Enabling Electric Vehicle Adoption: Identifying Charging Station Malfunctions

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Agenda

01  Motivation and Objective
02  Approach
03  Results
04  Impact
Problem Description

**Charging Station Ownership:** Public charging stations used by GM Electric Vehicle (EV) drivers are owned and operated by third party providers called Charging Point Operators (CPOs). Common CPOs include ChargePoint, EVgo, Shell Recharge, and more.

**Limited Station Visibility:** GM is reliant on the CPO’s for all maintenance, and CPO’s are often limited to reactive and delayed repairs. Additionally, GM lacks awareness of real-time station status.

**High Failure Incidence:** GM suspects high failure incidence across EV charging stations, which has negative implications for EV driver experience.

*Failure Incidence* is defined as the percentage of time that a charging station is not operating as expected.
The prevalence of failures at charging stations is widely disputed. Our project represents GM’s first attempt to understand the magnitude of this issue.

*CARB study was published in 2022 by University of California Berkely to understand the reliability of public electric vehicle charging stations

**downtime** is the total time that the charging station is not operational
Objective

Develop a modeling methodology to evaluate charging station health by identifying charging stations that have failed or are exhibiting deficiencies.
Data Overview

Considered data from 121 EV charging stations in California
49 Direct Current Fast Charge (DCFC) and 72 Level 2
January 2021 – March 2022
Approach

Charging failures are divided into three distinct types

- Charge does not start
- Charge is slow
- Charge terminates prematurely
Approach (Cont.)

Each failure type requires a unique modeling approach

Charge does not start

ARIMA forecasting models and residual analysis to determine points in time when there is a significant decrease in number of charges

Charge is slow

DBSCAN Clustering and time series density analysis to determine points in time that have a high percentage of anomalous charges

Charge terminates prematurely
Results

24.0%

Failure Incidence Among All Failure Types

10.1%  
Does Not Start

15.3%  
Slow

0.7%  
Terminates Prematurely
Results

24.0%

Failure Incidence Among All Failure Types

10.1%
Does Not Start

15.3%
Slow

0.7%
Terminates Prematurely

Delivered dashboard showing summary statistics and actionable insights by CPO provider:
Impact

Facilitates Relationships and Data Sharing with CPOs: This project improves visibility into CPO performance and provides valuable insight that enables GM to have better informed partnerships with CPOs.

Improves Driver Experience: GM can directly notify drivers of potential charging station failures, eliminating the frustration of encountering a malfunctioning station.

Accelerates EV Adoption: Higher reliability and uptime of charging stations will promote EV adoption and enable GM’s goals of an all-electric, zero-emissions future.
Thank you!