VERMONT
AGENCY OF TRANSPORTATION

FACT SHEET

2019 Research Showcase & STIC Annual Meeting

Modeling Electric Vehicle Energy Demand and Regional Electricity Generation Dispatch for New England and New York

PROJECT TITLE

Modeling Electric Vehicle Energy Demand and Regional Electricity Generation Dispatch for New England and New York

STUDY TIMELINE

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Fact sheets can be found for additional projects featured at the 2019 Symposium at http://vtrans.vermont.gov/planning/research/2019showcase

Additional information about the VTrans Research Program can be found at http://vtrans.vermont.gov/planning/research

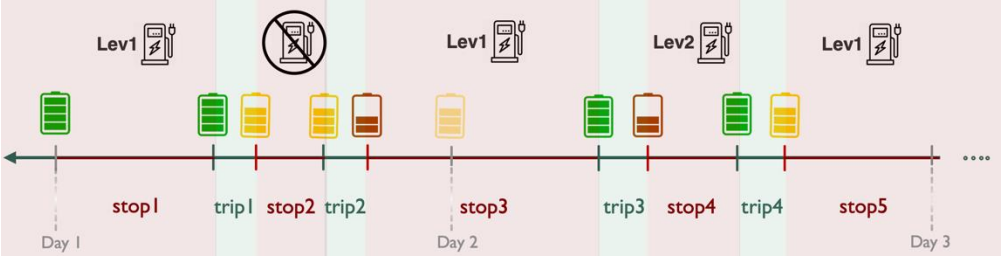
Additional information about the VTrans STIC Program can be found at http://vtrans.vermont.gov/boards-councils/stic

Introduction

The transportation sector is the largest emitter of greenhouse gases in the U.S., accounting for 28.6% of all 2016 emissions [EPA 2018]. Plug-in electric vehicles (PEV) can reduce transportation emissions when charged using low carbon-intensity power. Crucially, the time of day that vehicles charge impacts the source of the electricity used to charge them. This work investigates the net change in CO_2 emissions as well as the impacts the regional electric power grid from increased PEV deployment in New England and New York.

Methodology

In order to understand the impacts of PEV charging, it is necessary to understand how much energy is needed for charging at each hour of the day. The research team developed a PEV charging demand model that estimates the hourly charging demand needed to support current travel behavior reported in the 2016-2017 National Household Travel Survey. The model includes a range of PEVs, seasonal variability in travel, varying levels of public charging infrastructure availability, and a probabilistic representation of charging behavior. The hourly estimates of PEV charging demand are used as an input into a regional electric power sector dispatch model with high levels of wind and solar generation.



Conclusions

The model results support that PEV are an effective strategy for emissions mitigation in the study region when there is high renewable energy penetration, with 15% PEV penetrations reducing system-wide emissions by 5.27% in the most favorable scenarios. The average emissions associated with the PEV travel were between 90.09 and 91.91% less than for the same travel by internal combustion engine vehicles. The availability of publicly accessible charging stations at non-home locations influenced the level of synergy between PEV charging and solar generation

Potential Impacts

The results support the need for public charging infrastructure, specifically at workplaces, with the “work” infrastructure scenario shifting more of the unmanaged charging demand to daylight hours when solar generation could be utilized.