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Presentation Title: How Electric Vehicle Use Types Impact Utilities' Load Shapes; All EV Charging Loads Are Not the Same

Abstract: This paper will cover different electric vehicle (EV) types and uses, and the charging loads associated with light-, medium-, and heavy-duty electric vehicles.

Light-Duty Electric Vehicles. A combination of policies and promotional activities sets the California EV market from the rest of the US. The principal policy driver responsible is California's Zero Emission Vehicle (ZEV) regulation that requires an increasing share of EVs and other zero emission fuel type vehicles be sold annually through 2025. The second prong of ZEV is the infrastructure to support these vehicles. Currently ZEV has pushed California to have over 50% of all 2017 EV sales in the US and to have the highest EV Market share of any other state.

Medium- and Heavy-Duty Electric Vehicles. Unlike light-duty EVs, the growth in medium- and heavy-duty EVs (MHDEVs) is determined chiefly by economic growth. Additionally, many types of MHDEVs use different charger types than do light-duty EVs so that they may need additional infrastructure resources.

Effects on electrical loads. The increase of EVs across all duty types will have a profound effect on the increased need for electricity for California. But there are multiple effects on the hourly load shape. Time-of-Use rates and an increase in municipalities and commercial firms incorporating green vehicles in their bus and delivery fleets all have variable effects on the load shapes for charging battery-powered EVs.

The data used for this presentation is from California and was monitored by the chargers for the light-duty EVs and from the on-board system controllers for the medium- and heavy-duty EVs. The charging profiles for the light-duty vehicles contained 2000 chargers of light-duty EVs in public or commercial spaces and 500 chargers of light-duty EVs in residences, with data for a one year period. The charging profiles for the medium- and heavy-duty EVs is for a limited number of EVs for a period of two weeks.

The EV charging load shapes and how they impact the grid and how they can be used in forecasting will be discussed in this paper. EV charging profiles for light-duty residential charging is good for the utilities. Whereas public and commercial placement of EV chargers and charging of medium- and heavy-duty EVs contribute to peak period loads. Opportunities for peak period reduction programs for these chargers can help the utilities and the grid. The differences between charging profiles for different classes of vehicles will be highlighted.