Energy Science Technology & Policy
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Supercharging Electric Vehicles in Allegheny County

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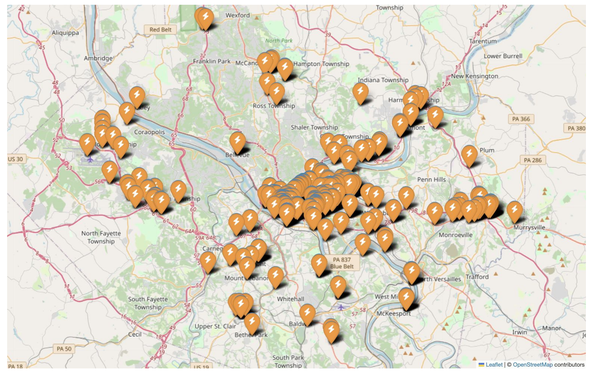
MSE

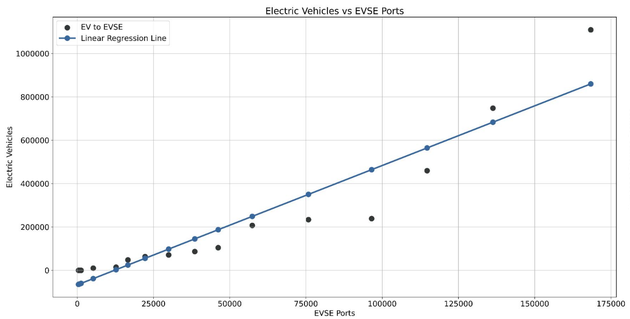
Background and Motivation

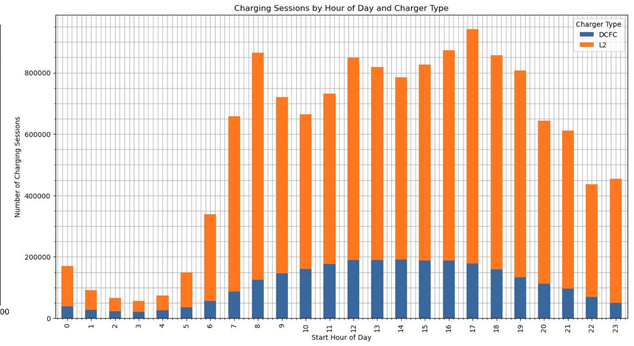
- Electric vehicles (EVs) are the key to decarbonizing the transportation sector.
- Insufficient public charging stations remains a significant barrier to widespread adoption.
- Pittsburgh Public Facilities has an EV Charging Strategic Plan that includes the addition of 100 charging stations per year, which represents the high adoption scenario.
- This study proposes that an increase in EV charging infrastructure, with the support of private electricity providers and government policy makers, will drive EV adoption and reduce emissions in the transportation sector.

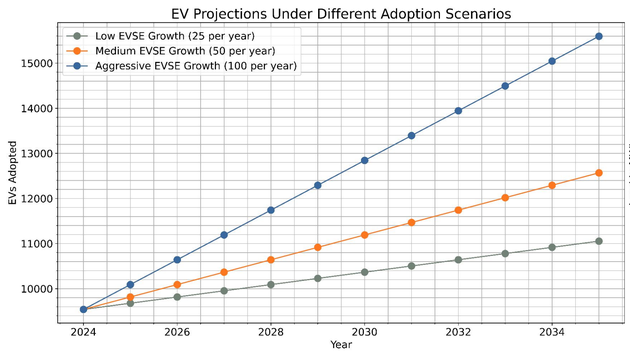


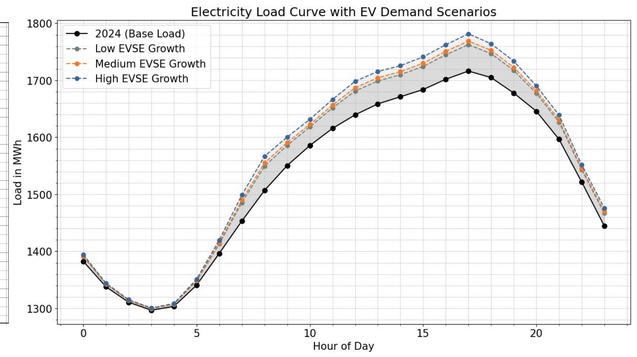
Projections

The three EV adoption scenarios modeled are the low, medium, and high EVSE trajectories. The high adoption scenario represents an additional 100 chargers per year, as previously proposed by Pittsburgh Public Facilities, with the medium and low being 50 and 25 additional chargers, respectively.



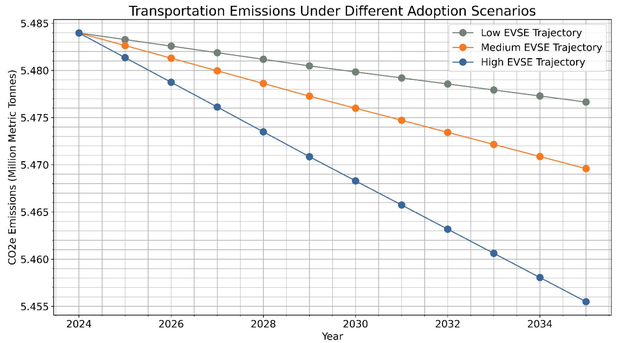






Emissions Implications

Shifting towards more EV use in the transportation sector decreases emissions from fuel combustion, but also affects the load on the electric grid. The following curve represents the emissions from ICE vehicles and EVs for the three EV adoption scenarios, including the change in direct and grid related emissions. This is assuming a “business as usual’ electricity grid projected by NREL.



Using a social cost of carbon as $51/tonne, the high adoption trajectory presents $4.65 million worth of social value from emissions reduction, in comparison to the low adoption trajectory.

Cost

The cost of charging infrastructure is supported through the EV Make-Ready Program, which reduces the upfront costs of installation. Stated in Pittsburgh’s Public Facilities EV Charging Strategic Plan, Duquesne Light Company has proposed to cover 80% of the install costs for new EV chargers in parking garages. The cost per networked dual port charger using this incentive can be outlined as follows.

Incentives	Equipment Cost + Warranty	Installation	Incentive	Total Cost
None	$7,040	$5,000	$0	$12,040
Make-Ready	$7,040	$5,000	$4,000	$8,040

Annual operating costs are around $2,890, and can be offset by charging and dwell time fees.

Conclusions

- EV adoption increases with charging infrastructure. In addition there is a very clear preference to use public chargers during the day, including peak preference fast charging as people leave work. This corroborates our hypothesis that access to public charging infrastructure encourages EV adoption.
- Emissions reductions from switching to EVs from ICE vehicles is greater than the emissions from additional load on the grid, indicated by a net decrease in cumulative emissions.
- Adding about 1 EVSE port results in about 6 EVs. Although the model is a simplified machine learning model with one variable, it had a coefficient of determination of 0.94, indicating that charging ports can be a main driver for EV adoption.

Limitations and Future Work

- Demand for EVs was simplified in the model, but more statistically significant variables can be used to estimate EV demand more granularly. Some variables include income distribution, charger locations, gas prices, etc.
- Emissions reduction can be modeled through different electricity grid scenarios, for example a fully decarbonized grid by a certain year.

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