



# Enabling Electric Vehicle Adoption: Identifying Charging Station Malfunctions

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# Agenda

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**01** Motivation and Objective

**02** Approach

**03** Results

**04** Impact

# Problem Description

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**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.

# Station Failure Prevalence

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28%

Reported non-functioning  
by CARB\* study

<5%

Reported downtime\*\*  
by CPOs

The prevalence of failures at charging stations is widely disputed. Our project represents GM's first attempt to **understand the magnitude of this issue.**

# Objective

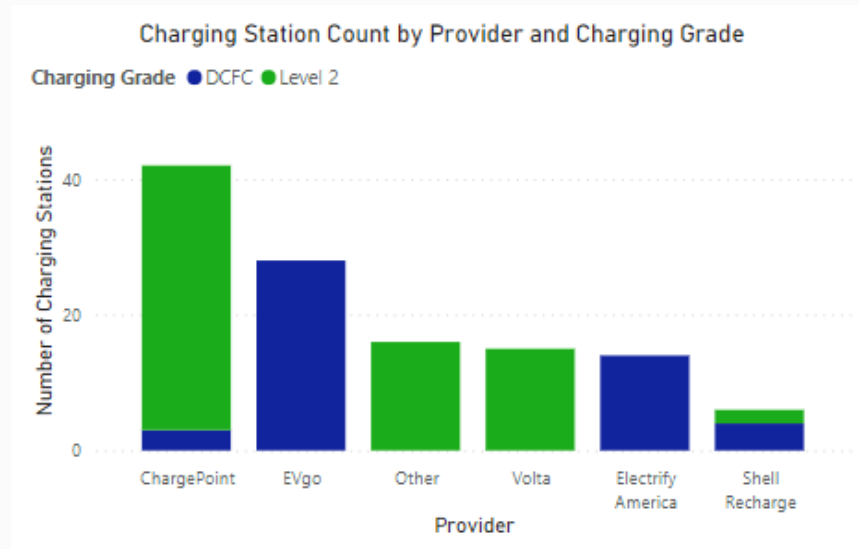
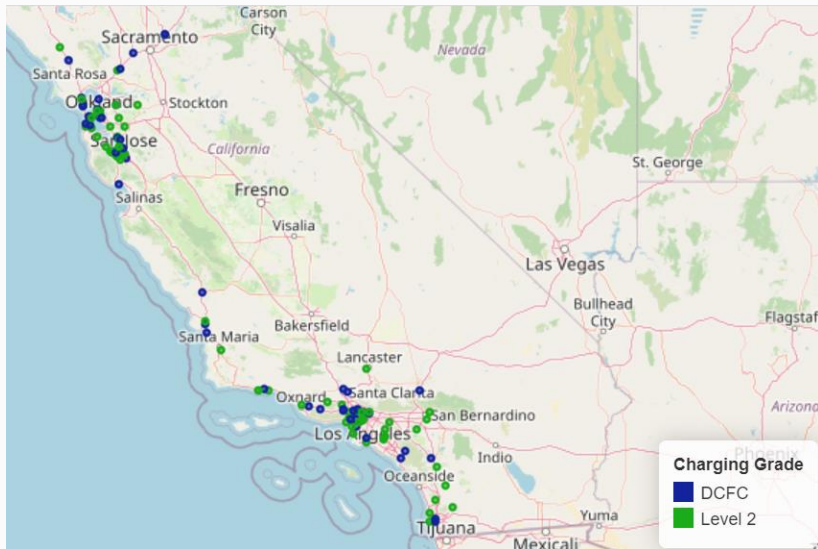


**Develop a modeling methodology to evaluate charging station health by identifying charging stations that have failed or are exhibiting deficiencies**

# Data Overview



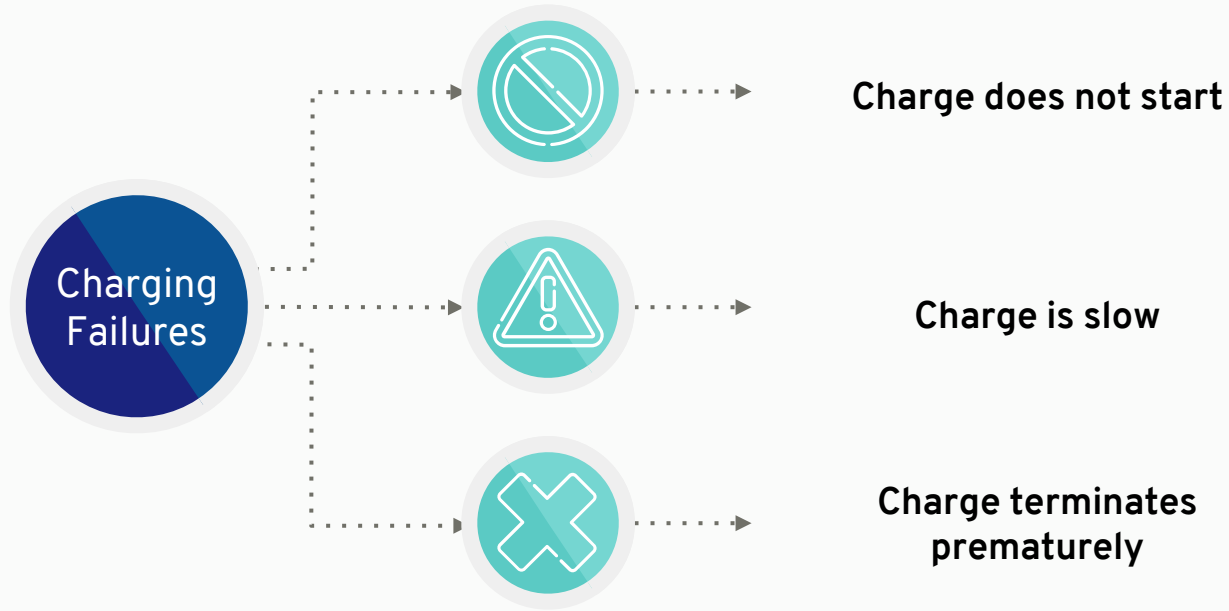
Considered data from 121 EV charging stations in California  
49 Direct Current Fast Charge (DCFC) and 72 Level 2  
January 2021 – March 2022



# Approach



Charging failures are divided into three distinct types





# 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

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24.0%

## Failure Incidence Among All Failure Types

10.1%  
Does Not Start

15.3%  
Slow

0.7%  
Terminates Prematurely

# 24.0%

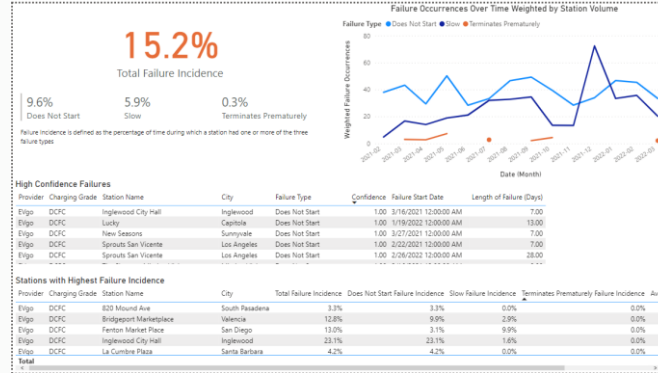
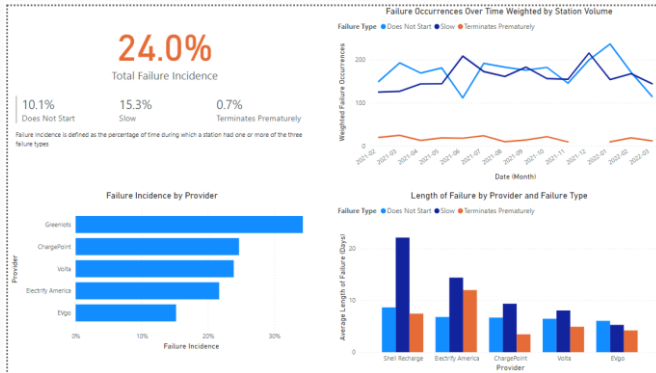
## Failure Incidence Among All Failure Types

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



# Impact

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**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!**