Optimizing EV Charging Station Placements

Strategic Infrastructure for Tesla in California

Introduction/Background

Tesla has pioneered EV technology, emphasizing charging infrastructure development.

California, leading the EV market, demands strategic charging station placements to support Tesla's growth.

Project Objective

- Strategically optimize charging station placements to ensure balanced utilization.

- Address over- and under-utilization across California counties.

- Align infrastructure goals with Tesla's mission for sustainable transportation and scalability.

Data/Problem Analytics (Methodology)

Utilization-Based Capacity Planning using:
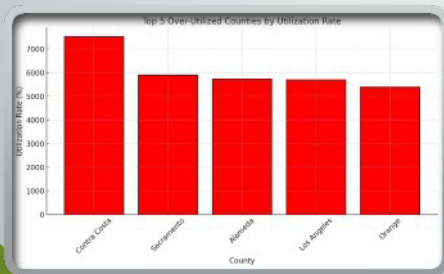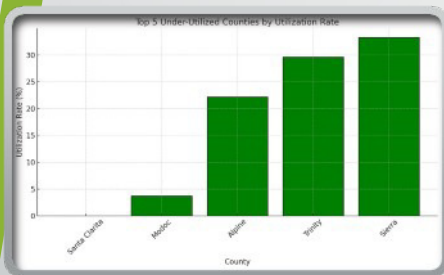
Linear Programming (Solver)

Sensitivity Analysis

Decision Analysis

Regression Analysis and Network Modeling

Data Sources: Annual charging hours, utilization rates, station capacities, etc. from Kaggle and California Energy Commission.

Data/Problem Analytics (Analysis)

- **Under-utilized counties:**
  - Recommend relocating or repurposing chargers.
- **Over-utilized counties:**
  - Require additional stations to meet 60% - 80% utilization targets.
- Optimization via Solver ensures balanced resource allocation.
- Key metrics include Utilization Rate and Idle Time.

Findings/Conclusions

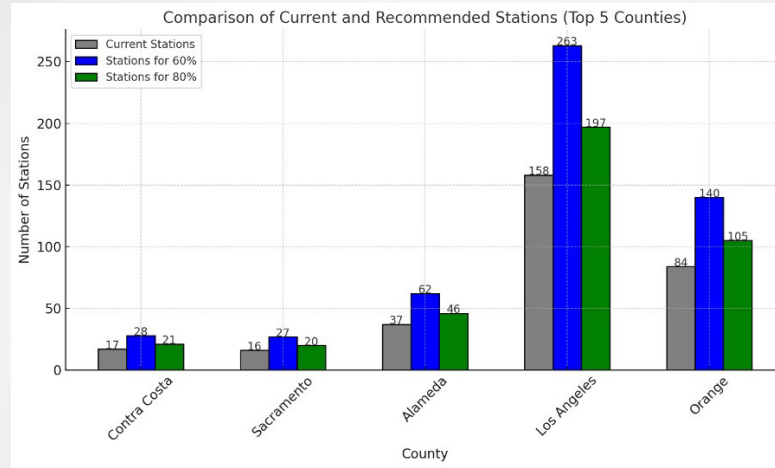Over-utilized counties need additional stations to maintain efficiency.

Under-utilized counties require demand-boosting strategies or reallocation of resources.

- Dynamic pricing and phased rollouts improve scalability and revenue.
- Scalability ensured by maintaining utilization rates between 60%-80%.

Findings/ Conclusions

- Los Angeles needs 105 more stations for 60% utilization
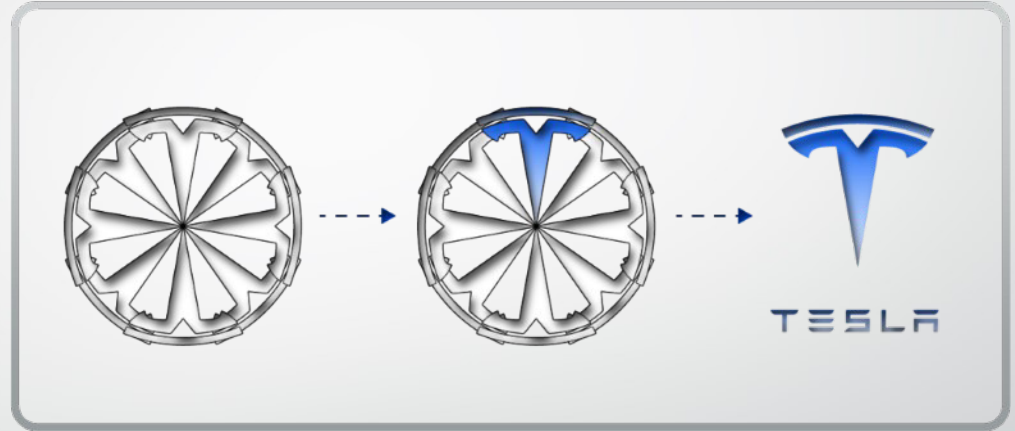
- Chargers in Alpine and Colusa can be relocated

County	Current Stations	Recommended Stations (60% Utilization)	Recommended Stations (80% Utilization)
Contra Costa	17	28	21
Sacramento	16	27	20
Alameda	37	62	46
Los Angeles	158	263	197
Orange	84	140	105

Comparison of Current and Recommended Stations (Top 5 Counties)

Findings/Conclusions

Managerial Implications

- Data-driven decision-making ensures optimal resource allocation

- Dynamic pricing shifts demand from peak to non-peak hours

- Infrastructure investments tailored to high-demand areas maximize ROI.

- Renewable energy integration enhances sustainability and profitability.

Prioritize investments in high-demand counties

Relocate chargers from low-utilization areas to high-demand regions

Use renewable energy to align with sustainability goals

Implement phased expansions and ongoing monitoring

Implementation of Results

Application of Decision-Making Theories — Utilization-Based Capacity Planning and Optimization Modeling solve real-world challenges.

Teamwork and Collaboration — Cross-functional teamwork emphasized adaptability and clear communication.

Predictive and Data-Driven Approaches — Regression analysis and scenario modeling provided actionable insights.

Broader lessons — Importance of proactive planning for scalability and sustainability. Alignment of strategies with environment and operational goals.
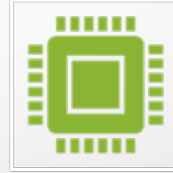
Idea Sharing

References

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Valakhorasani, M. (n.d.). Electric vehicle charging patterns dataset. Kaggle. Retrieved from https://www.kaggle.com/datasets/valakhorasani/electric-vehicle-charging-patterns

EnergySage. (n.d.). Tesla Supercharger guide. Retrieved from https://www.energysage.com/ev-charging/tesla-supercharger-guide

TIME	CONTENTS
October 2 – October 29, 2024	Project proposal design and presentation preparation
October 30, 2024	Project proposal presentation
November 1, 2024	Assign roles & responsibilities
November 4 – November 10, 2024	Research, gather, and refine data for analysis
November 11 – November 17, 2024	Begin data analysis & refine approach if necessary
November 18 – November 24, 2024	Finalize data and conclusions
November 25 – December 1, 2024	Compile report and presentation
December 2 – December 3, 2024	Finalize report & presentation Rehearse presentation
December 4, 2024	Final project paper submission and final project presentation

Appendix

Thank you!