

Project Proposal: Optimizing EV Charging Infrastructure in California

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Research Question:

How can we help cities/localities in California determine the optimal number and location of EV charging stations to reduce congestion and minimize energy costs?

With the rise of electric vehicles (EVs) as a vital solution for reducing greenhouse gas emissions, there is an increasing need for efficient and accessible EV charging infrastructure. California serves as an ideal base state for our study due to its [large EV population](#) and unique challenges:

High EV adoption but not enough chargers: Careful planning is required to ensure an adequate number of accessible charging stations. [California needs one million more chargers by 2030](#).

Electricity Grid Constraints: Managing energy supply efficiently, especially during peak hours, is crucial to avoid grid overload and high energy costs. California has [limited grid capacity](#) which leads to operational inefficiencies.

Other challenges include long wait times at charging stations due to congestion, staff capacity, funding delays and availability of fast chargers.

Our aim is to solve these challenges by finding out the optimal number and location of EV charging stations taking into account traffic patterns, population density and existing infrastructure within California. Using this data we aim to minimize urban congestion by optimally distributing these charging stations and minimizing energy costs through efficient scheduling.

Data Sources:

To support the analysis for optimizing electric vehicle (EV) charging stations in California by county, we will be using several data sources. 1. The California Department of Transportation provides publicly accessible traffic flow data, 2. offering insights into [Annual Average Daily Traffic](#) (AADT) across the state. The California Energy Commission supplies comprehensive information on existing 3. [EV charging station locations](#) and 4. [electricity capacity data](#), which are crucial for understanding current infrastructure and energy demands. 5. [Population density data](#) by city in California is available from USA.com, while 6. [EV registration data](#) by city can be obtained from sources such as The Sacramento Bee.

Methodology:

To address our question of determining the number of EV charging stations required per city/county in California, we will be using a two-stage optimization model with a primary goal of deciding the number of EV charging stations that reduces congestion and a secondary objective of minimizing energy costs by scheduling charging times based on usage patterns. Our stage 1 decisions focus on infrastructure planning with constraints regarding EV demand in the area, population density and traffic patterns while our stage 2 decisions focus on operational efficiency with capacity and price constraints.