An Optimal Allocation of EV Chargers for Multi-Unit Residential Buildings

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Abstract

The Government of Canada has an objective to reduce 45% greenhouse emissions by 2030. The 2030 Emissions Reduction Plan includes a roadmap for decarbonizing the transport sector. For it, the main aim is at least 60% of new light-duty sales of zero-emission by 2030. This objective will need a review of infrastructure for zero-emission vehicles.

This zero-emission fleet will require different infrastructure to the current fossil-fueled based. For Calgary, as most of other cities in the Global North, due to increase cost in housing and costs of living, there is an increase in demand for Multi-Unit Residential Buildings (MURBs). For MURBs with electric vehicle users (EVs) the new requirements will mean chargers with different capacities, a certain number of parking spots with chargers available, and installed infrastructure ready to adapt a charger (EV Capable).

Our project's main objective is to identify an optimal number and combination of EV chargers in multi-residential units of different sizes based on driving patterns in Calgary.

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Using a dataset of actual EV drivers in Calgary (a total of 129 EVs), we propose building synthetic multi-residential units of different sizes and assume a set of the EV drivers will live there. Given their known charging and driving habits, we can model how many and what type of EV chargers are needed to fulfill the user's necessities.

Each assumed multi-residential unit can vary in size and number of assumed EV users representing both different forms of residential units and different levels of EV adoption over time. Many different combinations of EV chargers (level 1, 2 and 3) could meet the needs of EV users in congregant settings. The data we have shows users who require fast charging and those for whom a level 1 charger will be more than enough. The heterogeneity of users and real life charging habits will be a significant advantage in this project. We will explore the range of solutions to charging need and the impact on convenience, electricity demand, and resilience for EV users.

The capacity of the grid for each simulated multi-residential will be assumed (within realistic parameters), as this data is not always easily accessible.

The results from this project will help give some guidelines for required chargers for multi-residential buildings, given Calgary's driver patterns, as well as information about the impact of EV chargers on electricity demand from different multi-residential units. This project will also contribute to give policy-makers in North America a guideline for buidling codes and electric capacity for MURBs that will be compatible with a reduction of greenhouse emissions from light-duty vehicles.

Keywords: Electric vehicle, Multi-Unit Residential Buildings, Infrastructure, Electrification of Transportation

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