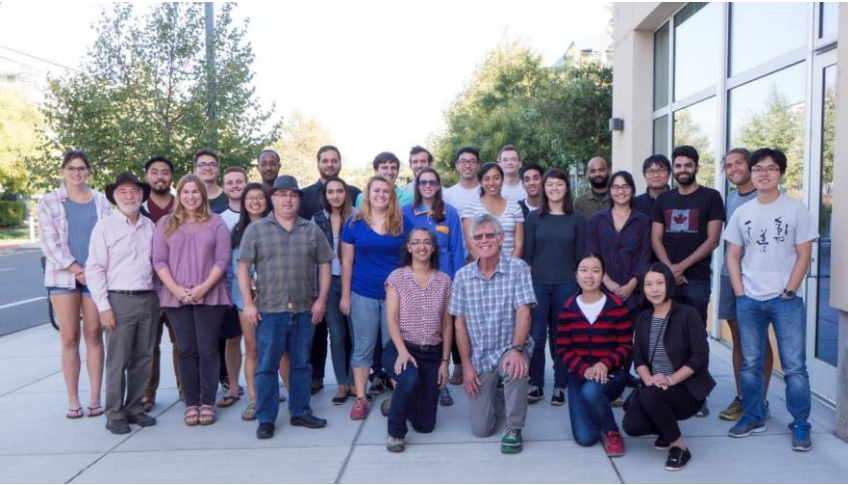
PLUG-IN HYBRID & ELECTRIC VEHICLE RESEARCH CENTER

of the Institute of Transportation Studies

Metrics & Methodologies to Evaluate Transportation Electrification Programs

CALIFORNIA PUBLIC UTILITIES COMMISSION

Gil Tal



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PH&EV Center Data Collection

Questionnaire Surveys

- Questionnaires with 30,000 PEV owners
- Non-EV buyer surveys with 25,000 car buyers in US

On road data collection

- OBD data on 600+ vehicles
- GPS data on 54,000 PEVs from OEMs

Infrastructure Data

- 9,000,000 Level 2 charging events
- 3,400,000 DC fast charging events
- Vehicle Reported Charging Events

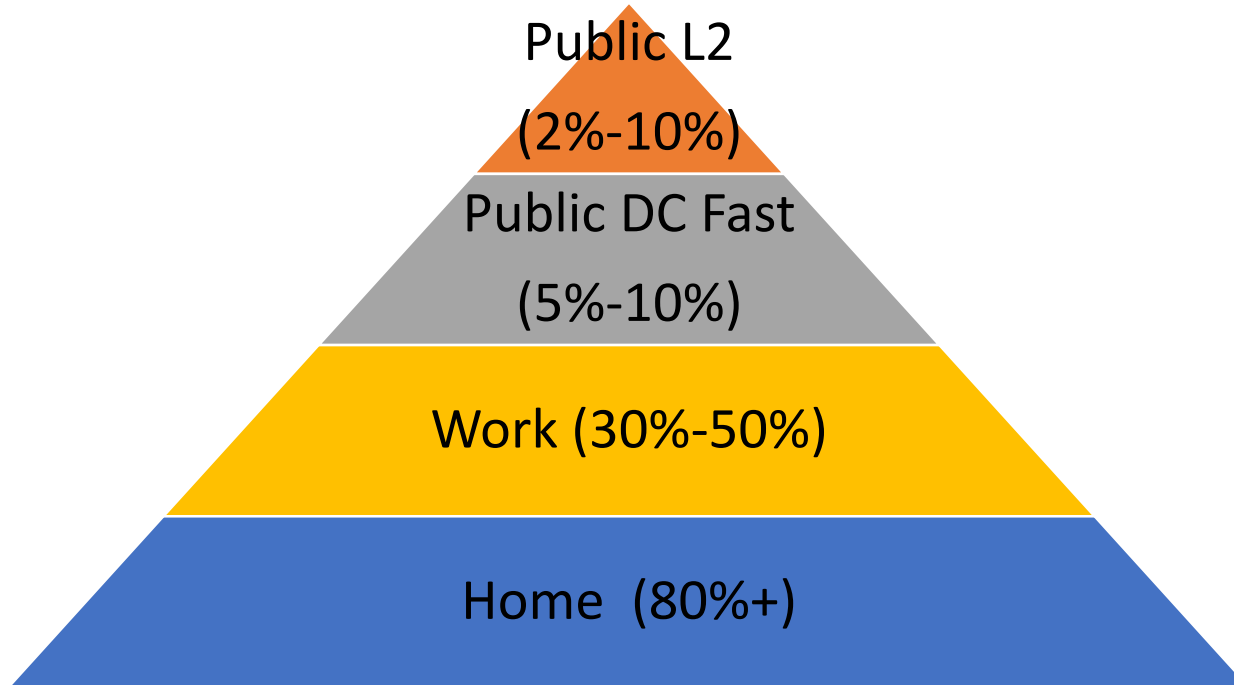
Registration Data

- 48,000,000 vehicles in 3 states
- 14,000,000 Households vehicle ownership

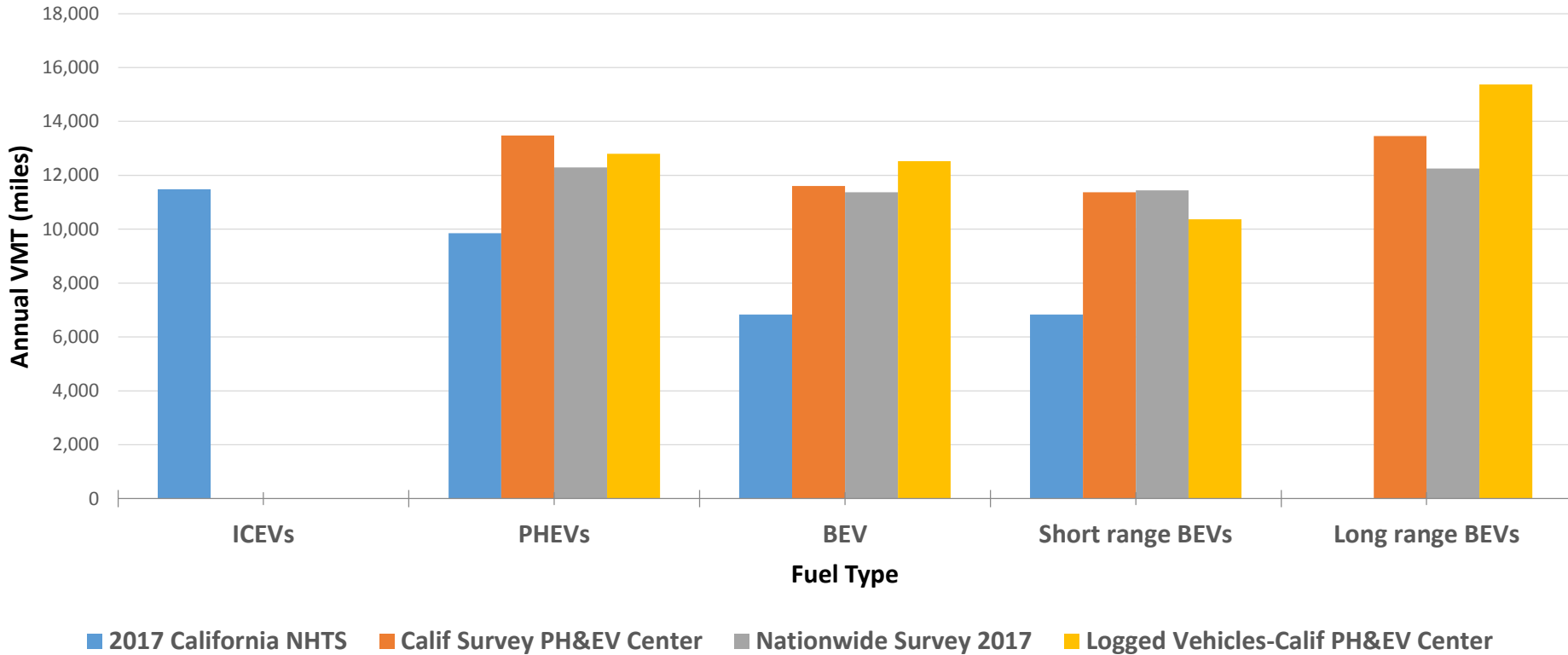
TNC Data

- ~5000 PEVs used for TNC
- 1.6 million TNC trips
- ~15,000 DCFC charging events

Charging Location of Individual Use

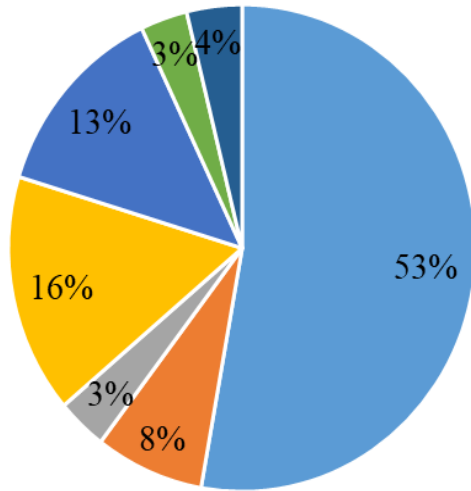


Annual VMT of plug-in vehicles in California 2018



Where and When PEVs Charge in a Week? (CA 2017)

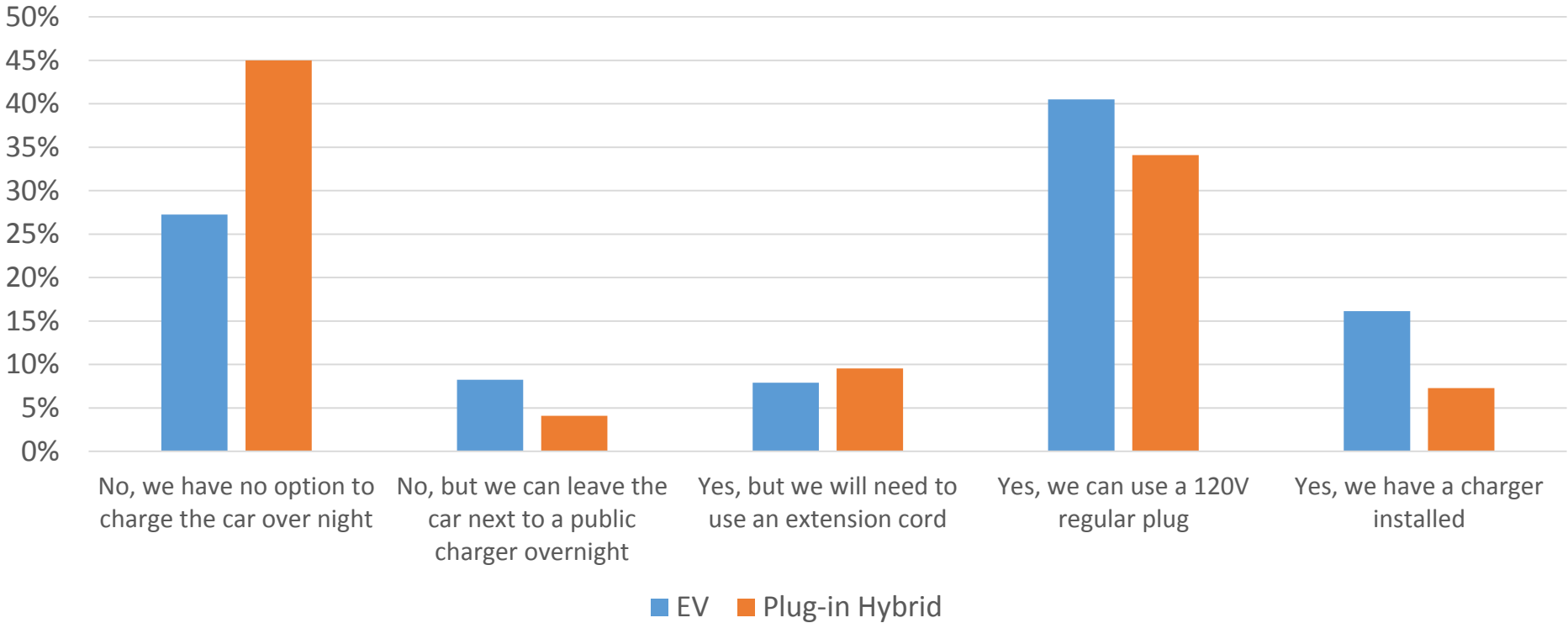
Overall Proportion



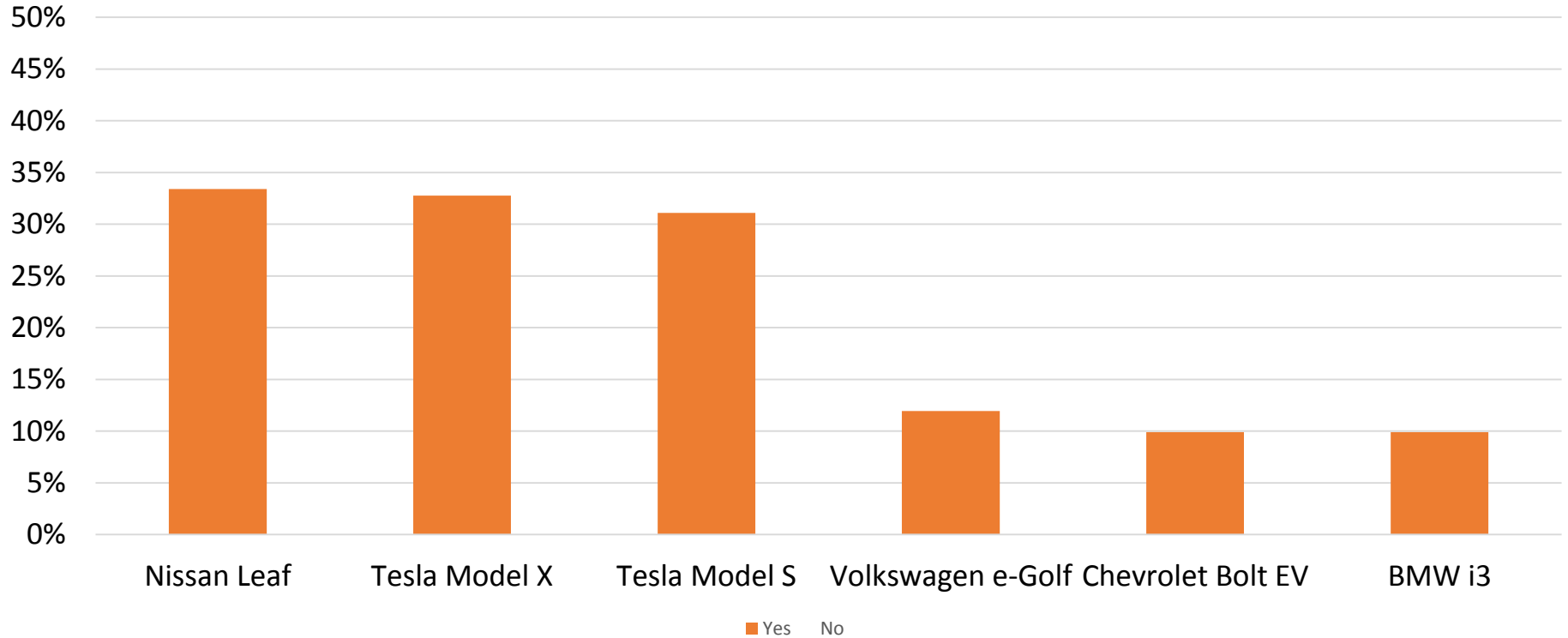
Proportion of respondents in charging behavior groups



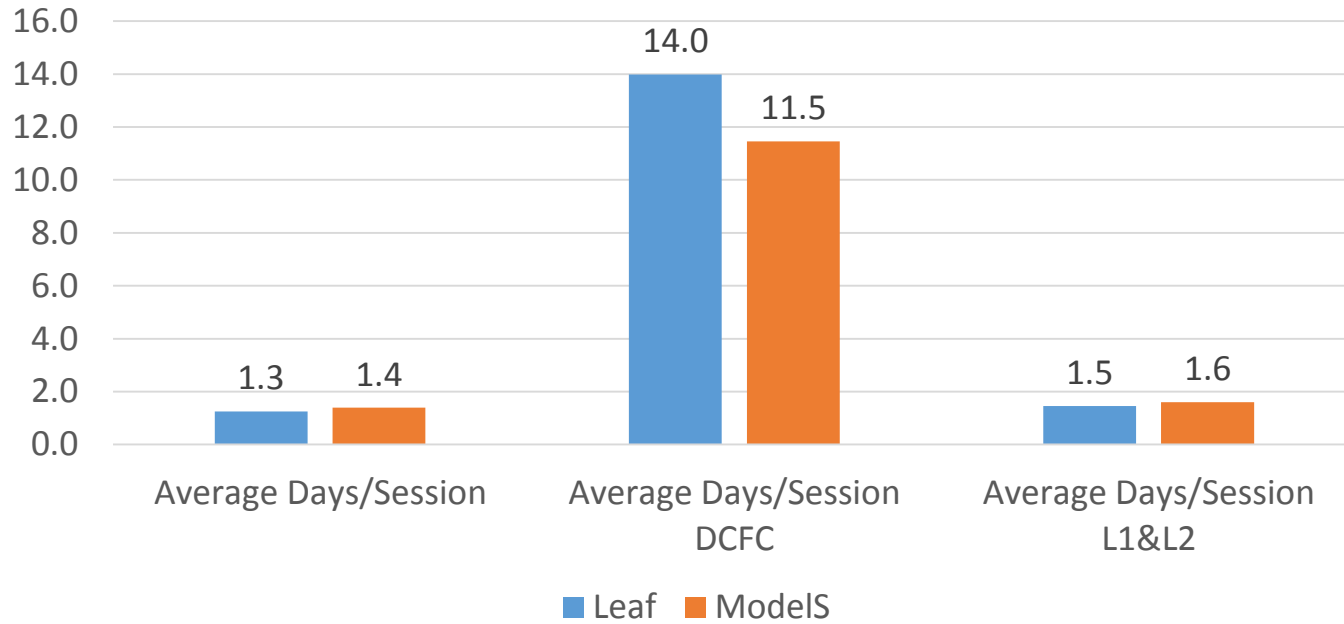
Can you plug in at home? (For those who are not doing so)



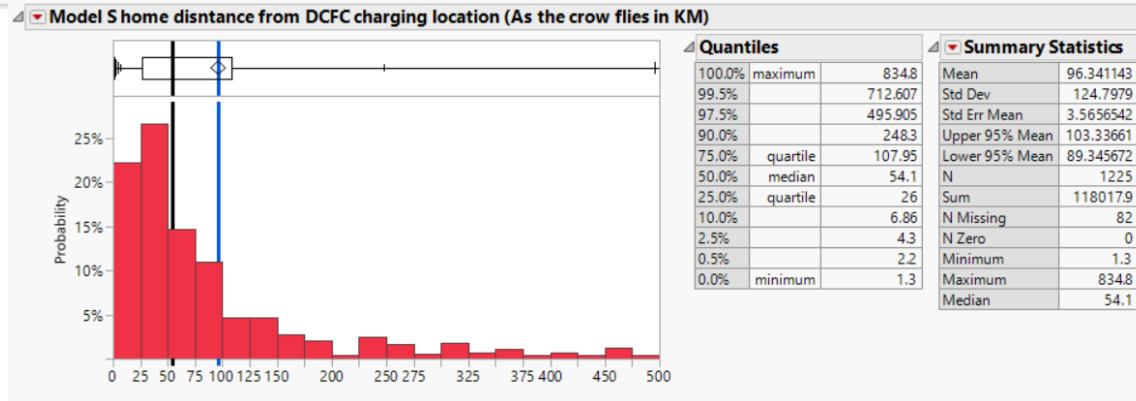
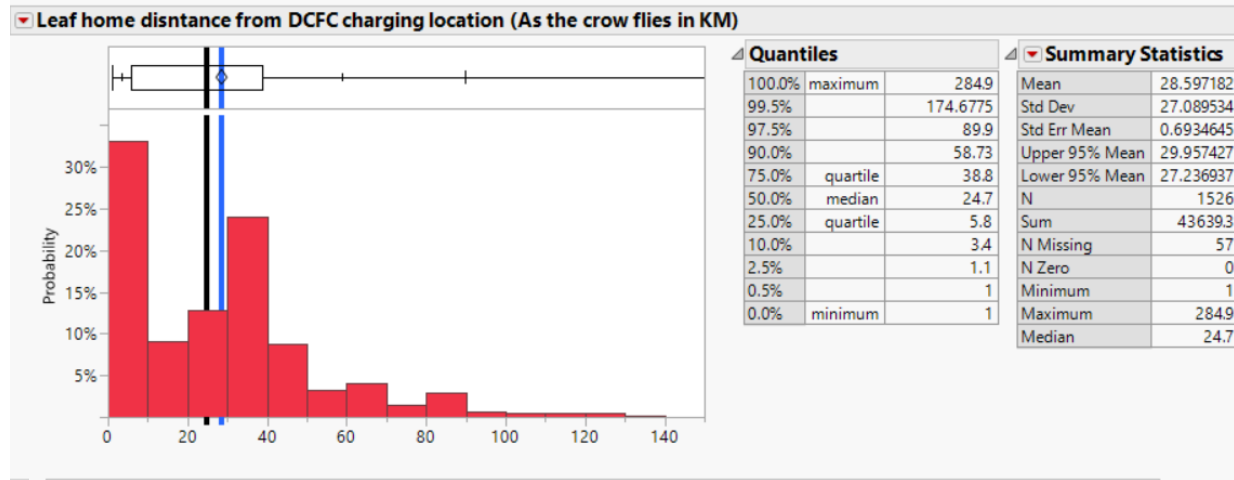
Who is using DC Fast Chargers? once or more in the last 30 days (CA 2018)



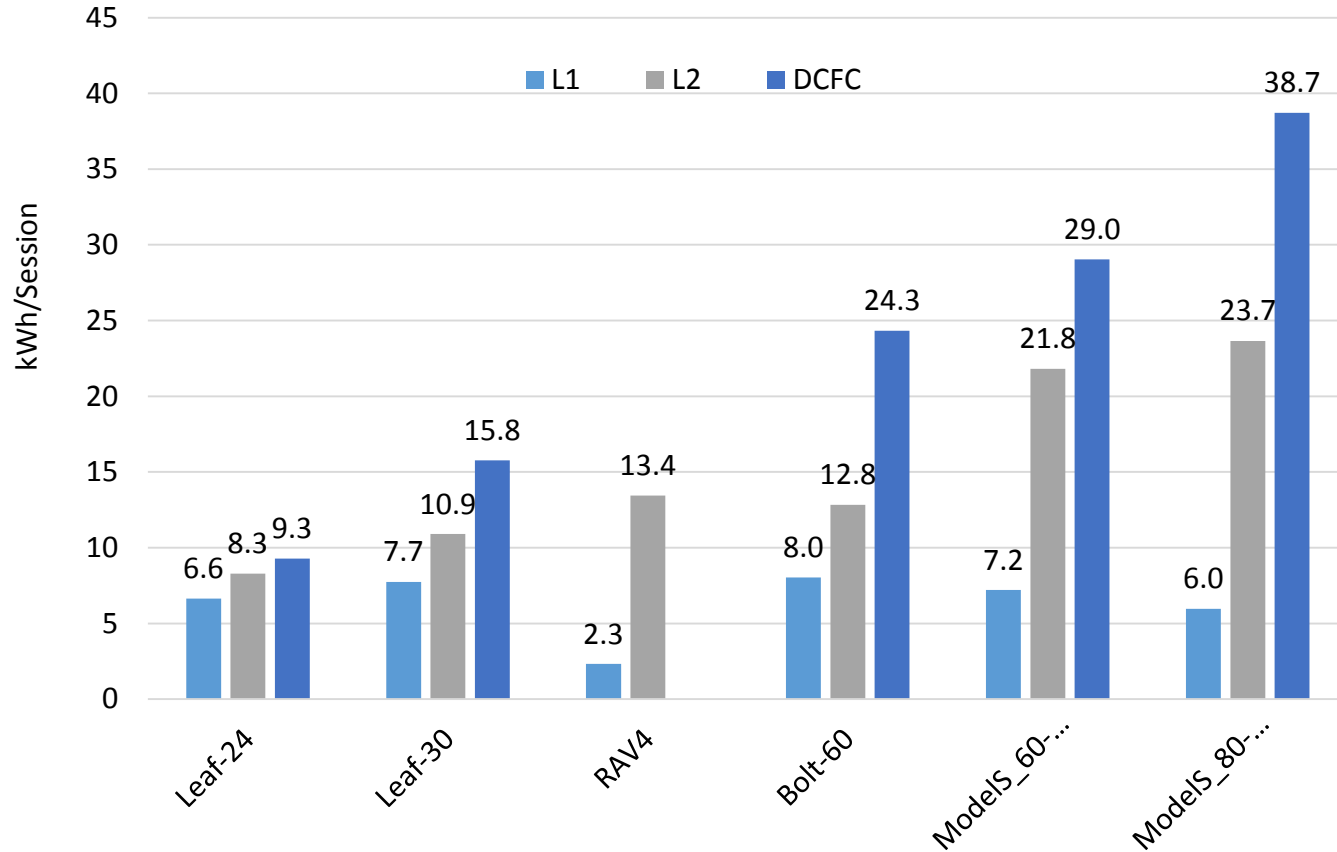
Days between charging events



Distance from home of DCFC charging

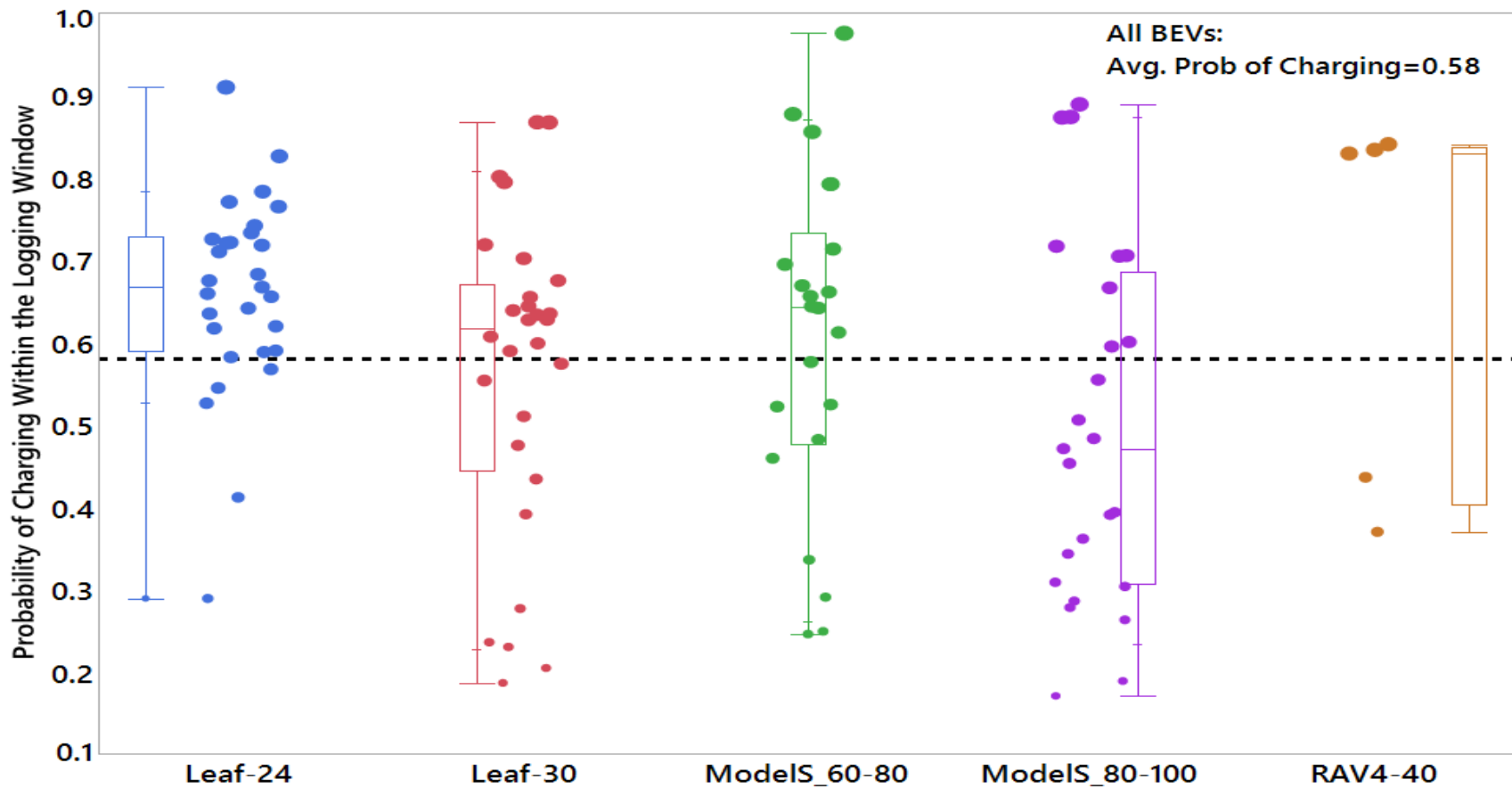


Average kWh/Session

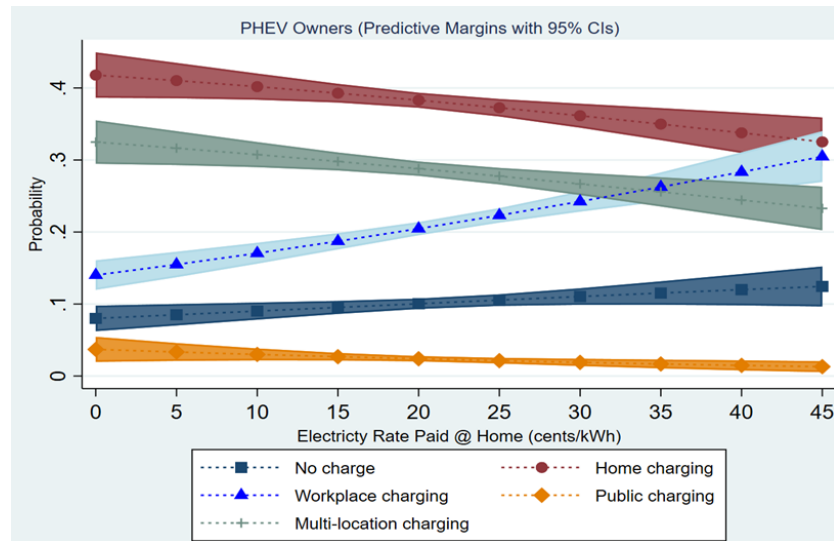
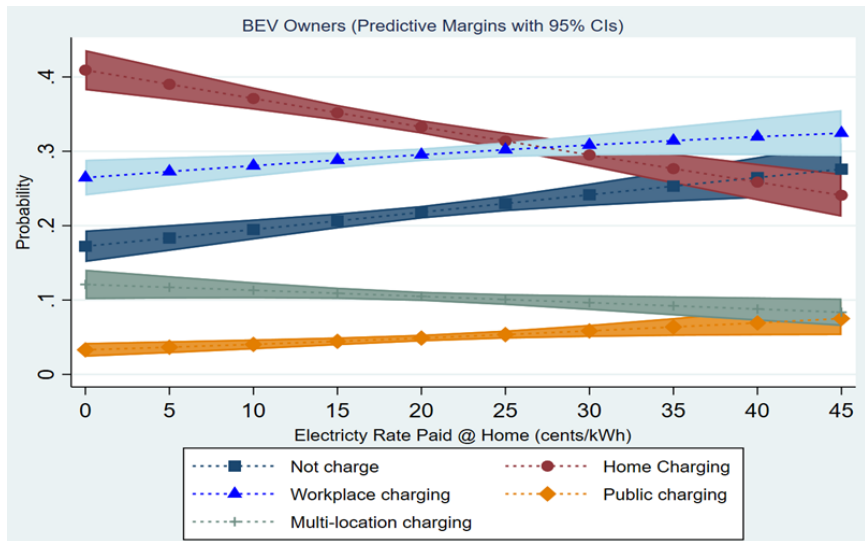


- On board power electronics limits on rated kW between BEVs

Probability of Charging over vehicle use days

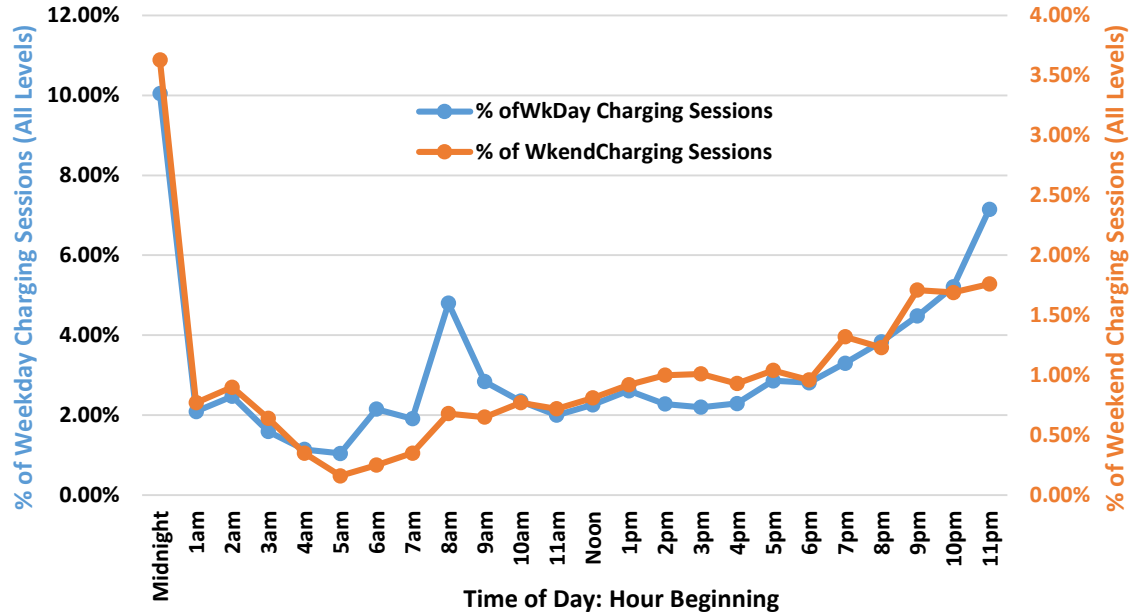


Probability of Charging as Factor of Home Charging cost



- Probability of home, workplace, and multi-location charging goes down with increasing cost
- Probability of public location charging goes up as range of vehicles increase

Charging start time: California 2016-2018

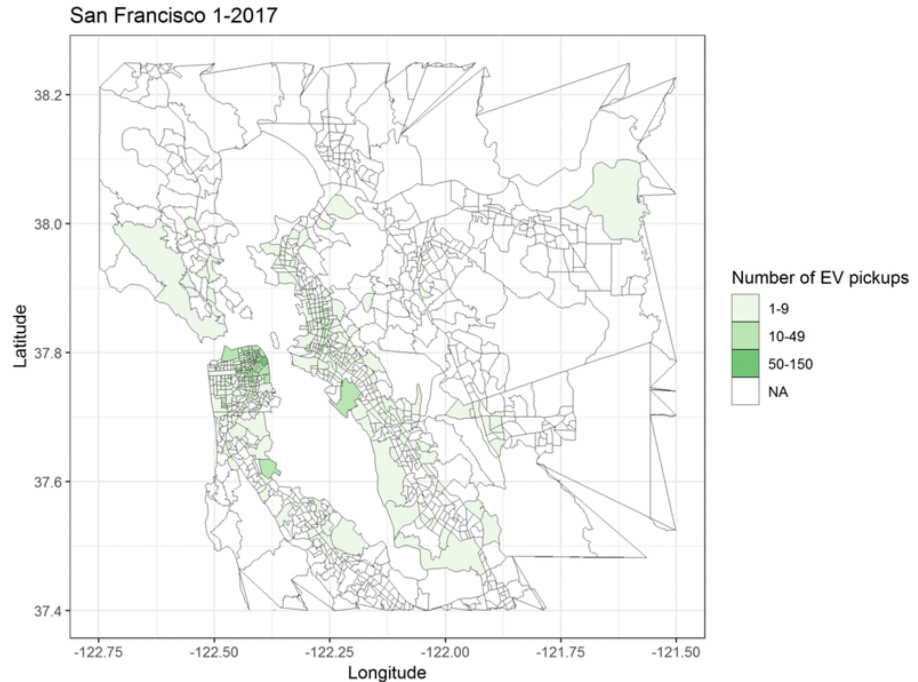


Coordinating charger infrastructure development with the distribution grid

- Launched two year project to understand impacts of future PEV charging on distribution infrastructure:
 - Measuring the landscape of distribution infrastructure
 - Integration Capacity Analysis tool
 - Working with SMUD, later extending to other utilities
 - Coupling distribution infrastructure and charger installation
 - Integrating electric vehicle charging behavior
 - Spatial distribution system limitations and costs
 - Developing pricing and policy levers

Understanding TNC demand vs. infrastructure needs

- The demand for electric TNC services do not always align with the location of charging locations
- We are developing a model for building out DC fast charging infrastructure for TNC electric vehicle use
- Minimizing discrepancies between chargers and ride demand
 - Increases profitability for drivers
 - Decreases deadheading for charging



INSTITUTE OF TRANSPORTATION STUDIES

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Thank You!

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