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Driving Change: Motivations and Barriers to Electric Vehicle Adoption

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Abstract

Washington state aims to have 100% of passenger vehicles be zero-emission vehicles (ZEVs) on the road by 2035, yet consumer adoption remains slow, and public confidence in this goal is low. This research explored how residents make vehicle-purchase decisions, their sentiment toward EVs, and the adequacy of current EV infrastructure. A statewide survey revealed weak correlations between individual demographics and the likelihood of EV adoption, while highlighting key barriers, including high upfront costs, limited charging infrastructure, and concerns about total ownership costs and environmental impacts. Existing infrastructure data indicates significant expansion is required to support projected EV growth. Based on quantitative and qualitative findings, three recommendation areas emerged: policy measures to incentivize adoption or reassess the ZEV timeline; environmental strategies focused on battery recycling and grid modernization; and technological improvements in charging access, vehicle capabilities, and infrastructure resilience. These efforts must be implemented in parallel to meaningfully accelerate EV adoption and move toward Washington's 2035 ZEV target.

Keywords: *Electric vehicle, consumer behavior, infrastructure, policy, technology*

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Introduction/Background

In 10 years, all 2.83 million passenger vehicles driving on Washington roads are expected to be powered purely by electricity — if the state's top leadership achieves its goal of 100% ZEVs by 2035. However, the state has a long way to go. Only about 2.8% of all passenger vehicles on the road in Washington fit into this category (Data.gov, 2024). Additionally, these battery-electric vehicles (EVs) accounted for only 10.8% of all new passenger vehicle registrations in the state in 2024 (Data.gov, 2024). To meet its goal, the state must accelerate ZEV adoption among drivers by providing robust charging infrastructure and other incentives. Understanding how consumers make these big purchases is a good starting point for identifying possible pathways to the 2035 goal.

Literature Review

Research on electric vehicle adoption has highlighted multiple factors influencing consumer behavior, including cost, range anxiety, incentives, and infrastructure availability. Prior studies emphasize that while financial incentives and environmental awareness encourage adoption, gaps in charging infrastructure and policy inconsistencies remain significant barriers. Multiple studies have identified cost, range anxiety, and charging accessibility as the primary determinants of EV adoption. Liao et al. (2017) found that while environmental benefits play a role in purchase decisions, total cost of ownership, charging convenience, and perceived technological risks remain the most influential factors. Their research emphasized that financial incentives, such as tax rebates, significantly increase EV adoption rates only when coupled with strong charging infrastructure development.

Similarly, Rezvani et al. (2014) analyzed psychological and social influences on EV adoption, noting that while environmental consciousness and social influence contribute positively, concerns about battery life, resale value, and charging reliability hinder widespread adoption. Their findings suggest that consumer education and policy addressing these concerns could improve adoption rates. This aligns with recent Washington state efforts to enhance EV incentives and awareness campaigns. A 2021 report from the International Council on Clean Transportation (ICCT) further supports these findings, stating that while EV purchase intentions have increased globally, adoption remains heavily dependent on external incentives and infrastructure availability. The report suggests that states with aggressive incentive programs and high charger density achieve significantly higher adoption rates than those with weaker policies.

One of the most frequently cited barriers to EV adoption is the availability of charging stations. Studies indicate consumers are reluctant to transition to EVs if charging is inconvenient, unreliable, or significantly slower than refueling a gasoline-powered vehicle. Sierzchula et al. (2014) found that while financial incentives positively correlate with EV adoption rates, their effectiveness diminishes in regions with low charging station availability. This highlights the importance of infrastructure expansion as a parallel strategy to financial incentives. Washington state faces regional disparities in charging station distribution. Reports from the Washington State Department of Transportation (2021) indicate urban centers like Seattle have relatively strong charger networks, but rural areas remain underserved.

A study by Nicholas and Hall (2022) on charging infrastructure gaps emphasized that policy-driven investments in charger deployment significantly impact EV market penetration.

Their findings suggest that states with comprehensive charging infrastructure strategies achieve higher adoption rates than those relying solely on purchase incentives. Studies have demonstrated that government incentives play a crucial role in shaping consumer decisions, but the structure and accessibility of those incentives matter. Hardman (2019) analyzed recurring vs. one-time incentives, concluding that long-term financial benefits, such as reduced electricity rates, access to carpool lanes, and lower maintenance costs, often drive higher adoption rates than one-time purchase rebates.

Additionally, Diaz and Clark (2023) explored the effectiveness of EV rebate programs. They found that while upfront financial incentives boost sales, their long-term impact is limited when consumers face high operational costs or limited charging access. Their findings suggest that aligning incentives with infrastructure expansion is essential for sustained adoption. A 2022 study by the U.S. Department of Energy (DOE) examined EV adoption trends across states. It concluded that states with higher levels of public-private partnerships in EV infrastructure development experienced faster adoption rates than those relying solely on government-funded programs. This highlights the need for Washington to engage private-sector stakeholders in expanding charging networks.

The findings from these studies reinforce the importance of a dual approach that enhances incentives while addressing infrastructure gaps. This research builds on these insights by:

1. Assessing Washington residents' attitudes toward EVs and identifying the key motivations behind their purchasing decisions.
2. Examining regional disparities in charging access and determining the prevalence of "EV deserts."
3. Evaluating the effectiveness of current incentive programs in meeting the state's 2035 ZEV goal.

By comparing these findings with existing literature, this research aims to validate whether Washington state aligns with broader EV adoption trends or faces unique barriers that require specialized policy interventions. These insights will help policymakers refine existing strategies, improve infrastructure planning, and design more effective consumer engagement programs to accelerate EV adoption.

Methods

The problem this study addresses is that Washington state's goal of achieving 100% zero-emission vehicle adoption by 2035 is challenged by slow consumer adoption, insufficient charging infrastructure, and uneven regional access. Fast charging still lags gasoline refueling in both speed and availability, especially in metropolitan areas where long wait times and limited power grid capacity create additional barriers. These infrastructure gaps, coupled with consumer concerns, inhibit EV adoption and jeopardize the state's ability to meet its transportation decarbonization milestones.

If these challenges persist, the consequences could be significant. Environmentally, continued reliance on internal combustion engine vehicles will contribute to greenhouse gas emissions and air pollution. Economically, slow ZEV adoption may hinder growth in Washington's clean energy and transportation sectors, limiting job creation and innovation. Socially, underserved areas — particularly rural and low-income communities — may face ongoing exclusion from sustainable transportation options, reinforcing existing inequities. These

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setbacks risk compromising public health and undermining the state's leadership in climate and sustainability policy.

While prior studies have identified broad factors affecting EV adoption, such as cost, range anxiety, and environmental attitudes, few have examined Washington-specific barriers, such as regional charging disparities and infrastructure limitations. This study contributes to the field by integrating consumer survey data and vehicle registration trends to identify obstacles and forecast infrastructure needs. The findings provide actionable insights for policymakers and planners working to align EV adoption strategies with Washington's 2035 ZEV goals, while also informing broader efforts to support equitable and effective EV transitions.

Research Questions

- What individual characteristics and external factors contribute most to consumer behavior in the context of purchasing a new electric vehicle?
- What is the current capacity of charging stations in WA, and what is the gap to where it needs to be to fulfill the 2035 goal of 100% passenger ZEV?
- How do people feel about electric vehicles and related policies/legislation?

Sample selection

The target population for this research project consisted of Washington state residents aged 18 or older who own a vehicle. This included individuals who have purchased either electric or non-electric vehicles and who may be responsible for making vehicle purchase decisions within their household. By including both electric and non-electric vehicle owners, this study explores the factors influencing vehicle purchases, particularly what factors were most important in the decision-making process. Understanding the motivations, preferences, and considerations of these consumers provided valuable insight into the effectiveness of incentives, market trends, and potential barriers to EV adoption.

The subject selection process used convenience sampling. Invitations to the survey were distributed through social media platforms and the professional and personal networks of the researchers to reach a diverse group of vehicle owners. Additionally, QR codes linking to the survey were posted at multiple EV charging stations within the research area to encourage participation from electric vehicle owners. Although convenience sampling may limit representativeness, the chosen methods enabled efficient data collection from a relevant and informed population, facilitating a meaningful analysis of purchasing motivations and general sentiment toward EVs.

Data collection procedures

This research project employed a mixed-methods approach, combining quantitative and qualitative analyses. The former was used on existing data sources, including vehicle registration records and alternative fuel station information. Coupled with established statistics on EV driving range, EV battery charging speed, and EV operation recommendations, the researchers used both large datasets to analyze the discontinuity of charging infrastructure in Washington State.

This study also employed a qualitative approach, using open-ended survey questions, to explore consumer attitudes and decision-making processes regarding EV adoption. This thematic analysis was essential for understanding the motivations, barriers, and firsthand experiences that influence EV purchase decisions. The survey conducted for this research included both structured and semi-structured questions to collect qualitative and quantitative data. Survey respondents were asked about their experiences with EVs, general driving preferences and habits, concerns regarding EV range and infrastructure, and opinions on current incentive programs. Demographic questions in the survey were included to help the researchers understand how different consumer characteristics may influence the decision to purchase an EV and to gain insight into overall sentiment toward EV adoption.

Validity and reliability

The survey's overall distribution limited the sample population because it relied on researchers' individual networks, both personal and professional. As a result, a large majority of survey respondents are from Western Washington. Additionally, missing zip codes and zip codes not in Washington were removed from the survey results to avoid unintended variation and to ensure any analysis could be traced back to a Washington resident. Additionally, the zip code question in the survey was displayed last and was required. Therefore, if someone left this question blank, it could be considered an incomplete response. Filtering these values reduced missing responses among participants. Because the survey was only available online, it was limited to people with an internet connection and either a computer or a mobile device. A future iteration of this research could adopt a more programmatic approach to distribute the survey to a broader population and improve accessibility.

Both existing data sources were quite large and, in some contexts, lacked documentation indicating which variable meant what. One example of this is the "status code" variable in the dataset for alternative-fuel charging stations. It was discovered that a value of "P" in this dataset meant the station was planned and not yet available. These were removed from the analysis to better gauge truly existing infrastructure.

Ethical considerations

This research followed key ethical principles regarding data privacy, consent, anonymity, and bias in survey data. Participants were informed of the study's purpose through a project description, and participation was voluntary, in line with ethical guidelines on consent and transparency (ACM, 2022, Sections 1.3, 1.7). Anonymity was preserved by omitting identifiable information and using broad demographic categories (ACM, 2022, Sections 1.6–1.7). To ensure data privacy, Qualtrics encrypted responses and limited access to authorized personnel. Survey bias was minimized through careful review of questions for neutrality (ACM, 2022, Section 1.1).

For secondary data, ethical considerations included legal access and data accuracy. Datasets were obtained from publicly accessible sources such as Washington's open data portal and the National Renewable Energy Laboratory and will be cited appropriately (ACM, 2022, Section 1.5). Data were evaluated for reliability and relevance to ensure sound analysis and conclusions (ACM, 2022, Section 2.1).

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Results and Discussion

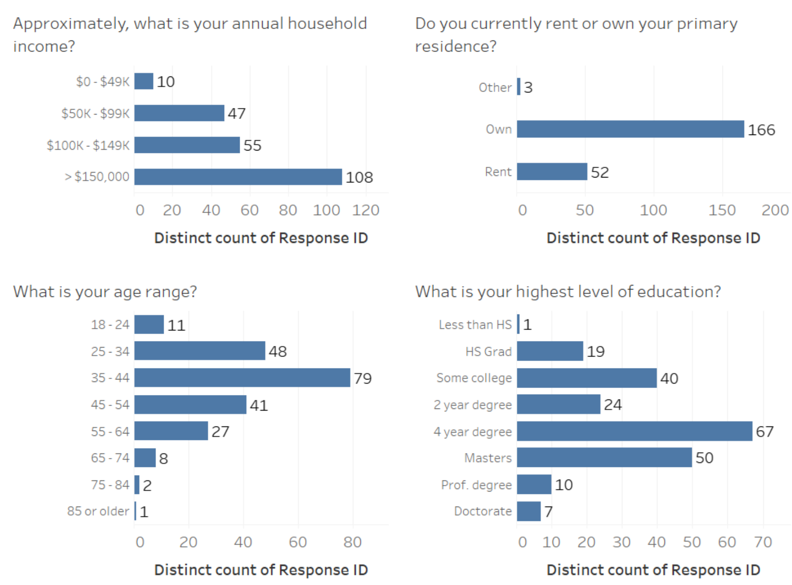
Survey demographics

The survey, used for both quantitative and qualitative analysis, received 267 responses, but 220 were included after filtering to match the target population of Washington state residents aged 18 or older who own a vehicle. While the survey aimed to understand Washington state residents' views on EVs, the use of convenience sampling likely led to demographics and responses that do not fully represent the target population. Most respondents were from Western Washington, with a sizeable portion from a south-central zip code and a small number from Eastern Washington.

The skewed distribution of demographic factors also suggests that the survey responses are unlikely to be representative of the target population. Figure 1 shows the distribution of demographics within the survey population, skewed towards certain groups. 74.1% of respondents had annual household incomes greater than $100,000, 75.1% owned their primary residence, 89.4% were between the ages of 25 and 64, and 72.4% had completed a college degree. As a result, the conclusions drawn from the survey data are likely to reflect the perspectives of these majority groups rather than those of the broader target population. However, analyzing the survey data would still yield valuable insights for forming recommendations regarding EV adoption.

Figure 1

Distribution of survey respondent demographics



Note. The survey's demographic questions yield a wide range of perspectives. Although the question about annual household income could have included more layers at the higher end to better split the income distribution.

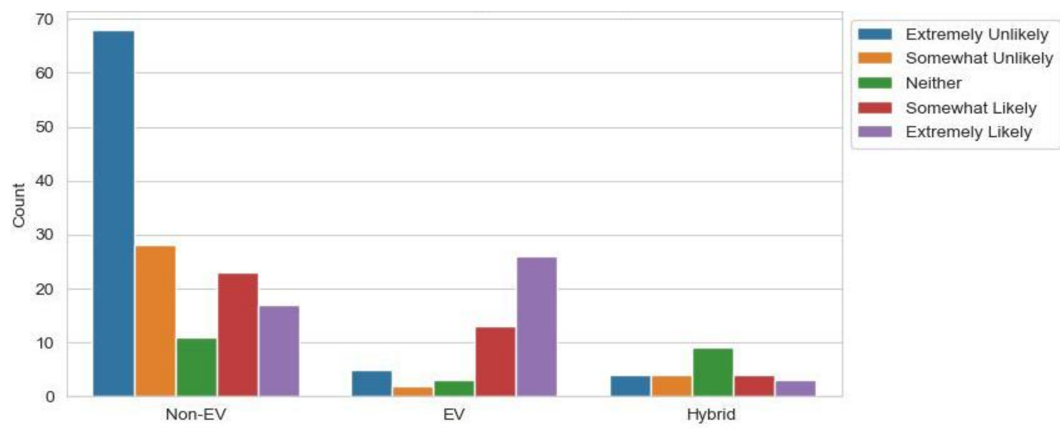
What individual characteristics and external factors contribute most to consumer behavior in the context of purchasing a new electric vehicle?

Based on survey results, all demographic factors included — current car type, age, annual household income, primary residence, and education level — show some correlation with the likelihood of purchasing an EV. Current EV owners were more likely to consider another EV purchase. In contrast, hybrid owners had a median response of “neither likely nor unlikely” and non-EV owners had more responses for “unlikely” (Figure 2). Households with higher incomes had more responses indicating “somewhat likely” or “extremely likely” to purchase an EV (Figure 3). Responses from homeowners were split between “likely” and “unlikely,” while renters and those in other housing situations had more “unlikely” responses (Figure 4). Lower education levels had more "unlikely” responses, while higher education levels were split between “likely” and “unlikely” or had higher counts for “likely” (Figure 8).

The overall pattern of responses shifting from “unlikely” to split or “likely” or vice versa across demographic groups suggests a possible relationship between these factors and the likelihood of purchasing an EV. However, the varied response distributions within each demographic group make it difficult to identify specific individual characteristics that impact the likelihood of purchasing an EV.

Figure 2

Likelihood distribution by current vehicle type



Note. The median likelihood for each group were: non-EV – somewhat unlikely, EV – extremely likely, hybrid – neither likely nor unlikely.

Figure 3

Likelihood distribution by annual household income

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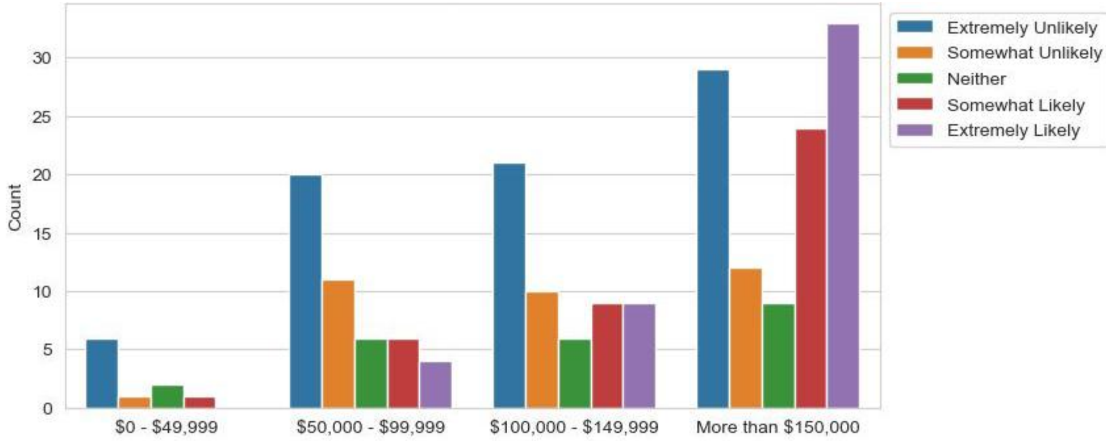
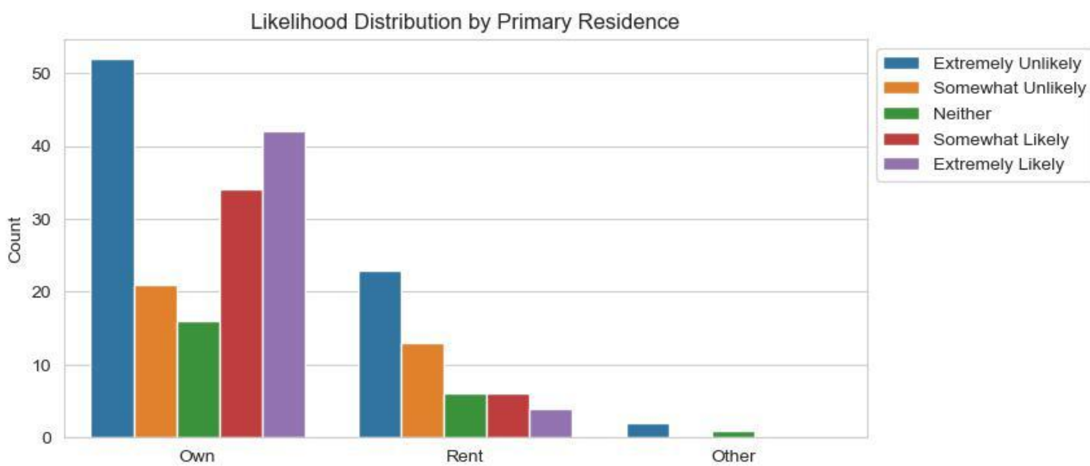


Note. The median likelihood for each group was: $0-$49,999 – extremely unlikely, $50,000-$99,999 – somewhat unlikely, $100,000-$149,999 – somewhat unlikely, and more than $150,000 – somewhat likely. There was low granularity for amounts over $150,000, suggesting that more income range options could have been included in the survey.

Figure 4

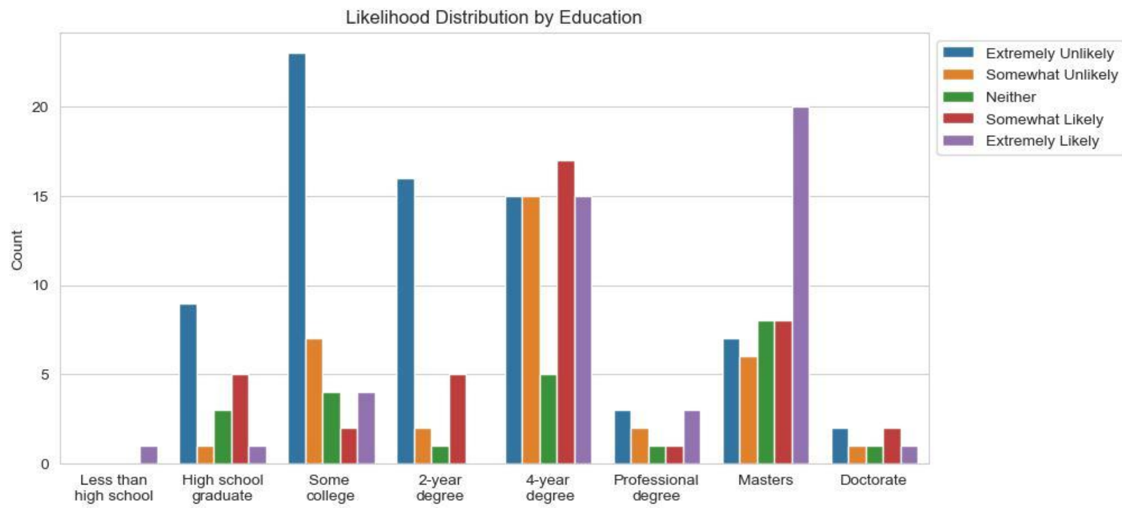
Likelihood distribution by primary residence



Note. The median likelihood for each group were: own – neither likely nor unlikely, rent – somewhat unlikely, other – extremely unlikely.

Figure 5

Likelihood distribution by education



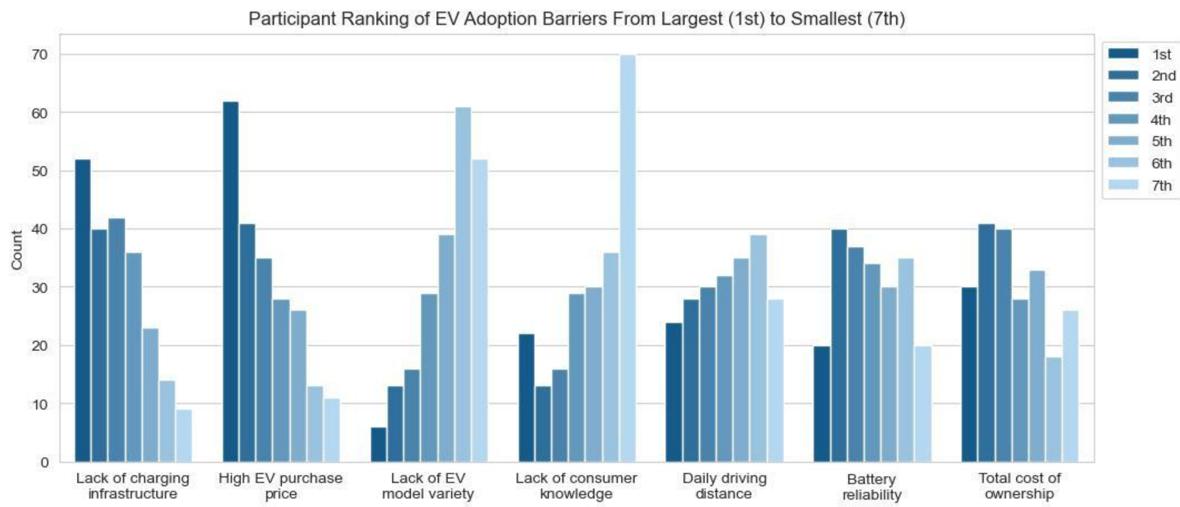
Note. shows the distribution of likelihood of purchasing an EV across different education levels. The median likelihood for each group was: less than high school* – extremely likely, high school graduate – somewhat unlikely, some college – extremely unlikely, 2-year degree – extremely unlikely, 4-year degree – neither likely nor unlikely, professional degree – somewhat unlikely, master's – somewhat likely, and doctorate – neither likely nor unlikely.

To further explore this relationship, the correlation coefficient was calculated between the likelihood of purchasing an EV and the demographic factors. This was done to quantify the strength of the relationship between these variables and determine whether individual characteristics influence the likelihood of an EV purchase. The signs of the coefficients for the demographic factors generally reflect the relationships observed in the survey data. For example, the age range had a coefficient of -0.150, and the highest level of education had a coefficient of 0.323, indicating the likelihood tending towards "likely" with younger ages and higher levels of education. However, all the coefficients were between -0.5 and 0.5, suggesting a weak or negligible correlation between the likelihood of purchasing an EV and the demographic factors (Turney, 2024). This suggests that individual characteristics, specifically demographics, do not significantly impact EV purchase likelihood. These findings are consistent with previous research on the influence of demographics on EV adoption, which found weak or indirect effects (Rezvani et al., 2014; Sierzchula et al., 2014).

According to the survey results, the external factors affecting EV adoption were high EV purchase prices and a lack of charging infrastructure. Survey participants were asked to rank specific barriers to EV adoption from largest (1) to smallest (7) and the count of each ranking for each barrier is shown in Figure 9. High EV purchase price and the lack of charging infrastructure were consistently ranked among the top 2 barriers, with high counts at rankings 1, 2, and 3. Other barriers with higher rankings included total cost of ownership and battery reliability, which had relatively high counts for rankings of 2, 3, and 4. Other studies examining the relationship between various factors and EV adoption also found that car or ownership costs, a lack of charging infrastructure, and reliability are influential (Carley et al., 2013; Liao et al., 2017; Sierzchula et al., 2014). This highlights the need to address high EV purchase prices and lack of charging infrastructure to increase EV adoption.

Figure 6

Participant ranking of EV adoption barriers from largest (1st) to smallest (7th)



Note. The median ranking for each barrier were 3, 3, 6, 5, 4, 4, and 3, respectively.

Decision tree classification model

A selection of survey variables was used in a decision tree classification model to predict whether someone was "somewhat" or "extremely" likely to purchase an EV. The question of whether someone currently owns an EV was intentionally left out because of the obvious correlation between owning one and purchasing another. The goal of the model was to determine whether a combination of variables was more effective at predicting the target outcome: the likelihood of purchasing an EV. These variables could be leveraged to improve EV adoption across the state.

While not all variables were classified as having high importance, the variables used in the model were: income range, whether someone owned or rented their primary residence, confidence level in the state having the infrastructure to support its 100% ZEV goal, how high someone thinks their energy bill might be if they charge an EV at home, sentiment toward the US phasing out gasoline-powered vehicles, rating of availability of EV models on the market, age range, highest level of education attained, awareness level of government incentive and longitude of respondent's zip code.

By adjusting the constraints to prevent overfitting and memorizing the data, ensuring splits are performed with enough data, and reducing variance by requiring leaves to have more samples, the model's accuracy is 87.5%. Table 1 details the classification report. It is slightly better at classifying Class 2 outcomes (likely) vs. Class 1 outcomes (unlikely). The confusion matrix for the decision tree model shows high prediction accuracy, with only 5 actual values misclassified. The most important features of the model are (in ranked order): sentiment toward the phasing out of gasoline-powered vehicles, bill expectations for at-home EV charging, primary residence (own or rent), and age.

Table 1

Decision tree model classification report

Score	precision	recall	f1-score	support
Class 1	0.84	0.89	0.86	18
Class 2	0.90	0.86	0.88	22
Accuracy			0.88	40
Macro avg	0.87	0.88	0.87	40
Weighted avg	0.88	0.88	0.88	40

Note. The full classification report shows the precision, recall and f1-score of the decision tree model. The model is slightly better at predicting class 2 (90%) than at predicting class 1 (84%).

The top four features could be applied to larger populations in specific contexts. The decision tree predicts whether someone will be likely to buy an EV based on their sentiment toward the phasing out of gasoline-powered vehicles, to be excited or neutral (phased_out < = 2.5), the individual being a homeowner (residence < = 1.5), and the assumption that one's bill might be on the lower side (bill < = 2.5). In contrast, the model predicts an unlikely response when sentiment toward phasing out of gasoline-power vehicles in negative (phased_out > 2.5), assumed bill increase is on the higher side (bill > 2.5), and they are older (age > 3.5).

What is the current capacity of charging stations in WA and what is the gap to where it needs to be to fulfill the 2035 goal of 100% passenger ZEV?

Two primary data sources were used in the calculations to address the issue of current charging infrastructure capacity and the growth needed to meet Washington's 100% ZEV goal by 2035. The first is an export of the National Renewable Energy Laboratory's database of alternative fuel stations. The export includes 2,904 stations and information about each, including latitude and longitude, connector types and counts, accessibility (public vs private), and many other variables. For this research project, the data have been filtered to include only stations not in "Planned" status, resulting in a final total of 2,785 stations analyzed.

To quantify "EV Deserts" in the state, additional data (Charger Types & Speeds, n.d.) was merged with this dataset. Some stations had multiple connector types, while others had connector types not listed in the specifications data source. Only stations with available specifications were analyzed.

EV Deserts

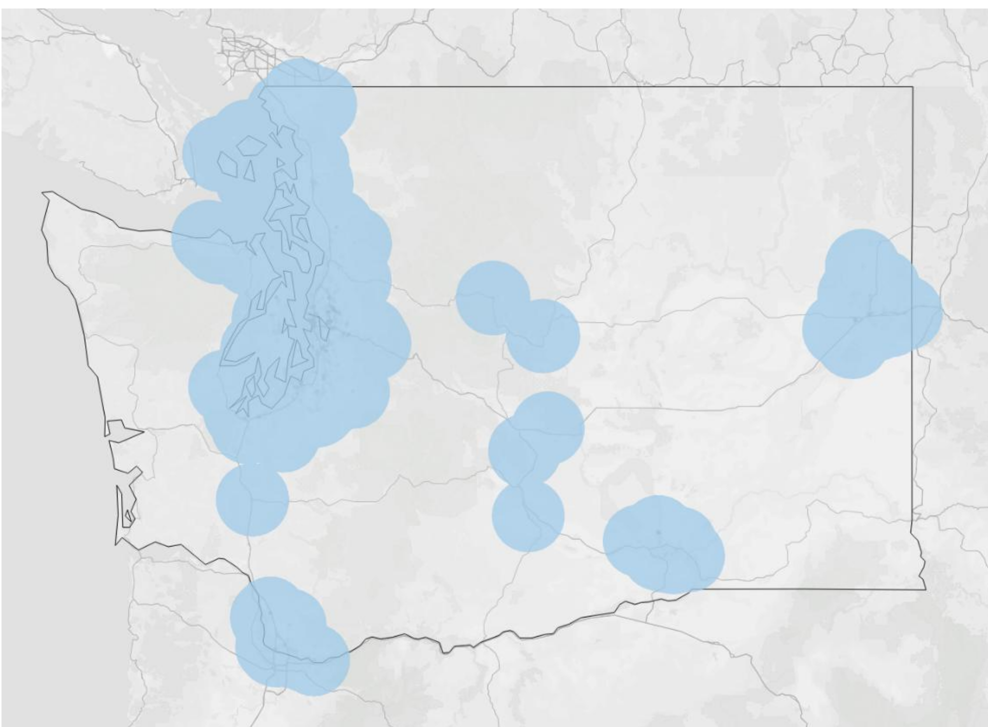
The survey results reveal challenges with the current EV charging infrastructure in Washington. Most notably, respondents cited simple availability, deficient or broken stations, and range anxiety (a lack of comfort driving longer distances due to poor station coverage).

Given the current infrastructure's limitations for the state's EV population, significant improvements are needed to sustain a fleet that's 24 times its current size. To help address infrastructure gaps, additional analysis of charging-station location data was conducted to understand the prevalence of "EV Deserts" in Washington. For this paper, "EV Deserts" are defined as areas with limited charging availability, including both connector specifications and quantities, as well as station count. More specifically, charging stations with fewer than 10 nearby stations were classified as "EV Deserts." In this case, "nearby" is defined as outside of the minimum driving range for the average EV after charging at that station for 60 minutes, but inside the maximum driving range after charging at that center station for 60 minutes. The station's maximum connector speed was used for this analysis. Stations with DC Fast Chargers, including CHAdeMO and Tesla chargers, are outliers in these results because it takes only 20 to 60 minutes to get a full charge on an EV using one of these connectors. Once fully charged, driving range varies by car make and model, but on average, EVs have a driving range of approximately 270 miles (Vehicle Technologies Office, 2024).

It was determined that 300 of the stations analyzed fit into this category and therefore represent an EV Desert in Washington. That does not include areas without any stations. In summary, approximately 11% of the level 2 charging stations have little to no continuity to the rest of the state's EV infrastructure. It should also be noted that this analysis was based on charging for 60 minutes. Filling up a gasoline-powered vehicle takes between 5 and 8 minutes, on average (GasBuddy, 2018).

Figure 7

EV charging continuity

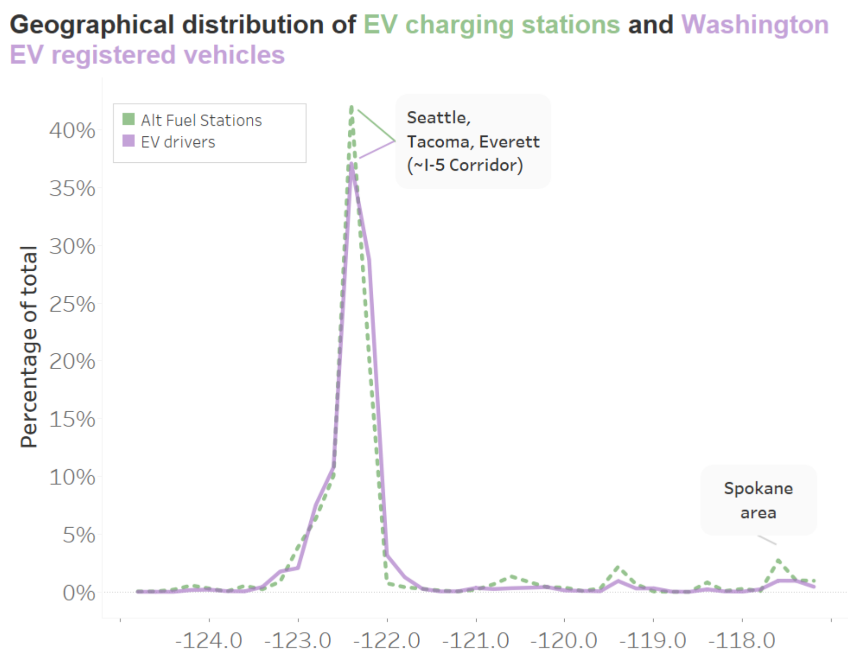


Note. Blue areas are regions of EV charging continuity for stations with at least one J1772 Level 2 charger. Therefore, the areas left blank on the map would be considered "EV Deserts" — where either no charging station exists or there is very limited availability and little continuity to other nearby charging stations. A conversion factor of x/1.3 was used to convert air miles to approximate driving miles (M. A. Diaz et al, 2003)

These areas of discontinuity are further emphasized by examining where along the longitudinal lines alternative-fuel charging stations exist and how that corresponds to where electric vehicles are registered (see Figure 8). The mirroring of these two distributions reveals the lack of infrastructure support for driving outside of the immediate area for EV owners.

Figure 8

Longitudinal distribution of charging stations and registered electric vehicles



Note. Longitude data for both charging stations and registered EVs in Washington were binned into equally distributed groups. The lines represent a percentage of the total for each measure.

Infrastructure demand

Tesla remains the most popular EV manufacturer in Washington state (see Figure 9), yet its presence in the public charging infrastructure remains limited. As the number of Tesla vehicles continues to grow, it will be essential for both the manufacturer and the state to invest in expanding accessible, non-proprietary charging infrastructure. Recent organizational changes at Tesla (Kirkham et al., 2024) underscore the risks of relying heavily on a single manufacturer for public EV charging access, further highlighting the need for diversified infrastructure solutions.

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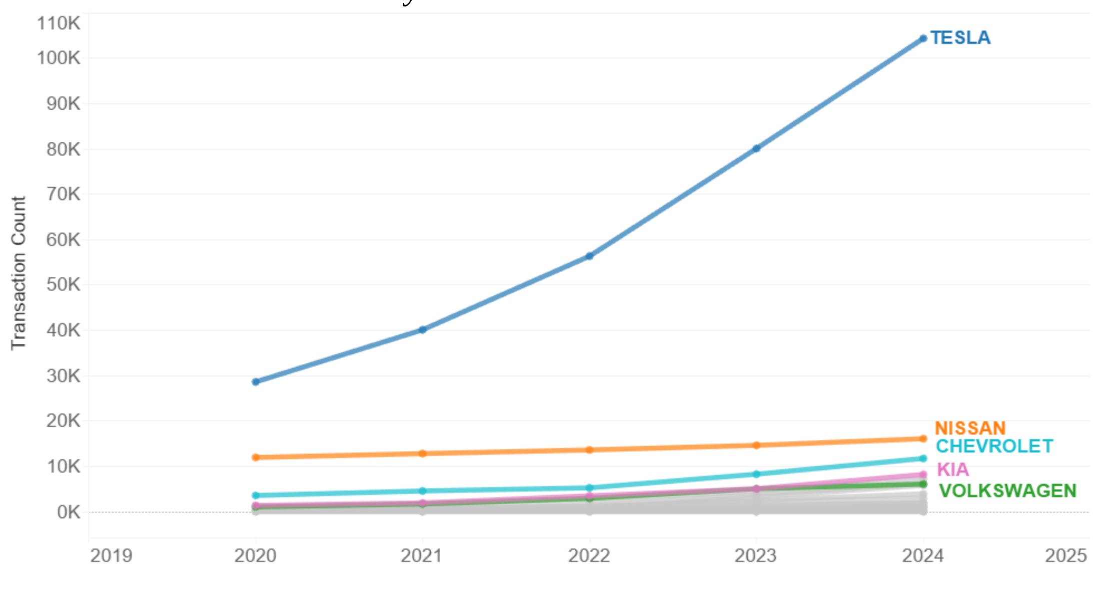
Figure 9

New and renewal transactions by car make



Note. This line chart displays electric vehicle registrations by make, focusing on the top five manufacturers. Tesla has experienced the most substantial growth in the past five years.

To assess current demand and future needs for EV charging infrastructure, Washington state vehicle registration data from 2019 to 2024 was analyzed. In 2024, electric vehicles accounted for 4.1% of all registration transactions. Since 2019, EV registrations have grown by an average of 20% annually. If this growth rate continues, EVs will not match the number of all vehicles on the road until approximately 2041, well beyond the state's 2035 goal. This estimate does not account for the slower decline of internal combustion engine (ICE) vehicles, which have decreased by only 5% per year. With over 2 million ICE vehicles currently registered, significant turnover will take time. Survey results also highlight strong support for targeted infrastructure expansion. Sixty-one percent of respondents preferred new charging stations along major highways, followed by workplace and shopping center locations (see Figure 10).

Figure 10

New charging infrastructure potential

	18 - 24 n = 3	25 - 34 n = 13	35 - 44 n = 23	45 - 54 n = 7	55 - 64 n = 1	65 - 74 n = 1
along major highways	2 67%	8 62%	12 52%	7 100%	1 100%	
near workplace	2 67%	7 54%	13 57%	4 57%		
near shopping centers	3 100%	7 54%	10 43%	4 57%	1 100%	
near downtown business districts	1 33%	7 54%	3 13%	5 71%	1 100%	
apartment complexes	1 33%					1 100%
public libraries					1 100%	

Note. The answer to the question "Where do you want to see charging stations built?" varied between age ranges, but not significantly. For this question, respondents could select up to 3 options or type in their own option (which are also reflected in the table). The number indicates how many people in that age group selected that option; the percentage is proportional to the total number of people in that age group who answered that question. This question was only asked of people who indicated they currently own an electric vehicle.

How do people feel about electric vehicles and related policies/legislation?

Three open-ended survey questions yielded 192 responses, from which seven key themes emerged: infrastructure, financial/economic concerns, environmental impact, product lifecycle, policies/regulations, behavioral factors, and emotional responses. Infrastructure and environmental concerns were most frequently mentioned, often accompanied by strong emotional reactions.

Question 15 responses (n = 116) emphasized infrastructure, environmental impact, and emotion. Emotional sentiment was present in 59% of responses, with 83% of those expressing negative views — primarily pessimism, resistance to change, and range anxiety.

Infrastructure concerns appeared in 48% of responses, focusing on the reliability, availability, and speed of charging stations, as well as limitations of the power grid. Environmental motivations were cited by 25%, though 16 respondents raised sustainability concerns, particularly about battery disposal and electricity sources. Financial concerns (19%) related to EV costs and equity issues. Policy-related feedback (15%) reflected support for more decisive government intervention through incentives and emissions regulation, though opinions were mixed on the best way to achieve climate goals. Additionally, some respondents indicated that electric vehicles do not adequately meet their transportation needs, particularly in terms of interior space and hauling capacity.

Question 26 reinforced these themes. Pessimism (30%) and resistance (23%) remained high, with respondents citing inadequate infrastructure and technology. Environmental awareness (21%) persisted, though often tempered by practical concerns. Infrastructure issues — charging access (15%), range anxiety (15%), broken stations (16%), and slow charging speeds (8%) — were frequently cited as barriers. Financial concerns (13%) focused on cost-effectiveness but also noted burdens from upfront expenses and home charging setup.

Question 32 responses largely mirrored Q15 and Q26, with high levels of pessimism (30%) and resistance to change (23%), especially around cost, infrastructure, and technological constraints. Calls for policy intervention (10%) continued, emphasizing affordability and adoption incentives.

Overall, the analysis indicates that while environmental motivations exist, EV adoption is significantly hindered by infrastructure deficits, financial barriers, and emotional skepticism — highlighting a need for policy action and system-wide improvements.

Recommendations and Conclusions

Policy Implications

This study underscores the need for enhanced policy interventions to support electric vehicle adoption. Addressing the cost barrier is paramount; revising existing trade policies — such as tariffs on imported EVs and batteries — may improve market competitiveness, expand model variety, and reduce prices (Magill, 2024; Workman, n.d.). Incentives should also target current EV owners, not solely first-time buyers. Long-term benefits — such as toll lane access regardless of carpool status — could reduce the total cost of ownership and encourage retention. Given widespread skepticism about Washington’s 100% ZEV target by 2035, a reassessment of the timeline or adoption percentage is warranted. Public resistance, particularly in regions with limited infrastructure, suggests significant groundwork is needed before such goals are achievable.

Environmental considerations

Respondents highlighted environmental concerns tied to both vehicle disposal and the EV lifecycle. Transitioning from internal combustion engine (ICE) vehicles necessitates structured buyback and recycling programs to recover critical materials and reduce landfill waste. Further, the sustainability of EVs is contingent on reducing environmental harm from battery production. This includes investing in battery recycling, reducing reliance on rare-earth materials, and supporting next-generation battery technologies. To fully realize EVs' environmental benefits, the charging infrastructure must also transition to renewable energy sources. Integrating solar, wind, and hydroelectric power, alongside grid-scale storage solutions, is critical for reducing reliance on fossil fuels and ensuring consistent, clean energy delivery. Finally, strengthening grid resilience is essential as electricity demand rises. Upgrading the power grid, supporting decentralized energy solutions (e.g., home solar and battery storage), and enhancing demand-response systems will be vital to supporting widespread EV use without overloading current infrastructure. A transitional strategy should also address non-EV emissions. Policies promoting fuel efficiency, cleaner fuels, and carbon offsets for ICE and hybrid vehicles can ensure environmental progress before full electrification.

Technological improvements

Key technological advancements are necessary to support broader EV adoption. Expanding and standardizing charging infrastructure — particularly along major transit routes — will alleviate range anxiety and improve the feasibility of long-distance travel. Mobile applications that integrate data from all major charging networks can further help drivers locate available charging stations. Manufacturers should develop EVs with greater power, durability, and utility to expand market appeal for industries and off-road applications. Enhanced battery insulation and temperature control are also needed to ensure reliability in extreme climates. Improving charging station security is another critical concern. Implementing tamper-resistant designs, remote monitoring, and vandalism deterrents will help maintain consistent access and reduce service disruptions. Together, these policies, environmental, and technological strategies can collectively address the barriers identified in this study and support a more sustainable and accessible EV ecosystem.

Limitations and Future Work

This study, while informative, was limited by its reliance on convenience sampling, which may affect the generalizability of its findings. The demographic distribution of respondents suggests that the sample may not accurately represent the broader population. It is therefore crucial for future research to consider a more systematic and stratified approach to survey distribution. This will ensure a more accurate and comprehensive understanding of the factors influencing EV adoption across different regions and accessibility levels. The qualitative analysis was conducted manually, introducing potential subjectivity and interpretation bias. Employing automated sentiment analysis tools or inter-rater reliability measures in future studies could enhance the consistency and objectivity of qualitative data interpretation.

Despite these limitations, the analysis offers meaningful insights into the barriers to EV adoption in Washington state. The resulting recommendations serve as a foundation for future policy and program development. These recommendations, when refined through feasibility studies and stakeholder engagement, will not only ensure alignment with state infrastructure capacity and consumer behavior patterns but also enhance their practicality and effectiveness. Implementation will require significant financial investment over the next decade, likely supported by federal funding, public-private partnerships, and targeted state initiatives. A phased strategy — incorporating near-term incentive adjustments, medium-term infrastructure development, and long-term regulatory reforms — will be critical to ensuring a sustainable and equitable transition to electric vehicles in Washington. This approach provides a clear roadmap for the future and instills confidence in the management of the transition.

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