An Activity-Based Travel-Demand Modeling Approach to Estimating Electric Vehicle Charging Load

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Abstract

Plug-in Electric Vehicles (PEVs) require a substantial electric load to charge batteries between travel tours. Given mass adoption of PEVs, battery charging may create new power load peaks during non-traditional times or may substantially increase the magnitude of pre-existing load peaks. These peaks are periods in which electric distribution infrastructure, specifically distribution transformers, may incur increased aging, which may potentially lead to component failure. Understanding how PEV charging will impact distribution transformer aging is important to utilities who are preparing to support the PEV fleet. This paper describes a method to estimate PEV charging load profiles using concepts in activity-based travel demand modeling. The model will dynamically predict PEV driver travel behavior based on one-day travel survey data, from which charging load characteristics (charging start time and duration) may be obtained. Though research is still in progress, results of this study are expected to show that the activity-based approach to PEV load forecasting reduces bias as compared to more simplistic stochastic PEV load models, yet still compares favorably to PEV load forecasts generated with a pure sampling strategy assuming actual travel behavior data. Additionally the model will serve as a solid starting point for dynamically generated multi-day PEV load forecasting.