

ELECTRIC VEHICLES POPULATION GROWTH IN WASHINGTON STATE

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Abstract— Electric vehicles (EVs) play a critical role in reducing greenhouse gas emissions and promoting sustainable transportation. This study focuses on analyzing the adoption of EVs in Washington State using an interactive dashboard. The dashboard provides insights into geographic distribution, growth trends, popular EV manufacturers and models, and Clean Alternative Fuel Vehicle (CAFV) incentive eligibility. Key findings highlight Tesla's market dominance, rapid adoption growth in urban areas, and the role of government incentives in driving EV ownership. These findings aim to guide stakeholders in enhancing EV adoption strategies, contributing to a cleaner and greener future.

Keywords—Electric Vehicles (EVs), CAFV Eligibility, EV Adoption Trends, Tesla, EV Manufacturers, Geographic Distribution, Dashboard Analysis, Washington State.

I. INTRODUCTION

Electric vehicles (EVs) are becoming a key part of the movement toward cleaner and more sustainable transportation. EVs help reduce harmful emissions and reliance on fossil fuels, making them an essential tool in combating climate change. Washington State has been a frontrunner in adopting EVs, thanks to supportive policies, expanding charging infrastructure, and growing awareness among its residents.

This project explores EV adoption in Washington using an interactive dashboard. The dashboard allows users to analyze EV data through dynamic filters and visualizations. Key areas of focus include where EVs are most commonly found, the growth of EV adoption over the years, the most popular EV brands and models, and eligibility for Clean Alternative Fuel Vehicle (CAFV) incentives. The aim is to provide actionable insights to encourage further EV adoption in the state.

II. PROJECT OBJECTIVES

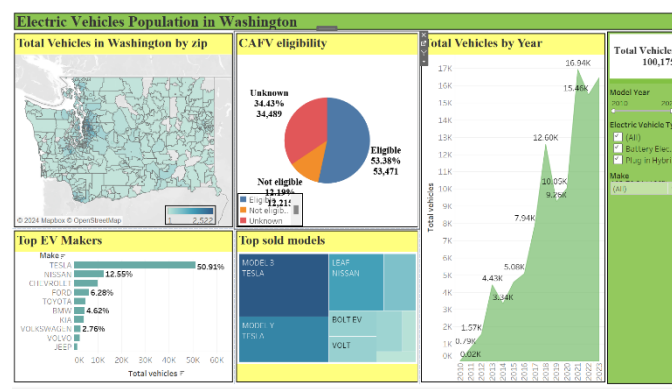
The project focuses on:

- Analyzing the geographic distribution of EVs across Washington's zip codes.
- Identifying the leading EV manufacturers and the most popular models among Washington residents.
- Tracking trends in EV adoption over the years.

- Examining eligibility for CAFV incentives to understand their impact on EV ownership.
- Allowing users to explore the data dynamically using filters for specific years, EV types, and manufacturers.

III. DASHBOARD OVERVIEW

The dashboard consists of several key visualizations, each enhanced with filters for dynamic analysis. These filters enable users to adjust the data view based on different criteria, such as model year, EV type (e.g., battery electric or plug-in hybrids), and car manufacturers. By applying these filters, users can focus on specific aspects of the EV population and tailor the insights to their needs.



A. TOTAL VEHICLES IN WASHINGTON BY ZIPCODE

A map shows the distribution of EVs across Washington's zip codes, with color shading indicating the concentration of EVs in each area. Key trends observed:

- Urban and suburban areas, particularly around major cities like Seattle, have the highest concentrations of EVs. These areas typically have better charging infrastructure, higher incomes, and more awareness of EV benefits.
- Rural areas see much lower EV adoption, likely due to limited access to charging stations and less familiarity with EV technology. Expanding infrastructure in these areas could help improve adoption rates.

- This map is interactive, allowing users to filter the data by model year or EV type to see how distributions change over time or across vehicle categories.

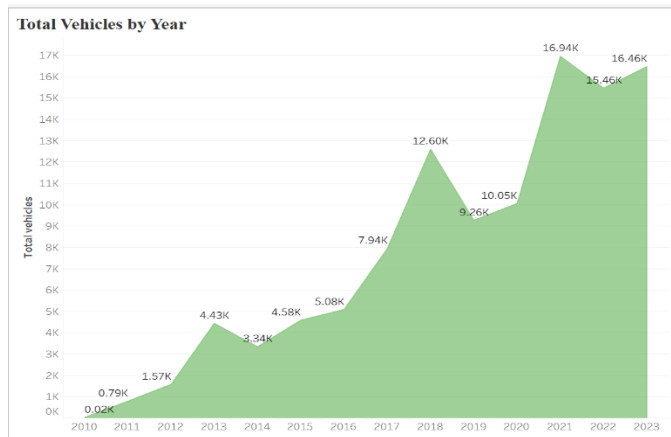
B. CAFV ELIGIBILITY

A pie chart breaks down the percentage of vehicles that qualify for CAFV incentives, as well as those that do not or whose eligibility is unknown. These incentives play a vital role in encouraging EV adoption by reducing costs for buyers. Key insights:

- A majority of vehicles are eligible for these incentives, indicating that Washington's programs to support clean energy are effective.
- Some vehicles are not eligible, likely due to factors such as older technology or limited energy efficiency.
- A significant portion of vehicles has unknown eligibility status, highlighting the need for improved data collection and reporting to better assess the impact of these incentives.

This visualization is tied to the filters, allowing users to see how eligibility varies by EV type, year, or manufacturer.

C. TOTAL VEHICLES BY YEAR



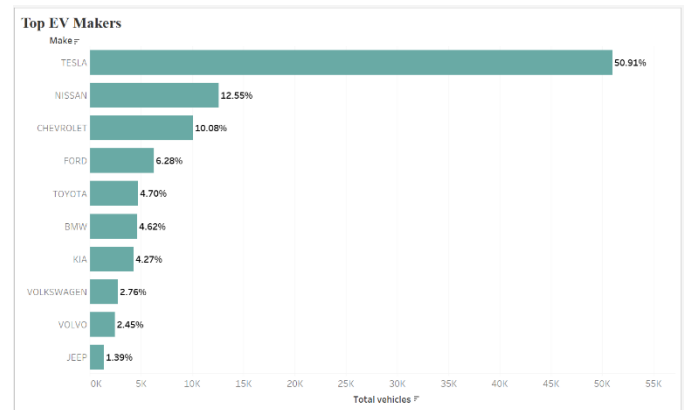
An Area chart illustrates the growth of EV ownership over time, starting from the early years of adoption to the present. This visualization captures a steady rise in EV numbers, with rapid growth observed in more recent years. Possible factors contributing to this trend include:

- Advances in EV technology, such as improved battery performance and longer driving ranges.
- The introduction of more affordable EV models that appeal to a wider range of consumers.
- Increased awareness about climate change and the benefits of switching to electric transportation.
- Expanding government incentives and tax credits, making EVs more accessible to the general public.

Filters for model year and EV type allow users to explore adoption trends for specific vehicle categories, revealing detailed insights into the factors driving growth.

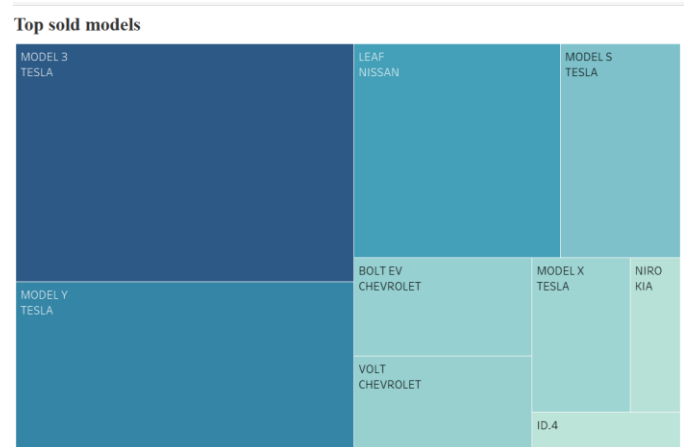
IV. EV MAKERS AND MODELS

A. TOP EV MAKERS



A bar chart shows the most popular EV manufacturers among Washington residents. Tesla leads by a significant margin, reflecting its strong brand reputation, advanced technology, and comprehensive range of vehicles catering to both luxury and practical needs. Other notable manufacturers, such as Nissan, Chevrolet, and Ford, also have a substantial presence. These brands focus on offering affordable, reliable EVs that cater to a broader audience.

B. TOP SOLD MODELS



A treemap visualizes the most popular EV models in Washington, providing a snapshot of consumer preferences. Tesla's models are the most dominant, appealing to buyers due to their performance, range, and charging infrastructure. Other well-known models, such as the Nissan Leaf and Chevrolet Bolt EV, also stand out, particularly among buyers seeking smaller, cost-effective vehicles. This visualization reflects the diverse preferences of EV buyers, from luxury vehicles to practical, budget-friendly options.

V. FILTERS AND INTERACTIVITY

The dashboard incorporates multiple filters to enhance interactivity and customization:

- **Model Year:** Users can focus on specific time periods to track trends or analyze vehicles from particular years.
- **EV Type:** Filters separate data by vehicle type, such as battery electric or plug-in hybrid, allowing comparisons of their respective adoption rates.
- **Manufacturer:** This filter lets users analyze individual car makers to see how their market share evolves over time or by location.

These filters provide flexibility, making the dashboard a powerful tool for exploring EV adoption from different perspectives

VI. KEY FINDINGS

- **Geographic Trends:** EV ownership is concentrated in urban areas, highlighting the importance of infrastructure and public awareness in driving adoption.
- **Rapid Growth:** The number of EVs has increased significantly in recent years, reflecting growing interest in sustainable transportation and advancements in technology.
- **Tesla's Dominance:** Tesla leads both in overall market share and in the popularity of individual models, although other manufacturers are gaining ground with affordable alternatives.
- **CAFV Incentives:** These incentives play a crucial role in promoting EV ownership. However, the unknown eligibility status for many vehicles suggests the need for better data tracking.

VII. RECOMMENDATIONS

To further boost EV adoption in Washington, several steps can be taken:

- **Expand Charging Stations:** Increase the availability of charging infrastructure in rural and underserved areas to make EVs more accessible.
- **Encourage Affordable Models:** Partner with manufacturers to promote and produce cost-effective EVs that appeal to a wider audience.
- **Improve Data Collection:** Address gaps in CAFV eligibility data to better understand how these incentives are impacting EV ownership and identify opportunities for improvement.
- **Public Education Campaigns:** Raise awareness about the benefits of EVs and available incentives through targeted outreach, especially in areas with low adoption rates.

VIII. CONCLUSION

The dashboard provides valuable insights into key trends, from geographic distribution to the performance of manufacturers and models. While there is much to celebrate, challenges remain in areas like rural adoption and data completeness.

With continued investment in infrastructure, better access to affordable models, and stronger outreach programs, Washington can maintain its leadership in clean energy and serve as a model for other states. EVs represent not just a shift in transportation but a step toward a cleaner and more sustainable future.

IX. REFERENCES

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