

EV Charging Station Demand Analysis

Transforming charging data into actionable infrastructure insights





CHALLENGE

The Growing Infrastructure Gap

Rapid EV adoption demands smarter charging infrastructure.

Understanding usage patterns is critical for:

- Optimizing station placement
- Managing energy consumption
- Supporting sustainable transportation

Data-driven decisions enable efficient infrastructure planning.

1,300+

Charging Sessions

20+

Data Attributes



Rich Data Foundation



Charging Info

Start time, end time, duration



Energy Data

kWh consumed, charging rate, battery capacity



Location

Station ID, city, geographic data



User Behavior

User type, vehicle model, distance driven



Data Cleaning & Preparation

01

Initial Exploration

Loaded dataset with Pandas, reviewed data types and summary statistics

02

Handle Missing Values

Removed ~5% of records with missing critical fields

03

Feature Engineering

Created charging_hour, peak_period, station_city, weekday trends



Tools: Python, Pandas, NumPy for robust data transformation

PEAK DEMAND

When Do People Charge?

Hourly Demand Pattern

Early morning hours show highest charging activity



Peak vs Off-Peak

Off-peak sessions dominate overall usage



Understanding temporal patterns enables dynamic pricing strategies

GEOGRAPHIC INSIGHTS

Where Is Demand Highest?

Los Angeles

Highest charging session volume and energy consumption

Energy consumption strongly correlates with session volume across all locations

Houston

Second-highest demand city, strong energy usage

Other Cities

Growing demand across multiple metropolitan areas

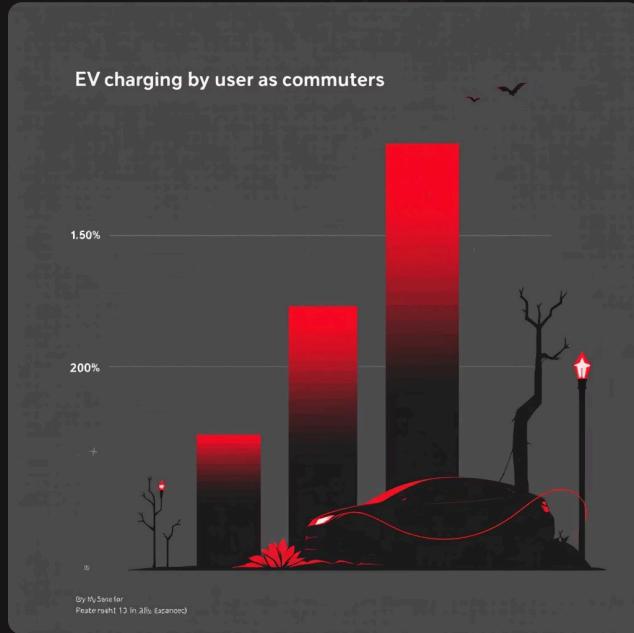
User Behavior Patterns

Weekday vs Weekend



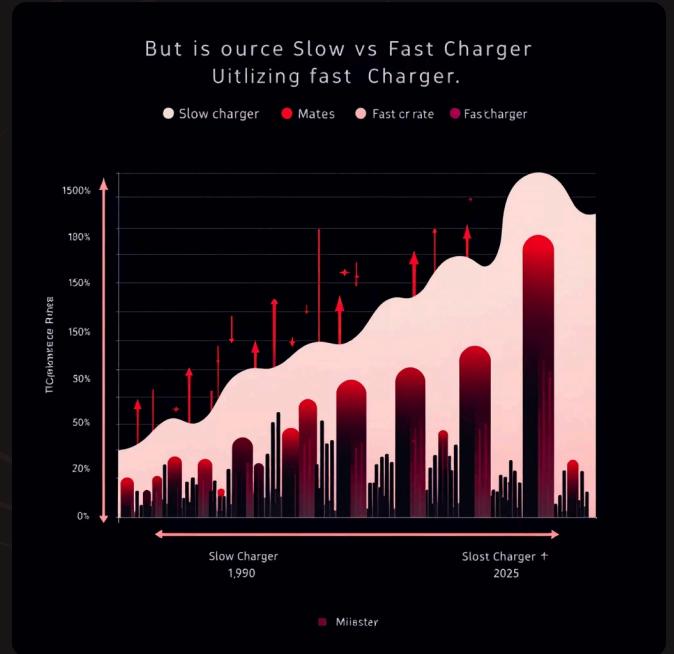
Distinct charging patterns between work days and weekends

User Types



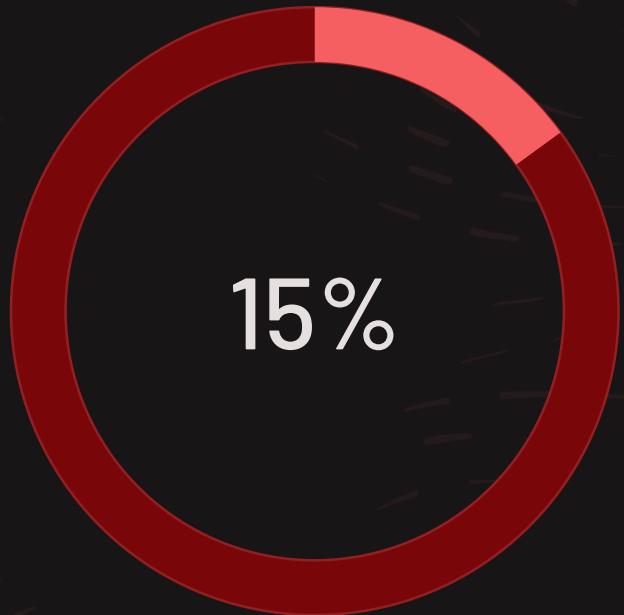
Commuters represent largest user group

Charger Types



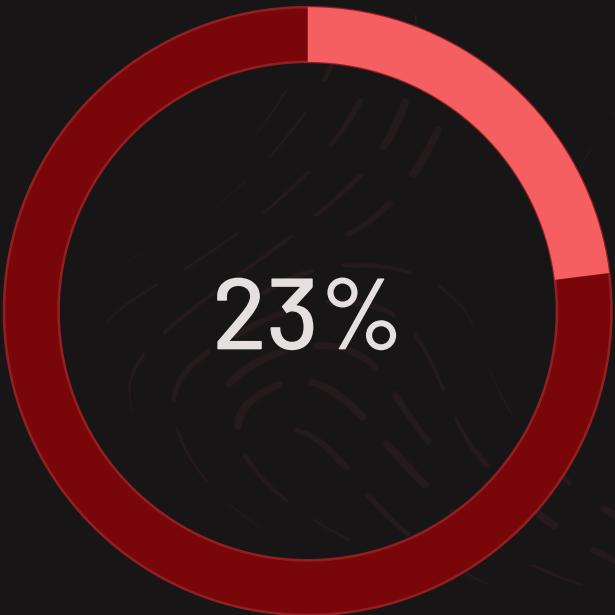
Slow chargers most frequently used

Monthly Demand Growth

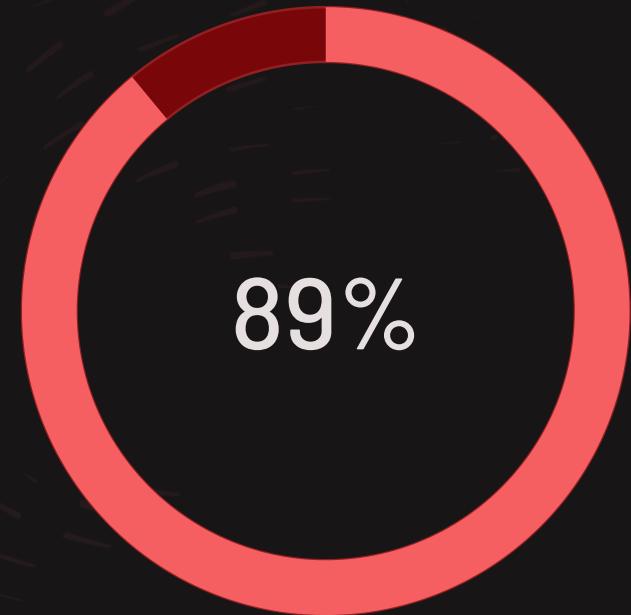


Average monthly growth in charging sessions

Consistent upward trajectory signals need for expanded infrastructure



Energy consumption increase year-over-year



Infrastructure utilization rate

Strategic Action Plan

1

Expand High-Demand Cities

Prioritize Los Angeles and Houston for new station deployment

2

Incentivize Off-Peak

Implement dynamic pricing to balance grid load

3

Increase Fast Chargers

Deploy more fast chargers in high-energy locations

4

Optimize Charger Mix

Balance slow and fast chargers based on user behavior



Project Impact

Demonstrated end-to-end analytics capabilities:

- Python data cleaning & feature engineering
- Exploratory analysis & KPI identification
- Power BI interactive dashboards
- Actionable business recommendations

*Transforming raw data into infrastructure intelligence
for sustainable transportation*



Python



Power BI



Analytics