Driving Change: Accelerating the Electric Vehicle Adoption Curve

Evolve Houston

August 15, 2025

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1. Introduction

Evolve is a nonprofit organization dedicated to improving air quality and reducing greenhouse gas emissions by increasing the adoption of electric vehicles in the Greater Houston area. This goal is important because, according to data from the US Department of Energy, the transportation sector is the largest source of greenhouse gas emissions in the United States. Gas vehicles in Texas produced, on average, 223 million metric tons of carbon dioxide (CO_2) in 2023. These emissions have significant public health and environmental impacts.

Houston ranks ninth on the list of 25 cities with the worst air quality, according to the American Lung Association. A University of Houston study found that exposure to PM2.5 was significantly correlated with increased cardiovascular and respiratory health outcomes, particularly at elevated concentrations in Harris County (Khalil et al., 2025). Additionally, scientists predict rising temperatures will lead to more frequent and extreme precipitation and heat events in the area (Greater Houston Community Foundation, 2025). These impacts motivate stakeholders, including Evolve, to seek strategies to reduce emissions.

In order to support Evolve's mission, the goals of this project are a) to investigate how Houston's demographic diversity influences electric vehicle adoption compared to overall trends and similar cities, and b) to propose strategies to increase adoption and measure Evolve's impact.

2. Approach/Methods

2.1 Literature Review

We conducted a literature review to identify the most critical determinants of electric vehicle adoption. These include demographics, income, education, and housing. Additionally, we identified adoption barriers and how they vary across communities based on access to infrastructure, political affiliation, weather, and the policies implemented to support electric vehicle adoption.

2.2 Case Studies

Four peer cities were analyzed to understand their approaches and to extract key takeaways for Houston. The peer cities are Austin, Charlotte, Los Angeles, and New York City. Austin and Charlotte were selected because of the observed strong growth in EV adoption over the past few years. Los Angeles and New York were primarily chosen because they, like Houston, are populous port cities with diverse populations. These four cities have implemented a range of policies, incentives, and mandates aimed at electrifying transportation.

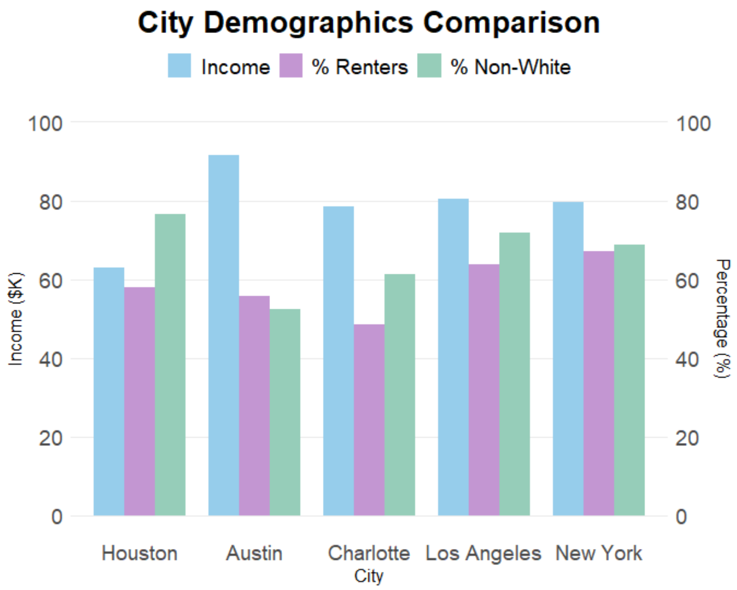

Figure 2.1 Key demographics by city

2.3 Regression Analysis

We used a regression analysis to pinpoint Houston ZIP codes with the greatest potential for EV adoption growth. Our approach compared predicted EV adoption rates with actual adoption to identify gaps that suggest untapped potential. Building on an existing regression study by Soltani-Sobh et al. (2015), we applied their state-level model to Houston ZIP codes. Their regression correlates EV market share (the proportion of total new vehicle registrations that are EV) with factors like income, vehicle miles traveled, and energy prices. We gathered the most granular data available, using ZIP-code and county-level statistics whenever possible.

While applying a state-level regression to ZIP-code data produces extreme values that should not be taken literally, the results effectively categorize areas into high and low adoption potential zones. The discrepancies between predicted and actual adoption rates will then be used to highlight where targeted initiatives could have the most significant impact. By examining the features of high-potential, low-performing areas, we can identify the specific adoption barriers they face. Drawing on the findings of our literature review, we can then develop targeted strategies to address these barriers.

Additional information on the regression can be found in the appendix.

3. Literature Review

3.1 Introduction

Widespread adoption of electric vehicles brings not only significant environmental and public health benefits but also supports local economic development. According to the

Electrification Coalition (2021), cities that implement strong vehicle electrification policies experience reductions in greenhouse gas emissions, along with gains in public health, transportation affordability, and social equity. These policies also stimulate job creation, particularly in clean energy, construction, and maintenance sectors. Reflecting this trend, cities worldwide are integrating the electrification of electric vehicle fleets into their long-term sustainability and urban development strategies (Jimenez et al. 2023). This global shift demonstrates that electric vehicles can play a crucial role in both combating climate change and promoting community development.

However, the adoption rates of electric cars vary widely across regions and demographics. Understanding these variations is essential for developing cost-effective policies that can accelerate the adoption of electric vehicles. The literature review synthesizes findings from academic and applied research to address the following questions:

- What is an electric vehicle adoption curve?
- What are the main determinants of electric vehicle adoption?
- How do cities use these insights to set practical and equitable adoption targets?

This report synthesizes the main findings of prior literature reviews that have examined studies on the adoption of electric vehicles from around the world. The reviews were selected based on their high citation rates, broad scope, and rigorous selection process. Additionally, this report examines empirical and survey-based studies conducted in regions that share key characteristics with the cities selected for the accompanying case studies. A study from Norway, a leader in electric vehicle adoption, is included to understand how these determinants compare across countries at different stages.

The literature consistently highlights demographic, economic, infrastructure, and behavioral factors as the most significant determinants of electric vehicle adoption, with upfront costs being the factor that most negatively impacts the adoption of electric cars.

3.2 What is an electric vehicle adoption curve?

An electric vehicle (EV) adoption curve illustrates the rate at which EVs are adopted within a population over time, typically following an S-shaped trajectory. This pattern aligns with the diffusion of innovation theory, which categorizes adopters into five groups: innovators, early adopters, the early majority, the late majority, and laggards, based on their willingness and speed to adopt new technologies (Rogers, 1962).

The 'S-shaped trajectory' of the curve signifies the initial slow adoption phase, the rapid acceleration phase, and the eventual saturation phase. In the early phase of the curve, adoption is slow, driven by innovators and early adopters. As awareness, infrastructure, and social acceptance grow, adoption accelerates rapidly once it reaches a tipping point (Lutsey et al., 2021). At this tipping point, the perceived costs and risks of the technology diminish, leading to broader societal acceptance (Speelman et al., 2022). Understanding these groups is crucial for policymakers, as it enables them to determine when and how to intervene to support the broader adoption of electric vehicles.

3.3 What are the primary determinants of electric vehicle adoption?

The determinants of electric vehicle adoption can be categorized into demographic, economic, infrastructure-related, and behavioral factors. A study conducted in Norway finds that age, education, and income are the most important determinants predicting EV adoption (Simsekoglu, 2018). Supporting this, a survey of Tesla owners in four Texas cities, including Houston, found significant variation in EV adoption across demographic groups. Clusters with high EV registration were associated with high-income, highly educated communities where residents tend to own multiple vehicles and are predominantly white, underscoring the strong relationship between demographics and adoption rates (Choi et al., 2024).

Rahman et al. (2024) conducted a comprehensive review of 127 articles. They concluded that, aside from demographic determinants such as age and income, a lack of charging infrastructure, long charging times, and limited consumer knowledge hinder the adoption of electric vehicles. On the positive side, their review identified environmental concern, perceptions of EVs as dependable, and long-term cost savings as commonly cited motivators.

Similarly, Machado et al. (2023) reviewed 124 global studies published between 2016 and 2020. They found that the purchasing price, risks associated with the market's infancy, and range anxiety due to a lack of charging infrastructure were the most commonly identified determinants hindering adoption. Maybury et al. (2022) reviewed 53 articles. Similarly, they concluded that the lack of successful business models, the need for costly charging infrastructure, and high upfront costs for consumers most directly impact EV adoption.

Javadnejad et al. (2023) focused their literature review on the U.S., highlighting upfront costs, battery replacement expenses, limited vehicle model options, and range anxiety as key obstacles to the broader adoption of electric vehicles. Survey-based studies reinforce these findings. For instance, Pamidimukkala et al. (2024) found that high purchase prices, expensive battery replacements, and insufficient public charging infrastructure were the top concerns among respondents in Texas. The Hobby School's 2023 Texas Trends survey found performance as the most significant attribute when purchasing or leasing, followed by charging capabilities and cost compared to gas vehicles. Similarly, a survey by Adepetu et al. (2015) in Los Angeles found that the cost of EVs posed a greater barrier to adoption than concerns about driving range.

Taken together, these studies reveal that a combination of demographic characteristics and practical obstacles influences the rate and distribution of electric vehicle adoption, with upfront costs being the most significant determinant of adoption rates. A lack of charging infrastructure and a lack of consumer knowledge are barriers that impact people differently based on their income, race, and zip code. Studying their impact is key to the development of equitable electric vehicle adoption initiatives. The following table summarizes the most common determinants identified across these studies.

Type	Determinants of Electric Vehicle Adoption
Demographic	Age, education, race, and zip code (urban/suburban/rural)
Economic	income, **upfront costs**, maintenance costs, and savings associated with electric vehicles.
Infrastructure	range anxiety, long charging times, and a lack of charging infrastructure.
Behavioral	lack of consumer knowledge of EV technology, perceived risk due to the market's infancy, environmental concerns, limited model diversity, and people's view of EVs as dependable

3.4 How do states and cities use the adoption curve and electric vehicle adoption indicators to define targets?

States and cities use the diffusion of innovation theory as part of a strategic framework to inform their interventions and establish realistic, impactful targets. States and cities refine their targets and tailor interventions by analyzing key indicators of electric vehicle adoption, including registration rates, charger availability, fleet composition, energy usage patterns, and market share (Pietrobelli et al. 2023). These indicators help determine where a population stands on the adoption curve and identify localized barriers to adoption.

States and cities often develop their goals and initiatives in alignment with broader national and state-level mandates. They also draw guidance from international and national alliances, such as the Zero-Emission Vehicle Alliance and the United States Climate Alliance. However, they implement localized strategies that reflect their unique circumstances and limitations. Most jurisdictions that have set quantitative goals for electric vehicle adoption aim to have 100% of all new vehicle sales be electric vehicle sales by 2035 (International Council on Clean Transportation, 2025). Additionally, states and cities develop programs directly tied to the identified barriers. For instance, California's *Clean Cars 4 All* helps low-income individuals afford electric vehicles. New York's *Charge Ready NY 2.0* prioritizes charger installations in underserved areas. Additionally, *Austin Energy* in Austin, Texas, and *Duke Energy* in Charlotte, North Carolina, run EV test-drive programs to boost awareness and trust in EV technology.

States and cities are increasingly able to define measurable, equity-focused targets for EV adoption and infrastructure by combining the conceptual roadmap of the adoption curve with real-world indicators and predictive modeling. This approach enables cities to establish data-driven goals and allocate resources more precisely. Table 2 below summarizes the goals established by the states where our case study cities are located.

State(s)	Description	Goal Date
California, New York	100% of new light- and medium-duty vehicles sold must be ZEVs	2035
North Carolina	1,250,000 ZEVs by 2030; 50% new sales ZEVs	2030

Table 2. States with Zero Emissions Vehicle Adoption Targets. States selected for the case studies that accompany this literature review. Adapted from the article "Which States Have Zero-Emission Vehicle Mandates?" published in 2024 by Lauren Fletcher on worktruckonline.com

3.5 Literature Review Conclusion

Electric vehicle adoption is a multifaceted process influenced by demographic, economic, infrastructure-related, and behavioral determinants. This literature review reveals that environmental benefits and long-term cost savings are strong motivators for the adoption of electric vehicles. Nonetheless, persistent barriers, including high upfront costs, inadequate charging infrastructure, and limited public awareness, continue to hinder widespread adoption. The adoption curve, rooted in Diffusion of Innovation theory, offers a valuable framework for understanding how EV uptake evolves and which types of interventions can accelerate it.

Cities and states are increasingly using a combination of adoption indicators and the EV adoption curve to guide their policymaking. Many are setting ambitious yet achievable targets, often aiming for the complete electrification of new vehicle sales by 2035. However, the literature also reveals that adoption is uneven and frequently skewed by determinants such as income, race, and geography. To ensure equitable outcomes, successful policy strategies must be both data-driven and tailored to address the specific needs of underserved communities.

As governments work to meet zero-emission targets, the integration of predictive modeling, localized indicators, and equity-focused interventions will be critical. Understanding not only how adoption occurs but also which populations require additional support in transitioning to electric vehicles will ensure the maximum environmental, economic, and social benefits from electric vehicles.

4. Main Findings from City Case Studies

After conducting a broad literature review, the team produced city-specific case studies. These case studies focused on strategies and actions. Cities that have successfully accelerated electric vehicle adoption in their jurisdictions share the following strategic approaches:

1. They publish data-driven goals, detailed action plans, and maintain robust data tracking systems to examine progress toward goals.

2. They establish policies to enhance coordination and collaboration among all levels of government, as well as constituents, public and private institutions, interest groups, and businesses.
3. They offer targeted financial incentives that cover the upfront costs of purchasing an electric vehicle and a charging station.
4. They fund public charging infrastructure projects.
5. They fund equity initiatives targeting communities with low levels of electric vehicle adoption.
6. They ensure public education campaigns are part of their overall strategy, keeping the public informed and aware of the benefits of electric vehicles and the charging infrastructure available.
7. They electrify their fleets.

5. Hypotheses derived from Literature Review and Case Studies

5.1 Income Hypothesis

If Houston neighborhoods have higher median household incomes, then they will demonstrate significantly higher electric vehicle adoption rates.

5.2 Infrastructure Hypothesis

If Houston ZIP codes have greater access to public charging infrastructure (measured by charging stations per capita), then they are likely to exhibit increased EV adoption rates.

5.3 Equity Hypothesis

If Houston provides financial incentives and charging solutions to neighborhoods with lower income and higher percentages of renters, then these areas will achieve EV adoption rates comparable to those in higher-income, homeowner neighborhoods.

6. Regression Analysis

6.1 Existing Regression

Regression analysis was used to get a quantifiable idea of how factors impact EV adoption. Using an existing regression from a 2015 paper by Soltani-Sobh et al., the coefficients were applied to Houston to get an estimate of EV share (the percent of all newly registered vehicles which are BEV or PHEV). Using US Census and other data, the paper's variables and coefficients were applied to Houston ZIP codes to estimate EV share. This is a broad, state-level regression which we applied to ZIP codes. While this broad regression provides useful regional predictions, the extreme predicted values (ranging from near 0% to almost 100%) suggest the need for a more Houston-specific model that better captures local factors influencing EV adoption.

6.2 Custom Regression

Building on this existing regression, we used EV share (same meaning as above) data provided by Evolve Houston to create a new regression. Based on our analysis, the following ZIP code-level variables were analyzed and found to have significant effects:

Factor	Effect
Median income	Positive
Population density (people per square mile)	Positive
Public charging stations per 1,000 people	Positive
Public charging ports per 1,000 people	Negative
Proportion of housing units which are renter-occupied	Positive
Proportion of people with a Bachelor's degree or higher	Strong positive

Key Takeaways:

- Income, population density, and educational attainment correlate positively with EV adoption.
- Counterintuitively, charging infrastructure showed a near-zero average net effect despite a hypothesis of positive prediction; this may be due to the prevalence of home charging, the simple method used to measure infrastructure, and proportionally more rural infrastructure.
- The renter proportion's unexpected positive influence may be linked to correlation with other positive factors like population density, despite expectations of a negative effect due to home charging barriers for renters.

6.3 ZIP Code Targeting

For optimized EV initiative success, geographic targeting is crucial. Our custom regression allows for such targeting by comparing predicted EV share to actual share. Below in green are the ZIP codes for which the regression's predicted EV share is higher than actual share. We believe these areas are ideal for targeting as they have high potential for adoption. Thus, the marginal benefit for these areas is expected to be higher than most.

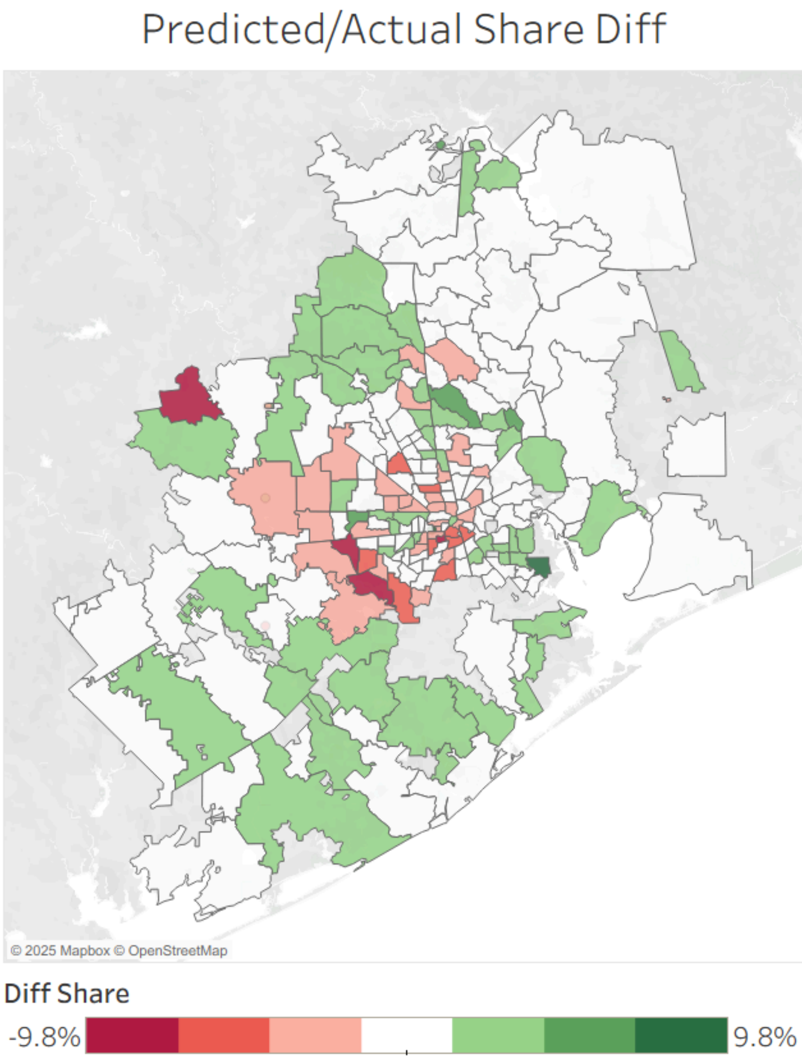

Figure 6.1 Difference in predicted and actual EV share

7. Incentive Recommendation

We propose targeted use of electric vehicle rebates aimed at Houstonians who own older gas-powered passenger vehicles. These residents may typically be lower income, and therefore most acutely experience price as a barrier to EV adoption. In line with Evolve Houston's mission to reduce greenhouse gas (GHG) emissions in the Greater Houston Area, we draw on the Replace Your Ride and the larger Clean Cars 4 All (CC4A) rebate programs from Los Angeles. The CC4A program offers grants (of up to $12,000) for residents to retire their older passenger vehicle for a Plug-in hybrid vehicle (PHEV) or a battery electric vehicle (BEV). Eligibility depends on income, and grants are higher for residents of disadvantaged community census tracts. As shown below, EV incentives can be a cost-effective tool for reducing CO_2 emissions compared to carbon capture.

<u>7.1 Program Funding</u>

The program will be funded through a public-private partnership model, which leverages the cost-effective nature of EV adoption for carbon dioxide reduction. Thus, our primary funding strategy targets climate-conscious businesses and corporations seeking to meet carbon reduction goals or corporate sustainability commitments.

7.2 BEV Manufacturing Impact

Electric vehicles indeed have a larger carbon footprint in the production phase than internal combustion engine vehicles. Thus, vehicles must reach a carbon break-even point to have a net negative carbon impact. For this reason, the proposed policy is for the adoption of used electric vehicles. This ensures that the lifetime of these used vehicles is extended, which increases their total CO_2 emission reduction.

7.3 Estimated Benefits and Costs

We draw on funding and outcome figures from the CC4A program to estimate costs and benefits for potential implementation in Houston. We assume a conservative rebate of $1,000:

CC4A Figure	Amount
Total Investment	$189 million
Vehicles replaced	21,900
CO_2 Reduction	98,700 metric tons
NOx Reduction	211.1 metric tons
Average cost/vehicle	$8,630
Average CO_2 reduction/vehicle	4.51 metric tons
Average NOx reduction/vehicle	0.01 metric tons

Eligible households: Our regression highlighted 32 Greater Houston ZIP codes with high potential for EV adoption growth. These ZIP codes are the target of this incentive:

CC4A Figure	Amount
Target ZIP codes population	803,414
Average household size in Houston	3.19
Estimated households in target area	251,854
Estimated households with vehicle	238,002
Estimated vehicles >15 years old	71,401

Uptake and Costs & Benefits: Assuming similar uptake rates to the CC4A program, we outline 3 uptake scenarios. Benefits are then estimated using Environmental Protection Agency (EPA) estimates assuming a 2% discount rate and emissions in 2030. We show that at the $1,000 rebate, the program is cost effective in terms of carbon dioxide reduction alone.

	Low Uptake	Moderate Uptake	High Uptake
Uptake rate	1%	2%	3%
Vehicles replaced	714	1,428	2,142
Estimated cost ($1,000 rebate)	$714k	$1,428k	$2,142k
CO_2 reduction in metric tons	3,217.9	6,435.8	9,653.7
NOx reduction in metric tons	6.88	13.76	20.65
EPA benefit	$701.8k	$1,403.5k	$2,106.3k
Net benefit	$640k	$1,280k	$1,920k
Net benefit/vehicle	$896	$896	$896

Additional externalities may be realized from other pollutant reduction and decreased fuel costs. These additional benefits could justify a higher rebate amount. The EV awareness survey could also inform the rebate amount based on predicted behavior change.

8. EV Awareness Survey

8.1 Purpose

We propose Evolve Houston implement a survey to gauge Greater Houston area residents' understanding of electric vehicles. Additionally, the survey can help determine an incentive amount which will optimize impact per dollar.

8.2 Layout

The survey will gather basic demographic, vehicle ownership, and EV perception information. Likelihood for EV adoption with and without rebates is also included to get an idea of rebate effectiveness.

Demographics
- Age
- ZIP code

- Race
- Household income

Transportation
- Car ownership
- Commute time
- Commute method

Personal EV Questions
- Current EV ownership status
- EV purchase likelihood
- EV purchase likelihood with $1k, $4k rebates
- Reasons for EV consideration
- Concerns about EV ownership

EV Knowledge
- EV Driving Range
- EV Charging Average Time
- Charging Options
- Charging Costs

9. Conclusion

The research shows that a combination of demographic, economic, and infrastructure factors shapes EV adoption in Houston. High upfront costs and limited access to reliable charging stations remain two of the most significant barriers for residents considering an electric vehicle. The literature review and case studies of Austin, Charlotte, Los Angeles, and New York City determined how cities that have successfully accelerated EV adoption rely on a combination of financial incentives, strategic infrastructure investments, and targeted community outreach. The most effective approaches also make a point to ensure that low-income communities are not left behind in the transition to clean transportation.

The regression analysis provided insights into where Houston's efforts can be most effective. By applying this model to ZIP-level data, we identified specific areas in Houston with high potential for EV adoption but currently low participation rates. These neighborhoods represent clear opportunities to target resources and policy interventions to accelerate EV acceptance in a way that is both strategic and equitable.

Based on these findings, several recommendations are proposed for Evolve Houston. Introducing a used EV rebate program modeled after Los Angeles' Replace Your Ride policy can help address affordability concerns among lower-income residents while supporting the region's broader emissions reduction goals. Policy efforts and outreach strategies should be tailored to the specific characteristics of each neighborhood. In communities with higher rates of homeownership, efforts can focus on new construction partnerships. In areas with large renter populations, it will be essential to work with property owners and multifamily housing developers to expand access to shared charging infrastructure.

Our proposal to Evolve concludes with a ready-to-implement EV Public Awareness Survey designed for deployment across the Greater Houston area. The survey will gather simple, measurable data on residents' knowledge, perceptions, and concerns regarding electric vehicles. It will also collect demographic information, such as age, race, income, and ZIP code, to help Evolve identify which groups require additional outreach or support. These results can then be used to develop EV Awareness Personas that reflect the diverse needs and experiences of different communities. This approach will help guide future education efforts and ensure that all residents, regardless of income or background, have access to the information and resources they need to transition to electric vehicles.

Appendix

Main Case Study Findings

City	Motivation	Strategies	Actions	Featured Approaches
Austin	Reduce emissions and improve air quality.	1- City-level policies, despite limited state-level incentives. 2- Ensure EV ownership is culturally, geographically, and economically diverse. 3- Invest in infrastructure. 4- Increase community engagement.	1- Invest in EV infrastructure 2- Ensure EV access is equitable across communities 3- Educate low-income areas. 4- Electrify the city fleet 5- Offer rebate incentives	Austin takes an aggressive, equity-focused approach to EV adoption by expanding charging access, offering incentives, and promoting EV education, while combining public programs with private investment to ensure EV benefits reach all communities.
Charlotte	Reduce transportation emissions	1- Develop detailed policy frameworks. 2- Establish electrification mandates. 3- Provide funding for projects. 4- Track progress toward goals. 5- Reduce upfront costs.	1- Electrify the city fleet. 2- Build public charging stations. 3- Fund equity initiatives. 4- Fund public awareness campaigns. 5- Provide incentives and rebates.	The utility and energy provider, Duke Energy, provides substantial financial incentives to install charging stations, including for renters and developers.
Los Angeles	Reduce air pollution and expand clean transportation options	1- Follow statewide mandates. 2- Enforce local regulations. 3- Create infrastructure goals. 4- Focus on equity and accessibility. 5- Public-private collaboration.	1- Expand charging infrastructure. 2- Offer financial incentives. 3- Create community engagement. 4- Electrify the public fleet.	The City of Los Angeles collaborates with local groups, hosts EV test drive events, and collects feedback. They shared information in different languages, trained EV owners to discuss their experiences, and installed chargers in convenient locations.
New York	Mitigate the effects of climate change and reduce air pollution	1- Complement Federal and State incentives by focusing on infrastructure development 2- Establish electrification mandates 3- Track progress toward goals 4- Public-private collaboration	1- EV charger mandates for parking 2- Zero-emission rideshare requirements 3- EV maintenance and repair training	New York City's unique density and multi-modal transportation system make infrastructure particularly important. NYC's approach shows that city-level efforts should complement state and federal policies

Case Study | Electric Vehicle Adoption in Austin, Texas

1 What Motivates Austin's Electric Vehicle Adoption Strategies?

The City of Austin is one of the fastest-growing metropolitan areas in the country, boasting a diverse and multicultural demographic. As of 2025, Austin boasts the highest EV adoption rate in Texas, primarily driven by the innovative tech industry and the city's progressive culture.

On the city level, Austin has implemented several EV-friendly policies designed to encourage adoption both privately and publicly. Rebate programs, fleet electrification projects, and initiatives focused on improving EV equity comprise the city's "Climate Equity Plan," an ambitious goal of reaching net-zero greenhouse gas emissions by 2040. Austin has identified transportation as the primary source of local air pollution within the city, prompting comprehensive action geared towards present and future EV adoption.

Austin's climate equity plan serves as the city's primary motivation in terms of encouraging electric vehicle adoption. According to the city government's climate equity plan, greenhouse gas emissions in Austin have peaked and are trending downward; however, they still fall short of current scientific recommendations to avoid long-term, disastrous climate impacts. Historically, Austin recognizes that public benefits from social initiatives have been distributed inequitably due to a history of segregation, redlining, and racial injustice. The city believes addressing this historical injustice through programs designed and implemented for low-income communities and communities of color is a pivotal and necessary step in Austin's fight for clean energy.

2 Why study EV adoption in Austin?

Austin makes for a natural comparison choice regarding EV adoption with Houston due to the shared political climate and state-level incentives unique to Texas. Studying Austin enables us to identify disparities between EV adoption barriers specific to Houston and those unique to Texas.

Unsurprisingly, Austin is leading the charge in EV adoption within Texas, with Austin and Travis County holding the highest EV adoption rates in the state by a considerable margin. According to TxDMV Data, Travis County has an EV registration rate of 2.12%, compared to Harris County's rate of 0.58% (Bernier, 2023). Understanding this disparity in EV adoption rates gives us a clearer potential framework of factors to drive EV accessibility within Houston, ultimately making Austin a suitable candidate for comparison.

Texas County	EV Adoption Rate (% of total registered cars)
Travis	2.12%
Williamson	1.54%
Hays	0.81%
Bexar	0.75%
Dallas	0.75%
Tarrant	0.59%
Harris	0.58%

2.1 Demographics

Austin currently features a quickly growing population of 967,862 (Census, 2023). Compared to Houston, Austin retains a higher median income, a more educated population, a lower median age, a thriving tech industry, and optimal climate conditions for EV adoption. The cultural environment within the city makes it a unique hub for EV innovation, particularly within the otherwise conservative political climate in Texas.

Beyond political and socioeconomic factors, Austin and Houston share several comparable characteristics relevant to EV adoption, including similar population growth rates, a significant renter population, high levels of car dependency, and extensive urban sprawl patterns. (Census, 2023)

Attribute	Measured by	Houston Metro	Austin Metro
Per Capita Income	2023 U.S. dollars	$41,142	$59,427
Population Growth	% Change from 2020 to 2024	3.9%	3.3%
Car Dependency	Cars per household	1.8	2
Urban Sprawl	Travel time to work	27 minutes	25.4 minutes
Minority-Majority City	Percentage of non-white residents	72.6%	52.40%
Renter Population	Percentage of the total population	45.2%	55.60%

3 Barriers to EV adoption in Austin

Like Houston, range, income, inaccessibility, and inequity are a few of the primary barriers to adoption in Austin. Charging stations are overwhelmingly concentrated in downtown Central Austin, leading to infrastructure challenges for the city's significant suburban population. Underserved communities are particularly affected by a lack of EV infrastructure, due to income and housing restraints that can make personal charging challenging.

A study by Choi & Jiao (2023) found EV registration was overly concentrated in areas that were predominantly white, with higher incomes and levels of education, with other factors such as residential choices (i.e., mobile homes) leading to geographical divides and social inequity regarding EV adoption.

4 Strategies to Accelerate Electric Vehicle Adoption

Despite Texas not having a significant amount of incentive regarding personal or public EV investment at the state level, Austin stands as an outlier in Texas in its EV policy leadership at the city level. EV incentives such as home charging rebates and vehicle credits encourage personal EV ownership, while the city has taken an aggressive approach to citywide clean energy investment.

4.1 Policy Framework:

City of Austin

- Austin's aforementioned Climate Equity Plan is a comprehensive plan including goals to achieve 40% of vehicle miles traveled electrified by 2030, install 37,000+ charging ports, and establish net-zero community emissions by 2040. It was adopted in September 2021 and emphasizes equitable access to EV infrastructure, ensuring "EV ownership IS culturally, geographically, and economically diverse." (City of Austin, 2021)

- Austin's Fleet Mobility Initiative aims to electrify the city's vehicle fleet with a target of nearly 1,000 battery electric vehicles by 2030, representing 300% growth from current levels. Austin currently operates 373 battery electric vehicles, logging 1.8 million miles annually and generating $2.5 million in fuel and maintenance savings. (De Figueiredo, 2025)

State of Texas

- Despite a lack of comprehensive state-level support regarding EV adoption, federal tax credit eligibility remains available within Texas, with Austin benefiting from its large share of state-wide EVs. Austin accounts for 19.53% of all Texas EVs despite a significantly smaller population share than Dallas-Fort Worth or Houston metros (DFW Clean Cities, 2025).

4.2 Community Engagement Initiatives

Austin Energy's publicly funded "EVs for Schools" program exemplifies quality public outreach regarding EV engagement. The program serves as a bridge between EV education and tangible infrastructure, installing charging stations at over 150 schools in central Texas while incorporating green energy education into curricula. This initiative, in particular, focuses on underdeveloped areas as a means of tackling the aforementioned equity concerns.

4.3 Electric Vehicle Adoption and Charging Infrastructure Initiatives

Public and Nonprofit Initiatives

Source of funding	Program name	Description	Effective Year
City of Austin	Fleet Mobility Initiative	Program to electrify city vehicle fleet targeting nearly 1,000 BEVs by 2030. Currently operates 373 BEVs.	2020
Austin Energy	Plug-In Austin Electric Vehicles	Comprehensive EV program offering rebates up to $1,200 for home chargers and up to $5,000 for commercial stations.	2021
Austin Energy	EVs for Schools Program	Educational program expanding from 4 pilot schools to 150+ schools across Central Texas, focused on serving low-income student populations.	2022
Federal Infrastructure Investment	Austin Energy Infrastructure Grant	$15 million federal grant plus $3.75 million local match for EV charging infrastructure expansion.	2024

Private Initiatives

Because Austin's publicly operated energy company drives the majority of EV expansion programs, the amount of private investment is fairly limited, although it is relevant to note the presence of Tesla's headquarters in Austin. It's estimated Tesla's Gigafactory has brought in over $2B in economic activity and employs around 15,000 people in Travis County. Tesla has also committed $750,000 for local education and sustainability programs in Austin. (McAfee, 2023)

5 Results

Evidence suggests Austin's EV strategies have been successful when compared to Houston's. Examining registered EV numbers from September 2021, Houston started with a slight advantage with 21,928 registered EVs compared to Austin's 20,202. This slight disparity can be attributed to Houston's larger population. As of June 2025, Austin had not only closed the gap but surged ahead with 39,773 registered EVs, while Houston sits at 35,285. This represents a stunning 96.9% growth for Austin compared to Houston's 60.9% growth, showcasing how Austin's comprehensive EV infrastructure investments, incentive programs, and policy initiatives have successfully accelerated electric vehicle adoption. (DFW Clean Cities, 2025)

Metric	2021	2025
Austin- Registered EVs	20,202	39,773
Houston- Registered EVs	21,928	35,285

6 Application to Houston

While demographic and geographic challenges make it unlikely that Houston will match EV adoption rates in Austin, there are many things Houston can take into consideration when examining Austin's case to strengthen EV implementation. Houston faces many similar challenges of range concerns, income barriers, and limited infrastructure in specific areas. To combat this, the development of an "Equity Plan" or a parallel approach could potentially ameliorate EV infrastructure within Houston, the same way it has within Austin, breaking down the barrier of EV inequity and the idea that electrified transportation is a luxury.

Overall, Austin's fiscal and social commitment to EV adoption and overall emission reduction is key. The following initiatives could be replicated in Houston with the support of the city government and private partners.

Austin's Initiative	Applied to Houston
Climate Equity Plan	Develop a comprehensive Houston Climate Equity Plan with specific EV targets. It could be achieved through the revival of Houston's 2020 Climate Action Plan.

EVs for Schools Program	Launch community outreach initiatives focused on EV education through local high schools. Potentially partner with the University of Houston or Texas Southern University due to their presence in the Third Ward, a historically underserved community.
Home EV Charger Rebate Program	Implement rebates for residential chargers through local energy companies or a city partnership.
Tech Industry Partnership Model	Leverage Houston's energy transition companies to create corporate EV adoption outreach programs, similar to that of Tesla and Austin.

Case Study | Electric Vehicle Adoption in Charlotte, North Carolina

1 What Motivates Charlotte's Electric Vehicle Adoption Strategies?

Charlotte is a city in Mecklenburg County, North Carolina. Charlotte's struggle for cleaner air began in 1997, when the Environmental Protection Agency (EPA) set new federal ozone standards that it failed to meet. Since then, the city has implemented steps to reduce ozone emissions, finally meeting the EPA's standards in 2013. The following year, the American Lung Association dropped Charlotte from its list of the top smoggiest cities for the first time in 13 years.

Charlotte's efforts to improve air quality did not stop at reducing ozone emissions. Concerned about the environmental and public health impacts of carbon emissions, officials established the Strategic Energy Action Plan in 2018. Charlotte's electric vehicle (EV) adoption initiatives are part of its comprehensive environmental resiliency, urban development, and public health plans.

One word to define Charlotte's EV adoption strategies is collaboration. Several entities, forums, and consortia comprising public and private stakeholders have been instrumental in planning, funding, and executing their initiatives. Their efforts have made Charlotte one of the cities with the fastest rate of electric vehicle adoption in the United States.

2 Why should we study electric vehicle adoption strategies in Charlotte?

Approximately 1.2 million people reside in the Charlotte metro area. Charlotte's population is significantly smaller than the population of the Houston metro area, but the cities share several attributes relevant to the study of equitable electric vehicle (EV) adoption strategies.

Attribute	Measured by	Houston Metro	Charlotte Metro
Per Capita Income	2023 U.S. dollars	$41,142	$49,991
Population Growth	% Change from 2020 to 2024	3.9%	7.9%
Car Dependency	Cars per household	1.8	1.7
Urban Sprawl	Travel time to work	27 minutes	25 minutes
Minority-Majority City	Percentage of non-white residents	72.6%	56.1%
Renter Population	Percentage of the total population	45.2%	44.5%

Table 1. Comparable attributes between Houston and Charlotte.

3 Barriers to Electric Vehicle Adoption

A 2022 focus group study found that knowledge gaps about electric vehicles (EVs) may be an obstacle to the broader adoption of EVs in North Carolina. Range anxiety, price, and limited access to convenient electric vehicle (EV) charging emerged as the top concerns for participants.

4 Strategies to Accelerate Electric Vehicle Adoption

4.1 Policy Framework

Policy stacking is necessary to maximize the effectiveness of EV adoption initiatives. Charlotte benefits from a pro-electric vehicle adoption policy environment at the county, regional, and state levels.

City of Charlotte

- The *Strategic Energy Action Plan* is a comprehensive plan including goals to increase EV charging infrastructure, ensure equitable access to EV infrastructure, and electrify the city's vehicle fleet. It was adopted in 2018 and updated in 2025.

- The *Unified Development Ordinance* is a zoning ordinance that incorporates sustainable development goals and mandates that certain buildings provide electric vehicle charging infrastructure. This ordinance was adopted in 2023.

Mecklenburg County

- The *Breathing Room Path Forward* is a plan to enhance local air quality by promoting the adoption of new fleet electrification and transportation choice initiatives. It was adopted in 2019.

Centralina Regional Council

- The *CONNECT Our Future Regional Growth Framework* is a regional growth plan that encompasses 14 counties (10 in NC and 4 in SC). The plan brings together public and private stakeholders to develop initiatives that improve air quality and advance sustainability initiatives in the region. The plan includes efforts to support cities in electrifying their vehicle fleets and was adopted in 2015.

State of North Carolina

- The *Zero Emission Vehicle Plan* aims to reduce statewide greenhouse gas emissions to 40% below 2005 levels by 2025, achieve a 50% reduction in transportation emissions by registering at least 80,000 zero-emission vehicles in the state by 2025[1], and increase the share of new vehicle purchases as electric vehicles (EVs) to at least 50% by 2030. This plan was adopted in 2019.

4.2 Community Engagement Initiatives

Strategic Energy Action Plan
In the process of updating the SEAP, the city surveyed residents and stakeholders to gather feedback on goals, actions, indicators of success, barriers, and tradeoffs.

Unified Development Ordinance
The city created the Unified Development Ordinance (UDO) committee to guide the implementation of its new zoning requirements. The UDO committee is a volunteer committee of neighborhoods, environmental groups, designers, and development professionals. The committee reviews potential amendments.

4.3 Electric Vehicle Adoption and Charging Infrastructure Initiatives

Public and Nonprofit Initiatives

Source of funding	Program name	Description	Effective year
City of Charlotte	Sustainable and Resilient Fleet Policy	A program to electrify the city's vehicle fleet. The town benefits from a cooperative purchasing initiative that allows cities to use the https://driveevfleets.org/ procurement portal to find competitively priced electric EVs. The city has installed 330 EV chargers for its fleet, which are also available to the general public.	2020
City of Charlotte Mecklenburg County	Leading the Change Decal Competition	Decal design competition. Participants designed a decal to be placed on all city and county low-emission vehicles and were awarded $5,000.	2022
Centralina Clean Fuels Coalition[2]	Alternative Fuels Ride and Drive	A program to provide EV rides to city employees to educate and inspire public sector staff on the benefits of alternative fuel vehicles.	2023
Forth Mobility & partners City of Charlotte	Carolina Carshare	Equity initiative offering an electric vehicle (EV) carsharing service in Charlotte's Corridors of Opportunity and neighborhoods with low rates of car ownership or access to transportation options.	2025
Forth Mobility	Ride and Drive	A program that recruits dealerships to participate in EV	2023

[1] North Carolina met this goal two years early in 2023.
[2] *Launched in 2004 by the U.S. Department of Energy's Clean Cities program. CCFC also receives funding from private donors.*

	Events	awareness events and provides dealership staff training to enhance their understanding of how electric vehicles work and how to sell them.	
The Kulwicki Foundation BATT Cave Research Center	49ers Racing EV team	The engineering dept. At the University of North Carolina at Charlotte, a student team designs, builds, and competes with a formula-style electric vehicle (EV), spreading awareness about the potential of EVs through outreach programs and events, and giving presentations to groups of government, industry, and economic partners.	2022

Table 2. Public and Nonprofit Initiatives to Incentivize Electric Vehicle Adoption in Charlotte.

Private Initiatives

Duke Energy is an energy and utility company headquartered in Charlotte, and it is the primary driver of private EV adoption initiatives. Charlotte benefits from its proximity to North Carolina's Research Triangle. Several companies have partnered with Duke University, North Carolina State University, and the University of North Carolina at Chapel Hill to develop new renewable energy technology. The Research Triangle Regional Partnership provides grants for workforce development programs to ensure North Carolina is ready for electrification.

Source of funding	Program name	Description	Year Implemented
Duke Energy	EV Charger Prep Credit Homebuilder Charger Prep Credit	The program provides a one-time credit up to $1,133 per charger to help cover the costs of preparing a home or business for an electric vehicle charger. $150 credit for every new home equipped with EV charging infrastructure by commercial home builders.	2022
	Charger Solutions Program	A rental program that enables residential and business customers to lease an EV charger from the company for a monthly fee, covering upfront installation costs.	2024
	Park and Plug	A program to expand EV charging options that includes 100 public charging stations, 24 fast charging stations, 25 charging stations at multifamily dwellings, electric school bus chargers, and offsetting a portion of the purchase price of electric school buses.	2022
	Workplace Charging Program	The program aims to increase employee EV adoption and demonstrate leadership by expanding the availability of EV charging across Duke Energy locations.	2021
	EV Garage	A mobile display where visitors can explore EV chargers, an	2022

		EV savings calculator, an EV selector tool, and a charging map to help people understand how EVs can fit into their lifestyles.	
Edison Electric Institute[3]	National Electric Highway Coalition	Collaboration among electric companies, including Duke Energy, that are committed to providing electric vehicle (EV) fast charging stations along major highways.	2021

Table 3. Private Initiatives to Incentivize Electric Vehicle Adoption in Charlotte.

5 Results

Mecklenburg County experienced a 22% increase in electric vehicle (EV) registrations and a 300% increase in EV charging infrastructure from 2020 to 2024. The county remains in compliance with federal air quality standards. As of 2025, 3% of the city's vehicle fleet consists of electric vehicles.

Metric	2020	2024
Registered EVs	2,336	13,985
Registered PHEVs	1,216	4,715
EV Charging Stations	+100	936

Table 4. Changes in Electric Vehicle Adoption and EV Charging Station Availability, 2020-2024.

6 Application to Houston

The following initiatives could be replicated in Houston with the support of the city government and private partners.

Charlotte's Initiative	Applied to Houston
Strategic Energy Action Plan	Update the 2018 Resilient Houston plan and the 2020 Houston Climate Action plan.
Sustainable and Resilient Fleet Policy	Accelerate efforts to electrify Houston's fleet to keep up with goals outlined in the Houston Climate Action plan.
Carolina Carshare	Partner with rental car providers to install electric vehicles (EVs) in or near multifamily dwellings in areas with low rates of car ownership or low EV adoption rates.
Mobile EV Garage	Partner with local providers to create a mobile display that can travel to events in

[3] Utility industry association

	the Houston area, aiming to familiarize Houstonians with EV charging technology.

Table 5. Applications to Houston.

Case Study | Electric Vehicle Adoption in Los Angeles, California

1 What Motivates Los Angeles's Electric Vehicle Adoption Strategies?

The majority of Los Angeles residents live in apartments, as staying in the city requires high living expenses. Most people who choose to live in houses move to the suburbs or rural areas to save some money. All of these factors contributed to the city being highly car-dependent, as many residents commute to their jobs (Greg and Deverell, 2010).

As of 2023, commuters constituted 85.3% of workers. This is a variable that the city can't control, but which directly contributes to air pollution, a problem they're trying to solve. What they can do is inform their citizens about ecologically friendly options for mobility, whether public or private transportation. The city is giving them options.

Los Angeles's public transportation has been gradually shifting to zero-emission electric buses; however, most citizens still travel by private cars, as public transportation is primarily accessible only in downtown areas, which limits its usage. Additionally, people are concerned about safety and reliability, especially parents who prefer their kids to carpool instead of using public transportation.

The county has adopted LA County's First Zero-Emission Vehicle Master Plan, which focuses on expanding charging infrastructure. Currently, there are around 30,000 publicly available chargers in Los Angeles County, short of the County's goal of 60,000 chargers by 2025. This infrastructure investment creates jobs and positions LA as a leader in the growing EV market.

2 Why should we study electric vehicle adoption strategies in Los Angeles?

Private electric vehicle (EV) adoption in L.A. has increased exponentially in the past ten years. In 2024, the cumulative sales of EVs in Los Angeles were 591,068, and the sales of the previous year were 128,300 electric vehicles. The total of Zero-Emission Vehicles (ZEVs) in L.A. at the end of 2024 was 493,741.

Electric cars demand the use of charging stations, something that Los Angeles has been working on, but still needs to address some issues, like accessibility. The city offers 7,523 public charging stations, 458 of which are free. Los Angeles has a total of 432 DC Fast Chargers.

One of the main factors to consider when buying an EV is the weather. A study made by AAA (2019) identified the average temperatures at which the EV driving range is affected. Those temperatures ranged from 20°F to 95°F, which Los Angeles does not experience, as its average lowest temperature is 51°F and the highest is 79°F. This indicates that electric cars would run without issue in Los Angeles.

Approximately 4 million people reside in the city of Los Angeles. Its population is significantly bigger than Houston's, but the cities share several attributes relevant to the study of equitable electric vehicle (EV) adoption strategies.

Attribute	Measured by	Houston Metro	Los Angeles Metro
Per Capita Income	2023 U.S. dollars	$41,142	$46,270
Population Growth	Residents added from 2020 to 2024	3.90%	-0.50%
Car Dependency	Cars per household	1.8	2
Urban Sprawl	Travel time to work	27 minutes	30.8 minutes
Minority-Majority City	Percentage of non-white residents	76%	71.7%
Renter Population	Percentage of the total population	58%	63.67%

3 Barriers to EV adoption

Like Houston and the other peer cities, price is always going to be the main barrier to EV adoption. Nonetheless, a study made by Adepetu and Srinivasan (2019) identified that there are other factors to consider. Accessibility to consistent and reliable EV charging is one of them. Individuals living in apartment buildings face barriers due to limited electric capacity, installation costs, and landlord opposition. Furthermore, the city does not have the necessary infrastructure for a 100% EV adoption. The electrical grids were not created to handle drivers charging their cars simultaneously. Additionally, there's not as much public access to charging stations as there are gas stations.

4 Strategies to Accelerate Electric Vehicle Adoption

4.1Policy Framework

California State

- *Advanced Clean Cars II (ACC II)* requires automakers to sell more zero-emission vehicles with a goal of 100% zero-emission new car sales by 2035.
    - Update of the Zero-Emission Vehicle rule.
- *Electric vehicle (EV) charging for new construction:* Electric vehicle supply equipment (EVSE) shall be installed.
- *Electric vehicle charging space (EV space) locations.* At least one EV space shall be located in common-use areas and available for use by all residents.

- *Executive Order B-48-18,* Governor Jerry Brown set a target of 5 million zero-emission vehicles on the road by 2030.
- *Executive Order B-32-15* Directed State departments to create the California Sustainable Freight Action Plan, which establishes clear targets to improve freight efficiency, transition to zero-emission technologies, and increase the competitiveness of California's freight system

Los Angeles County

- *LA County Municipal Code* mandates for new multi-family and commercial construction:
    - 30% EV‑Capable parking (pre-wired & panel capacity for Level 2 chargers).
    - 25% EV‑Ready (complete circuit & receptacle ready for Level 2)
- *Zero-Emission Vehicle (ZEV) Master Plan*: Sets targets for public charging expansion, fleet electrification by 2035, streamlined permitting, and equitable infrastructure in disadvantaged communities.
    - Allocated $3.8 million toward public and fleet charger installations at County facilities.

Los Angeles City

- *L.A. Green Building Code* requires 20% of parking spaces in new residential and commercial construction to be EV-ready (pre-wired for chargers).
    - An additional 10% must have full EV charging stations installed.
    - Applies to new developments and major renovations.
- *EV Parking Ordinance:* Certain public parking lots and structures must provide dedicated EV parking and chargers.
    - Preferential parking for EVs is allowed at select locations.
- *City Fleet Electrification*: 100% zero-emission light-duty fleet by 2028.
    - Including DASH buses.

4.2 Community Engagement Initiatives

Adopt a Charger
They help speed up the use of electric cars by adding more places to charge them. They do this by connecting sponsors with locations like parks, museums, or beaches, where they can install free public charging stations.

- Ex: L.A. Zoo now has EV chargers thanks to them.

Electrify Expo
With over a million square feet dedicated to electric innovation, the Los Angeles Drives Electric Clean Vehicle Rebate Project provides a major platform where residents can experience EVs firsthand through test drives and demonstrations.

EVs for Equity, Ride and Drive Clean
Hosted bilingual events (English/Spanish). These included financial counseling, info on $9,500+ in grants, and real-time help filling out applications.

Free Webinars on Electric Vehicle Charging Infrastructure
With help from a California Energy Commission grant, Los Angeles County offers a webinar series for anyone involved in EV charging projects. The aim is to give facility managers, project leads, government officials, and higher education professionals the tools and information they need to successfully plan and install EV charging stations.

4.3 Electric Vehicle Adoption and Charging Infrastructure Initiatives

Public and Nonprofit Initiatives

Source of funding	Program name	Description	Effective year
California State	Clean Vehicle Rebate Project (CVRP)	Provides rebates of $1,000-$7,500 for new zero-emission vehicles.	2023
State of California Department of Motor Vehicles (DMV)	Clean Air Vehicle Decals	HOV access for battery and plug-in vehicles	2019
Los Angeles County	Clean Cars 4 All	Provides up to $12,000 toward new/used EVs or PHEVs for lower-income consumers in priority populations, plus $2,000 for home charging equipment or public charging credits.	2022
Los Angeles City	Los Angeles Department of Water and Power (LADWP)	Rebates offer up to $1,000 rebate for Level 2 charger purchase/installation, plus $250 rebate for dedicated EV meter installation.	2023
Los Angeles City	BlueLA Carsharing Pilot Project	Offers discounted membership ($12/year and $0.15/min) in disadvantaged neighborhoods, backed by a $1.7M grant.	2018

The South Coast Air Quality Management District (South Coast AQMD)	Qualified Replace Your Ride program	Offers applicants up to $12,000 to replace their older, high-polluting vehicle with a newer vehicle, upgrade to a Plug-In Hybrid, Battery, or Fuel Cell (Hydrogen) Electric Vehicle.	2024

Private Initiatives

Source of funding	Program name	Description	Effective year
Southern California Edison	Pre-Owned Electric Vehicle Rebate Program	Offers a $1,000 or $4,000 rebate based on household income, plus up to $4,200 through the Charge Ready Home Rebate Program for Level 2 EV charger installation.	2021
Southern California Edison	Southern California Edison Pre-Owned EV Rebate: Hybrid/electric vehicle replacement program	Offers up to $9,500 for replacing older, high-polluting vehicles.	2024
The South Coast Air Quality Management District (South Coast AQMD)	Residential EV Charging Incentive Program	Offers up to $250 for most residents, and up to $500 for low-income residents for installing a Level 2 home EV charger.	2023

5 Results

Metric	2020	2024
Registered EVs	156,889	493,741
Registered PHEVs	69,665	116,199
EV Charging Stations	1,700	7,568

Los Angeles County experienced a 68.22% increase in electric vehicle (EV) registrations and a 345% increase in EV charging infrastructure from 2020 to 2024. As of 2025, 18% of the city's vehicle fleet is electric.

6 Application to Houston

The following initiatives could be replicated in Houston with the support of the city government and private partners.

Los Angeles's Initiative	Applied to Houston
Electrify Expo	Educate citizens on the importance of EV adoption and the options they have.
EVs for Equity, Ride and Drive Clean	Offering bilingual events expands the audience, especially in a high-intensity Spanish-speaking city like Houston.
Southern California Edison Pre-Owned EV Rebate: Hybrid/electric	90% of residents in Harris County have a private car; a rebate for replacing that older, high-polluting vehicle may influence the shift to a more environmentally friendly one.
Clean Air Vehicle Decals	HOV access for battery and plug-in vehicles in a city with heavy traffic congestion, like Houston, may be a game-changer for commuters.

Case Study | Electric Vehicle Adoption in New York City

1 What Motivates New York City's Electric Vehicle Adoption Strategies?

New York City's commitment to climate action and sustainable transportation has roots beginning with their first version of the PlaNYC climate action plan in 2007. This comprehensive plan brought together 25 city agencies with the ambitious goal of reducing the city's carbon emissions by 30% and improving quality of life while preparing for population growth. PlaNYC specifically targeted transportation, energy, and air quality as key focuses. The plan was updated in 2011 and has since continued to evolve and grow. This long-term strategic approach to environmental challenges has created a policy framework and institutional momentum that supports NYC's current electric vehicle adoption strategies, making it an ideal case study for understanding how cities can drive change through transportation electrification.

Building on this foundation of climate action, cities are now pursuing electric vehicle (EV) adoption to address climate change and air quality challenges. As they do this, understanding proven strategies becomes essential. This case study examines New York City's electric vehicle initiatives, particularly infrastructure development and fleet electrification, to identify actionable strategies for Evolve Houston's mission to accelerate EV adoption across Houston.

2 Why should we study EV adoption strategies in New York City?

New York City's high density and multi-modal transportation system make electric vehicle adoption unique. The city's PlaNYC climate action plan highlights its commitment to sustainability and climate-focused action. While their city-level EV initiatives do not include direct rebates, NYC's policies complement the federal and state-level rebates by focusing on infrastructure development and fleet electrification programs. Takeaways from NYC's efforts can help inform initiatives for Houston, where, unlike other major cities, there are currently limited state and city-level incentives available to consumers and fleet operators. Houston's reliance primarily on federal programs creates a gap that could be addressed by learning from NYC's infrastructure-focused approach.

Since demographic information is vital to consumers' decision-making, comparisons between key factors of Houston and New York City are included below. For example, differences in median income may mean that Houston consumers are more price-sensitive. Additionally, both cities' high renter populations may be a barrier to in-home charging.

Attribute	Measured by	Houston Metro	NYC
Per Capita Income	2023 U.S. dollars	$41,142	$50,776
Population Growth	% Change from 2020 to 2024	3.90%	-3.70%
Car Dependency	Cars per household	1.59	0.62

Urban Sprawl	Travel time to work	27 minutes	41 minutes
Minority-Majority City	Percentage of non-white residents	76%	69%
Renter Population	Percentage of the total population	58%	67%

3 Barriers to Electric Vehicle Adoption

Infrastructure Limitations: Jung, Jaeyoung, and Chow (2019) use taxi simulations to show that EV infrastructure and charging times negatively impact EV per taxi revenue compared to non-EV taxis. Even with the Taxi & Limousine Commission's (TLC) recommended number of electric chargers, significant charging queue delays develop when EV taxis make up a large share.

Inequitable Access: Analysis by Khan et al. (2022) shows that the distribution of charging stations in New York City does not follow population density, but rather is very highly correlated with income, race, and the presence of highways. For example, the median household income for zip codes with vs without charging stations was found to be $87,242 and $75,471, respectively. Additionally, the median black-identifying population percent is 7.26% in zip codes with charging stations compared to 22.05% in those without.

4 Strategies to Accelerate Electric Vehicle Adoption

Financial Incentives: Research by Williams and Anderson (2022) gathered information on the factors that influence 'EV converts'. They show that 63% of plug-in hybrid EV adopters considered rebates essential to their purchase decision. Additionally, 64% of Tesla adopters state that they wouldn't have purchased the vehicle without rebates. Additionally, a majority of these converts were not aware of rebates before purchasing, signaling that awareness alone has an impact.

Accessible Charging: Williams and Anderson (2022) further analyze 'EV converts' on their knowledge of EV charging. Compared to Tesla non-EV converts, a large share of Tesla converts "rated their dealer as very knowledgeable about away-from-home charging," likely easing any existing range anxiety. Additionally, non-Tesla consumers in the Williams and Anderson (2022) study were most likely to have access to EV charging stations at their workplace.

NYC's systematic approach to charging infrastructure placement offers a proven methodology for Houston. Research-based analysis of demand patterns to determine optimal charging station locations can be adapted to Houston's geography and travel patterns. Key applications include strategic placement in high-demand areas while ensuring coverage in underserved communities, and prioritizing fleet electrification as anchor users for charging networks.

Targeted Incentives: NYC's experience suggests Houston should implement differentiated strategies with higher rebates for lower-income adopters and fleet-wide rather than individual-only policies. Research demonstrates that in mixed EV/conventional vehicle fleets, operational dynamics can create unintended competitive disadvantages that policy design must address.

Equity-Centered Approach: NYC's finding that diverse communities show significant EV interest suggests opportunity in Houston's diverse population, provided that targeted outreach and appropriate incentive structures are implemented.

Filling Policy Gaps: City's efforts are most effective when layered with relevant federal and state-level policies. In New York City's case, they rely on such policies for direct consumer incentives. Instead, their city EV initiatives focus on mandates, such as zero-emission requirements for ridesharing services. City funding is also going directly into constructing fast charging stations as part of the PlaNYC climate initiative.

Policy Level	Individual EV Adoption	Commercial/Fleet EV Adoption	Infrastructure Expansion
Federal Level	Rebate: New- Up to $7,500 tax credit based on critical mineral and battery requirements Used- Up to $4,000 based on sale price	Rebate: Up to $40,000 based on vehicle weight class and cost	Rebate: Up to 30% of costs
New York State Level	Rebate: $500-$2,000 based on vehicle range	–	Rebate: $3,000-$4,000 per charging port
New York City Level	Initiative: supporting EV maintenance and repair training with Hertz	Mandate: 100% of rideshare vehicles will be zero-emission (or wheelchair accessible) by 2030	Mandate: 20% of parking spots must have EV chargers with room for expansion

5 Results

Metric	2020	2025
New BEV+PHEV Registrations	3,910	9,990 (+155%)
EV Charging Ports	6,113	11,076 (2023)

6 Application to Houston

Infrastructure-First Approach: NYC studies show that insufficient charging infrastructure creates exponentially increasing problems as EV adoption grows. Additionally, the perception of EV charging availability impacts buyers' likelihood to adopt electric vehicles. Rather than limiting infrastructure investment, Houston should prioritize charging network development to avoid the queue delays and operational inefficiencies observed in constrained scenarios. Though this would be best when layered with State-level incentives, infrastructure is still a vital factor by itself.

Comprehensive vs. Gradual Conversion: NYC research demonstrates that partial fleet conversion can create competitive disadvantages between electric and conventional vehicles operating in the same market, suggesting Houston should consider comprehensive rather than gradual fleet conversion policies for maximum effectiveness.

Consumer Segmentation: Understanding "EV Converts" - consumers who initially showed little interest but ultimately adopted EVs - provides valuable insights for targeting mainstream adoption beyond early adopters. These consumers are influenced by different factors than enthusiasts, including rebate availability, practical considerations, and social normalization.

NYC's experience demonstrates that successful EV adoption requires coordinated infrastructure investment, targeted financial incentives, and community-level engagement strategies. Houston can leverage these proven approaches while adapting to its unique characteristics to accelerate equitable EV adoption across the region.

Regression Info

Existing Regression

The 2015 Soltani-Sobh et al. paper regression was based on national panel data. Thus, application to ZIP code-level aggregate data in Houston was challenging. Variables were interpreted as accurately as possible. The following were the paper's coefficients:

Variable	ZIP Code Interpretation	Coefficient	Standard Error
Intercept	–	-12.03***	1.61
Income	Median Income	$8.2*10^{-5}$*	$5.2*10^{-5}$
Vehicle Miles Traveled (VMT)	Average VMT	$1.1*10^{-5}$	$2.3*10^{-5}$
Electric price	Average TX Electric Price	-3.67***	0.91
Gas price	Average TX Gas Price	0.076	0.278
Percent of roads labeled 'Urban' (binary)	Same	11.1***	4.19
HOV access EV incentive presence (binary)	Same; 0 in TX	-0.392	0.38
Financial EV incentive presence (binary)	Same; 0 in TX	0.52**	0.3
R^2	–	0.775	–

***: significant at the 5% level
**: significant at the 10% level
*: significant at the 15% level

Applying a broad, national regression to the ZIP code level yielded extreme values; most regions were predicted to have close to either 0% or 100% EV share. Still, results seem to resemble actual EV share distribution in Houston. Such data were provided later and allowed us to create our own regression.

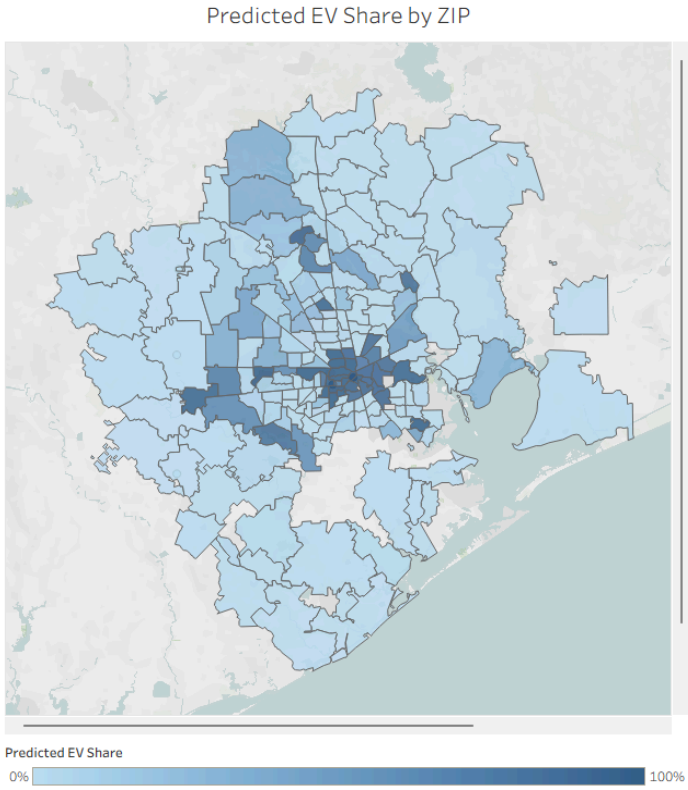

Figure A.1: Predicted EV adoption by ZIP code (existing regression)

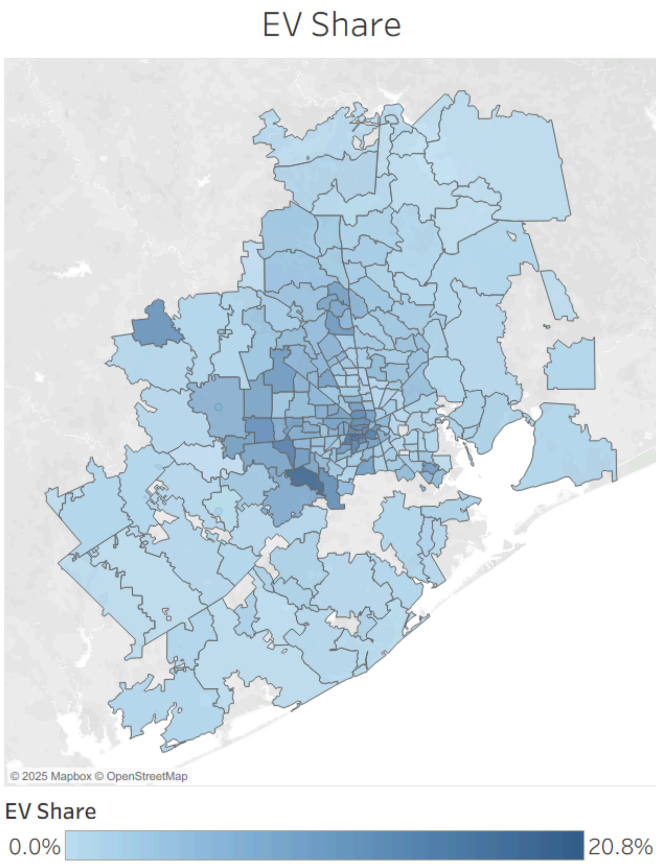

Figure A.2: Actual EV adoption share by ZIP code (data provided by Evolve Houston)

Custom Regression

We performed a linear regression on n = 219 ZIP codes in the Greater Houston area with available data. These data are from the 2023 Census American Community Survey. EV share was calculated from vehicle registration data provided by Evolve Houston. It is calculated as the sum of registered BEV and PHEV vehicles as a proportion of all registered vehicles from January, 2023 to March, 2025. EV share is a percentage, and thus ranged from 0-1. Because of this range, a logistic regression was also attempted. The results were, however, marginally more extreme in predictions than the included regression.

Factor	Coefficient	Interpretation	Standard Error	t Statistic
Intercept	-0.0456**	–	0.009	-5.070
Median Income	$5.932*10^{-7}$**	A $10,000 increase in median income is associated with a 0.59% increase in EV share.	$1.01*10^{-7}$	5.847
Population Density	$3.808*10^{-6}$**	Each additional 1,000 people per square mile is associated with a 0.38% increase in EV share.	$9.14*10^{-7}$	4.167
Public Charging Stations Per 1,000 residents	0.0578*	Each additional public charging station per 1,000 people is associated with a 5.78% increase in EV share.	0.0234	2.430
Public Charging Ports Per 1,000 residents	-0.0159**	Each additional public charging port per 1,000 people is associated with a 1.59% decrease in EV share.	0.006	-2.672
Renter Proportion	0.0412*	A 10 percentage point increase in renter proportion is associated with a 0.41% increase in EV share.	0.016	2.579
Proportion with a Bachelor's Degree	0.1728**	A 10 percentage point increase in people with a Bachelor's degree is associated with a 1.73% increase in EV share.	0.038	4.533
R^2	0.639	This model explains 63.9% of the variation in EV share across the analyzed Houston ZIP codes.	–	–

**: significant at the 1% level
*: significant at the 5% level

Key Takeaways:

- Predicted effects of factors such as income, population density, and educational attainment are observed in this regression.
- The charging infrastructure findings contradict our initial hypothesis that charging infrastructure would positively predict EV adoption. It should be noted that there are, on average, 3.3 charging ports per public charging station in this dataset. Thus, the average total effect of each additional public charging station is close to zero. We believe that a simple measure of charging infrastructure per person may be insufficient. Most EV owners charge at home. Thus, prospective EV buyers would be expected to take into account home charging and charging at places of interest, which may very well be outside of their home ZIP code. Additionally, rural ZIP codes with significant road networks may have proportionally more charging infrastructure per resident, which could help explain this counterintuitive result.
- The renter proportion variable was hypothesized to have a negative effect on EV share, since home charging has significantly higher barriers for renters than home owners. Its positive influence in this regression may be tied to potential correlation with other positive factors such as population density.

Regression Visualizations

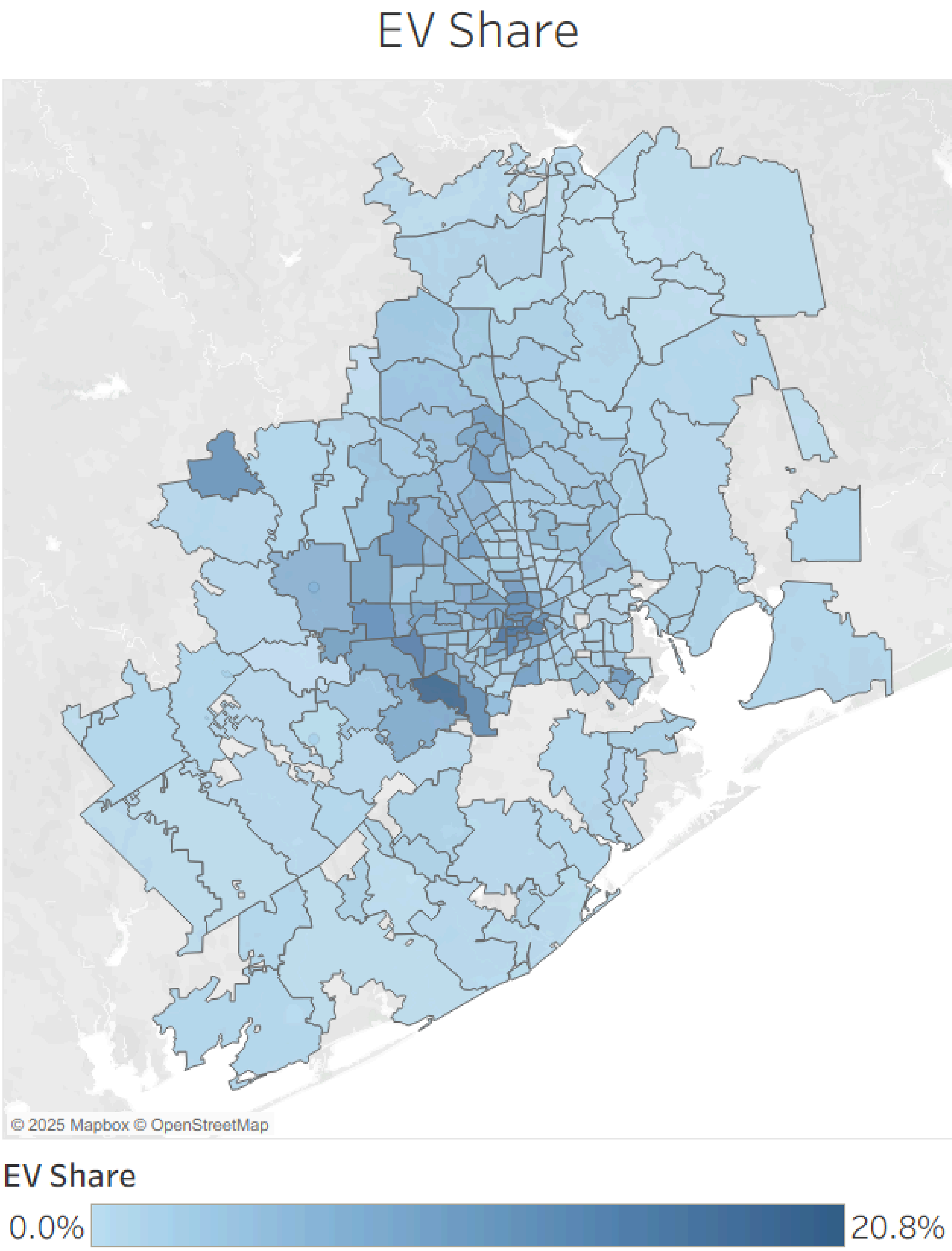

Figure A.3: Actual EV share

Clear concentrations can be seen in urban and wealthy areas of Greater Houston.

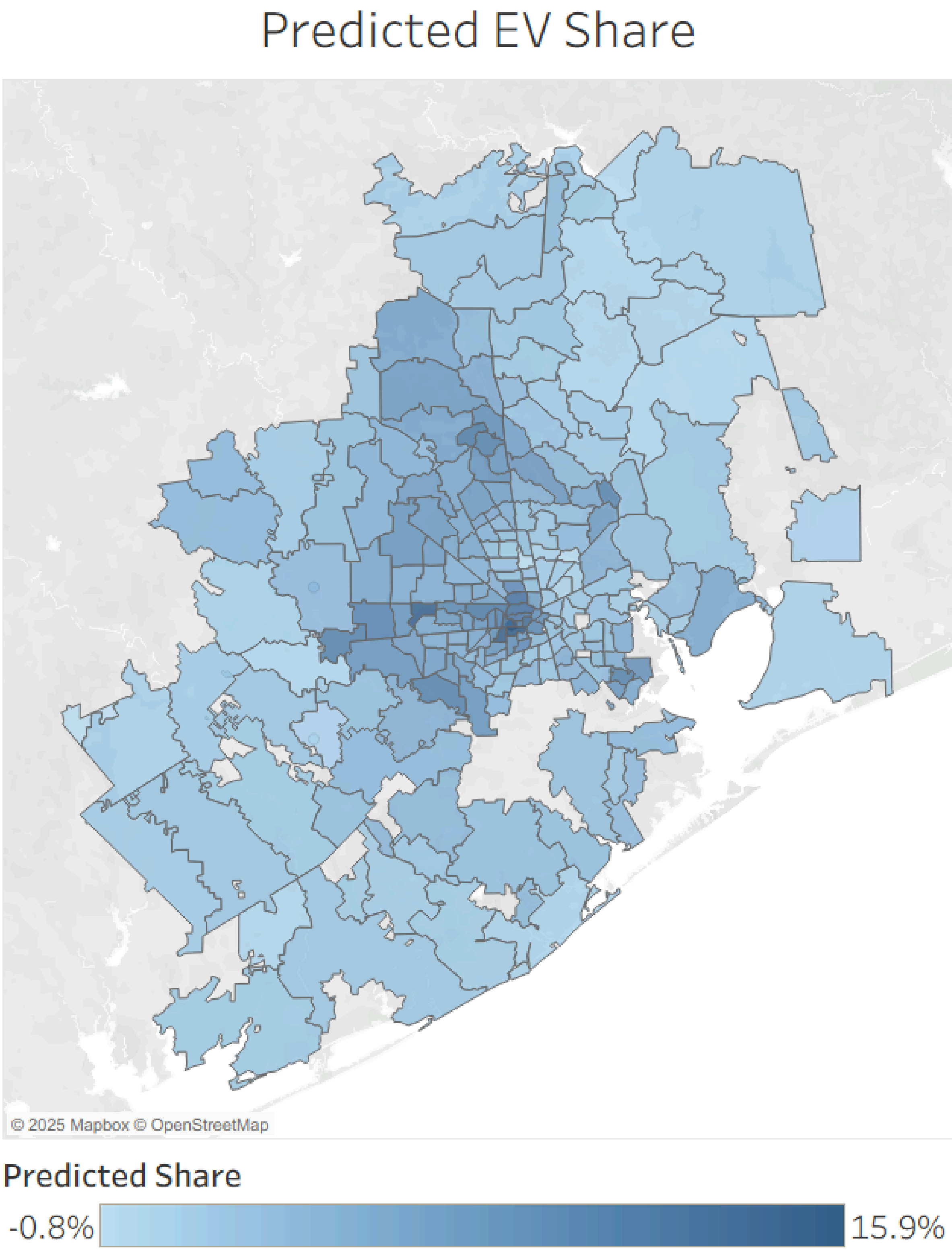

Figure A.4: Predicted EV share

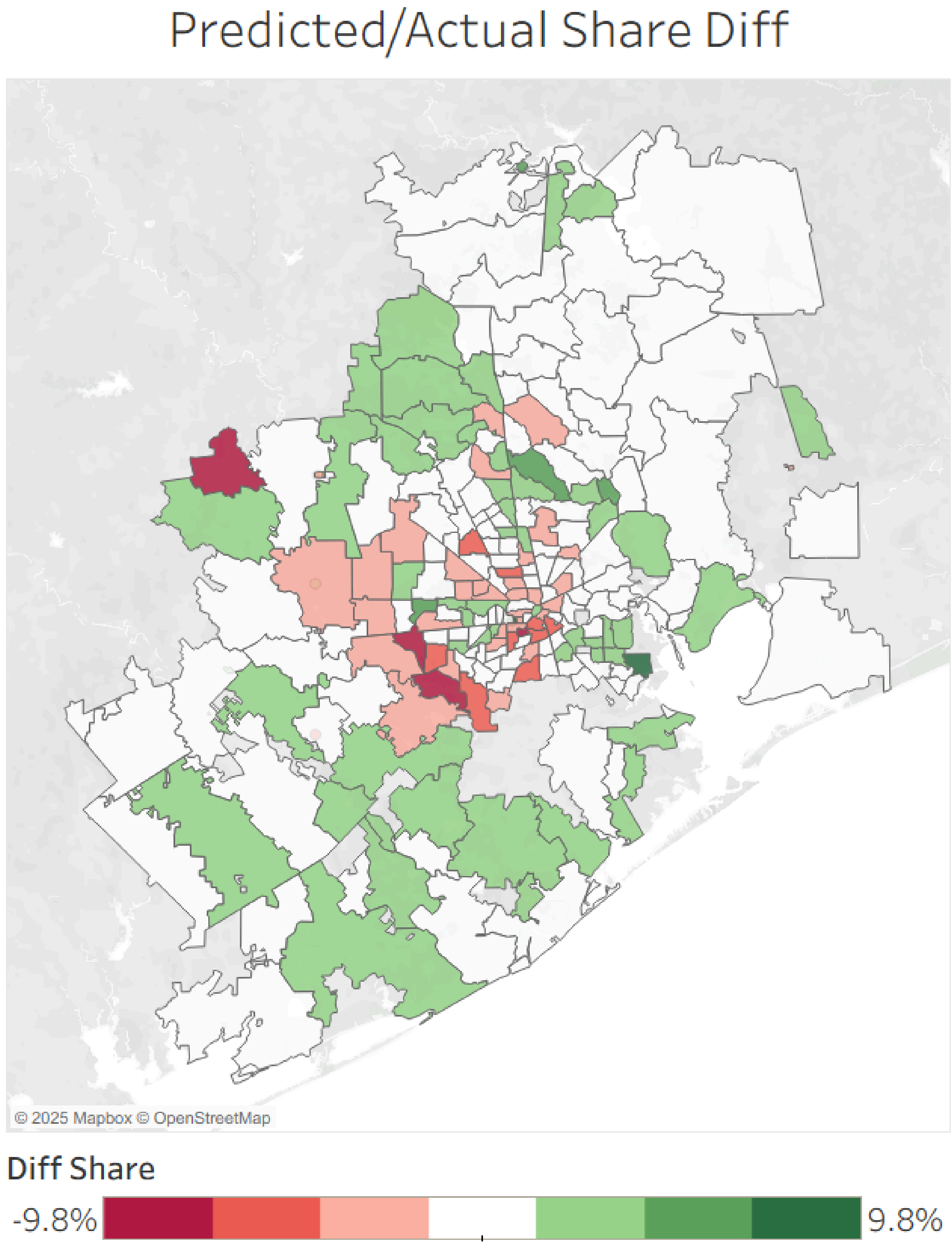

Figure A.5: Difference between Actual and Predicted EV share

Green ZIP codes show areas where the regression overestimated EV adoption. These are identified as high potential areas, as they may have most necessary factors for EV adoption despite current adoption being low.

Target ZIP Codes

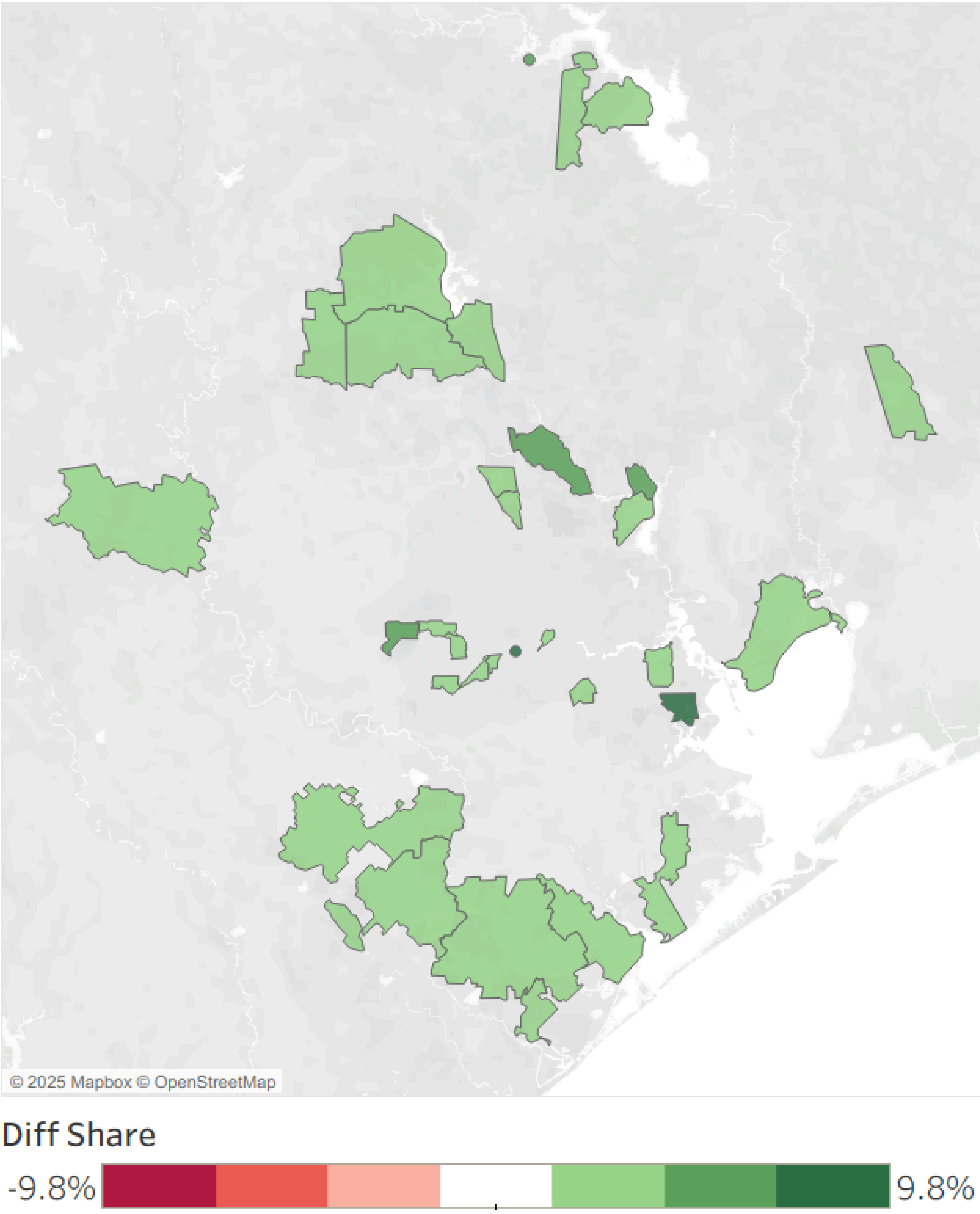

Figure A.6: Filtered difference between Actual and Predicted EV share

Same as Figure A.5, but only displaying ZIP codes with a difference of 2% or more. These ZIP codes are chosen as the target for the proposed EV incentive program.

Survey Overview

Survey questions will be focused on individual demographics, transportation, and electric vehicle perceptions. If implemented, the following are some of the questions Evolve Houston can ask:

Demographics

- How old are you?
    - 21-31
    - 32-42
    - 43-53
    - 54-65
- What is your ZIP code?
    (Open text response)
- How would you describe your race?
    - Asian
    - White
    - Black or African American
    - Native Hawaiian or other Pacific Islander
    - American Indian or Alaska Native
    - Hispanic or Latino
- What is your total annual household income before taxes?
    - Less than $25,000
    - $25,000 to $49,999
    - $50,000 to $74,999
    - $75,000 to $99,999
    - $100,000 to $149,999
    - $150,000 to $199,999
    - $200,000 or more

Transportation

- Do you own a car?
    - Yes
    - No
- How long does it typically take you to travel to work/school (one way)?
    - I primarily work from home / do not commute
    - Less than 10 minutes
    - 10 to 20 minutes
    - 21 to 30 minutes
    - 31 to 45 minutes
    - 46 to 60 minutes
    - More than 60 minutes
- What is your typical one-way commute method?
    - Personal vehicle (gasoline/diesel)

    - Electric vehicle
    - Public transportation
    - Bicycle or walking
    - Other (please specify): _______________

Personal EV Questions

- Are you currently an EV driver or considering purchasing an EV?
    - I currently drive an EV
    - I am considering purchasing an EV
    - Neither
- How likely are you to purchase an EV for your next vehicle?
    - Very likely
    - Somewhat likely
    - Neutral
    - Somewhat unlikely
    - Very unlikely
- Would an EV rebate, incentive, or credit make you more likely to purchase an EV?
    - Yes
    - No
    - I'm not sure
- How likely are you to purchase an EV for your next vehicle if a $1,000 rebate was offered to you?
    - Very likely
    - Somewhat likely
    - Neutral
    - Somewhat unlikely
    - Very unlikely
- How likely are you to purchase an EV for your next vehicle if a $4,000 rebate was offered to you?
    - Very likely
    - Somewhat likely
    - Neutral
    - Somewhat unlikely
    - Very unlikely
- What were your top reasons for choosing or considering an EV? *(Select all that apply)*
    - Environmental concerns (e.g., air quality, climate change)
    - Fuel cost savings
    - Vehicle performance
    - Incentives (tax credits, rebates)
    - Interest in new technology
    - Other (please specify): _______________

- What barriers or concerns do you have regarding EV ownership? *(Select all that apply)b*
    - Lack of public charging
    - Vehicle cost
    - Driving range
    - Home charging limitations
    - Other (please specify): _______________

EV Knowledge

- How many miles can most fully electric vehicles (EVs) drive on a full charge today?
    - Less than 100 miles
    - 100–200 miles
    - 200–300 miles
    - Over 300 miles
    - I'm not sure
- What is the average time it takes to fully charge an EV at home using a standard wall outlet (Level 1 charger)?
    - Less than 2 hours
    - 2–4 hours
    - 8–20 hours
    - I'm not sure
- Which charging option gives the fastest charge for EVs on the road today?
    - Level 1 (standard home outlet)
    - Level 2 (home or public station)
    - DC Fast Charger
    - I'm not sure
- On average, how much does it cost to fully charge an EV at home (assuming a typical U.S. electricity rate)?
    - Under $5
    - $5–$10
    - $10–$20
    - Over $20
    - I'm not sure
- Do you know where the nearest public EV charging station is located near your home or workplace?
    - Yes, near my home
    - Yes, near my workplace
    - Yes, near both
    - No, I'm not sure
    - I haven't looked

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