

# 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

 DATASET

# 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

## Houston

Second-highest demand city, strong energy usage

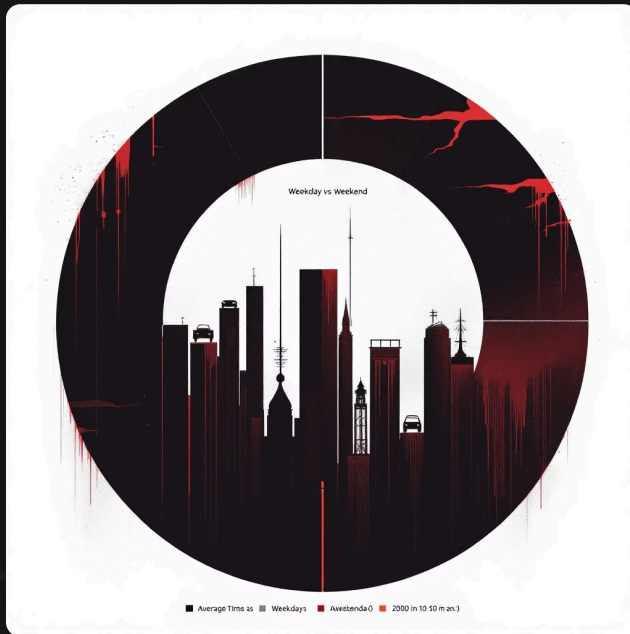
## Other Cities

Growing demand across multiple metropolitan areas

Energy consumption strongly correlates with session volume across all locations

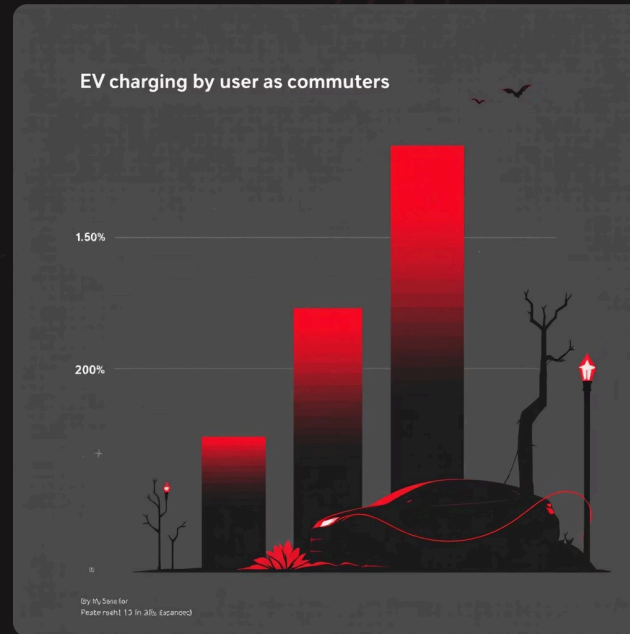
# User Behavior Patterns

## Weekday vs Weekend



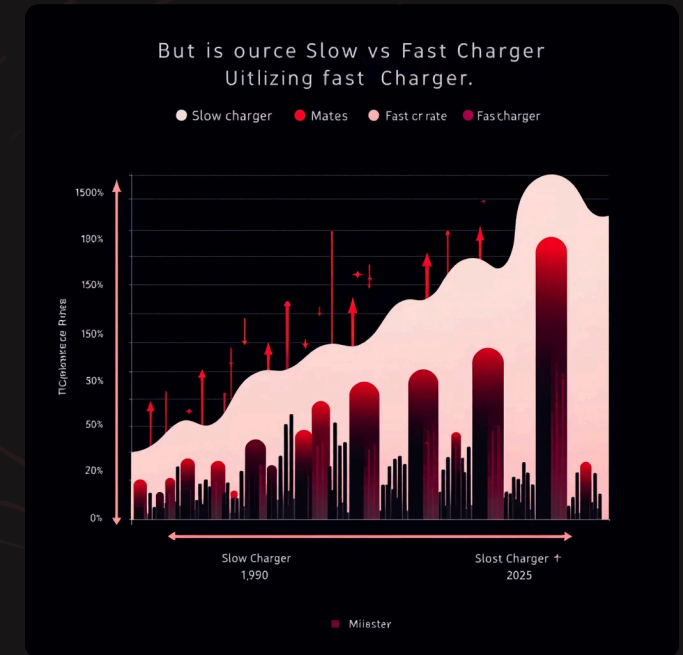
Distinct charging patterns between work days and weekends

## User Types



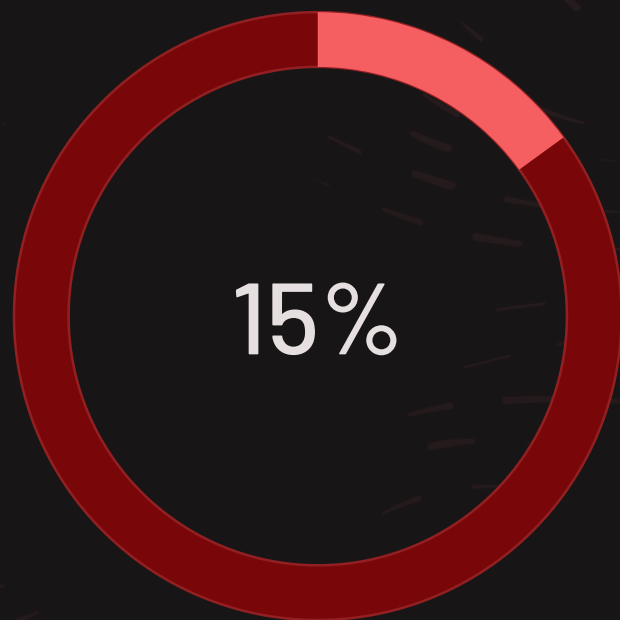
Commuters represent largest user group

## Charger Types

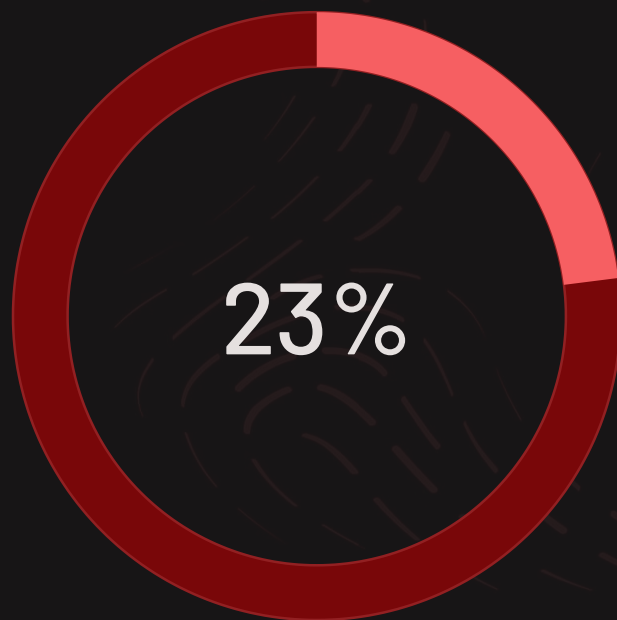


Slow chargers most frequently used

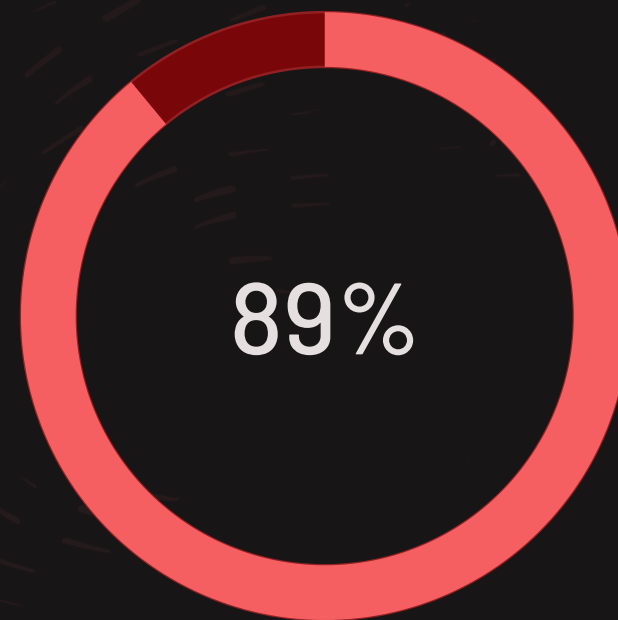
# Monthly Demand Growth



Average monthly growth in charging sessions



Energy consumption increase year-over-year



Infrastructure utilization rate

Consistent upward trajectory signals need for expanded infrastructure



# 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