Analysis of EV Charging Stations within SDG&E Territory

**Abstract:**

With rising environmental concerns and policy incentives, the electric vehicle (EV) market has grown rapidly. Despite this growth, current EV infrastructure lacks equitable accessibility across diverse communities. Prior studies often overlook the integration of demographic and vehicle type data in analyzing charging station distribution. This project addresses this gap by incorporating demographic and vehicle data. The goal of this research is to assess the alignment of current infrastructure within the San Diego area, providing insights that may guide the expansion of alternative fueling stations to support the increasing demand of sustainable transportation in the future. Methods include data fusion, time-series analysis, and graph theory to unearth insights using datasets from the Alternative Fuels Data Center (AFDC), U.S. Census Bureau, and California Department of Motor Vehicle (DMV).

**Introduction:**  
As environmental concerns and policy incentives drive demand for cleaner transportation, EVs continue to expand rapidly worldwide. In 2023, almost 14 million new electric cars were registered globally. This surge represents a 35% increase from 2022 and highlights the momentum within the EV market, which now comprises around 18% of all cars sold, compared to just 2% five years earlier in 2018. Within the San Diego Gas & Electric (SDG&E) territory, where California’s EV adoption has consistently outpaced national averages, the need for robust and accessible EV infrastructure is critical. This report investigates the distribution of alternative fuel charging stations alongside regional demographics and vehicle fuel types, aiming to identify gaps and inform future infrastructure development.

The main dataset used in this study is the Alternative Fuels Data Center (AFDC) dataset, which provides comprehensive information on alternative fuel charging stations across the United States. Each entry represents a unique charging station and includes key features such as the station’s open date, fuel type, geographic coordinates (latitude and longitude), and zip code. This dataset is invaluable to the project because it offers detailed, location-specific data that allows for a spatial analysis of charging station accessibility within SDG&E territory.

Two complementary datasets are used. The first complementary dataset is 2022 American Community Survey 5-year data. This dataset, organized by zip code, offers demographic variables such as population density, median income, and education level. It can be merged with our main dataset via zip code. This data allows us to analyze the relationship between demographic characteristics and the availability of alternative fueling infrastructure. The second additional dataset is Vehicle Fuel Type Count by zip code. This dataset provides critical insights into the types of vehicles predominantly used in each area and enables us to assess whether the current infrastructure aligns with the local demand for specific fuel types.

Several studies have been conducted on the distribution of EV stations. The **Pew Research Center’s 2024 analysis** on the state of EV charging infrastructure emphasizes the disparity in charging station accessibility across the U.S. This study underscores that while major urban areas often have robust charging networks, rural and lower-income communities are frequently underserved. The study also indicates that high-traffic corridors and intercity highways require more charging points to support long-distance EV travel effectively. These findings underscore the importance of strategically placed charging stations to encourage broader EV adoption and equitable access. **SEPA Power’s report on EV Charging Infrastructure** provides a technical analysis of EV infrastructure needs, focusing on the operational requirements and challenges associated with integrating EV charging stations into the existing power grid. SEPA’s study points out that the increase in EV demand places considerable pressure on local grids, particularly in areas with dense EV usage. This report highlights the importance of considering grid capacity and stability when expanding charging networks, as areas with insufficient grid resources may face challenges in meeting charging demand without upgrades.

References

<https://www.pewresearch.org/data-labs/2024/05/23/electric-vehicle-charging-infrastructure-in-the-u-s/pl_2024-05-24_ev-chargers_0_01/>

<https://sepapower.org/knowledge/ev-charging-infrastructure/>