Data Analysis Research Capstone Project

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Chapter 1

Introduction and Rationale

This research and analysis project will investigate available data sources and provide results indicating the most productive areas of the U.S. to focus an advertising campaign promoting the purchase of vehicles that use renewable energy. This project will include renewable energy generation capacity data from the energy sector. Additionally, it will investigate possible correlating data points to target households with enough income to purchase new electric vehicles (EVs) and solar systems, as well as those most likely to have vehicles and significant commuting requirements. The project will include the application of data analysis and programming methods and technologies, as well as the creation of visualizations for interpreting results.

The Earth's climate is continuing to warm with no limit or end in sight. Storms are increasing in size and severity, oceans are warming and rising, and far too many people are largely ignoring this existential problem. Human pollution in the form of carbon dioxide (CO_2) released into the atmosphere has been occurring for the last couple of centuries, starting with the Industrial Revolution. However, there have been technologies available for decades that can slow down and reverse humanity's impact on the environment. A significant transition to clean and renewable energy is required to correct this situation, and current technologies have not been fully adopted. Transportation and electricity production are primary candidates for transition since they make up 28% and 25% of total U.S. Greenhouse Gas Emissions by Economic Sector in 2022 (Sources of Greenhouse Gas Emissions, 2025). By promoting EVs in areas with large amounts of renewable electricity generation, the result should improve two areas with high emissions.

I have a personal interest in this project as someone concerned about the environment required for the continued existence of creatures on this planet. I have been driving various EVs for 13 years. My wife and I drive EVs, and we taught our three kids to drive using EVs. A couple of years ago, we also added enough solar renewable electricity production and storage capacity to our house to power our vehicles and our entire house, including all heating and cooling. We now collect the sunlight already landing on our house and convert it to usable energy. We require minimal external power during the summer and have full-home power backup. We also help the power company by adding power to the grid during demand peaks.

Research Objectives and Questions

The primary objective of the advertising research and analysis project is to answer the question of where the most productive areas of the U.S. are to focus an advertising campaign promoting the purchase of vehicles that use renewable energy. There are several research questions that the analysis will attempt to answer. Proposed questions that should help with the objective include:

- Where are concentrations of high-capacity renewable energy generation?
- Where are concentrations of moderate-income and high-income households?
- Where are concentrations of long commute times and distances?
- Where are concentrations of households with higher-level education?
- Where are concentrations of existing EV owners?
- What are regional temperature ranges?

- Which of the above concentrations correlate and how?
- Does a prediction model follow current concentrations of existing EV ownership?
- Does a prediction model exist that aligns all factors expected to help EV sales?

The project will include cleaning and preparing data, and then building and fitting models to the data. Model performance criteria and results will be examined to determine if questions are answered. Since most of this project is finding correlating concentrations of specific features, geospatial clustering analysis models will likely be used primarily, including hierarchical clustering and density-based spatial clustering models. Linear regression models and classification models will also likely be used to analyze data, find expected and unknown correlations, and answer questions. Output from these models should shed light on possible relationships in the different datasets. Linear models are used with continuous dependent variables, such as income and commute distance, and classification models are used with categorical data, such as education levels and binary data, such as existing EV ownership. It is not known at this point how many models will be used for the project.

Primary Data Sources and Scope

The advertising research and analysis project will be inclusive of the entire mainland contiguous United States for the national aspect of the advertising campaign coverage. The data will likely be selected at the postal code, city, or county level, depending on availability and suitability. The expected and desired dataset granularity will be less than the state level.

The primary data source for the data will be Policymap.com, where the following datasets will be obtained:

- Electricity generation capacity from renewable sources in 2023
- Estimated percentage of people with at least a bachelor's degree, between 2019-2023
- Estimated median income of a household, between 2019-2023
- Estimated average travel time to work in minutes in 2019-2023.
- Estimated percentage of workers who drove to work in 2019-2023
- Estimated average number of vehicles per household in 2019-2023.

Other datasets will be obtained from NOAA.com, Data.gov, or Kaggle.com for data related to EV ownership and regional average temperature ranges.

Feasibility and Next Steps

The advertising research and analysis project is expected to be feasible with most datasets available and previously investigated on PolicyMap.com. Issues with scope and timeline could affect the project's feasibility. Limiting the project questions, datasets, and analysis could help with the scope, complexity, and feasibility. Two of the datasets have not been investigated other than a cursory search, and none of the datasets have been obtained for offline research and analysis.

Chapter 2

Literature Review

This research project must answer some key questions to solve the puzzle of where to focus an advertising campaign promoting the purchase of electric vehicles powered by renewable energy. Published articles and studies can be used to corroborate or invalidate proposed assumptions and questions. Research and review of literature found many corroborating points.

A couple of things that help sell products, likely including electric vehicles (EVs), are exposure and peer pressure, which plant the idea that a product is desirable and should be purchased. “A recent study of new EV registrations in 11 U.S. markets revealed a “cluster effect” in EV adoption. Prospective buyers are often influenced by EV owners within their social circles—neighbors, family, or colleagues” (Harrison, 2024). Another likely factor influencing EV purchases is household income, as affluent households are more likely to adopt higher-priced products early. “Households that earn at least $200,000 are the primary purchasers of electric cars, representing 42.6% of sales as of November, according to transaction data shared with MarketWatch by S&P Global Mobility” (Wong, 2025). For solar panel purchases, a similar phenomenon exists. “The median household income of a solar adopter in the US was about $117,000 in 2022, researchers from the Lawrence Berkeley National Laboratory found” (Reed, 2023). Education is also likely to affect EV and PV purchases. “Individuals with a graduate degree are two times more likely to own an electric vehicle. Those with graduate degrees made up 28 percent of electric vehicle market share” (Smith, 2018).

To push the value of renewable energy sources, regional capacities should be identified, such as Texas, where Ford F-150s are the most popular vehicle, not EVs. “Texas generated

169,442 gigawatt-hours from wind, utility-scale solar and small-scale solar in 2024, which is significantly more than the runner-up, California, which generated 92,316 gigawatt-hours from those resources." (Gearino, 2025). Daily worker commutes should be understood as a key factor in helping to push EV sales. New York, Maryland, and New Jersey all have average commute times exceeding thirty minutes, with several other states coming close to thirty minutes (Maniece, 2025). More targeting information can come from understanding where EVs are most popular. "California comes out on top for EV registrations by a wide margin, registering more than a million more EVs than the runner-up state. In fact, California registered more EVs than the combined efforts of the next eight states in this list" (Fink, 2025). Interestingly, Florida and Texas come in at second and third place with 254,878 and 230,125 EV registrations, respectively.

The literature aligns with the project's intended purpose. One statistic of interest, found in a side note on a website and not further researched, is that some lower-income EV owners don't follow the trend of higher-income EV ownership. These owners likely purchased lower-priced EVs for their savings on fuel and maintenance costs. When I leased my first EV, I was not only interested in the latest technology. I was also one of those owners concerned not only with climate change but also with the costs of ownership and maintenance. I found and leased an EV for the monthly cost of the diesel I was using to fuel my truck.

Hypotheses Development

To answer the central question of where to focus an EV promotional advertising campaign, assumptions and hypothetical statements about EV purchasing motivations must be accepted or rejected as statistically significant with statistical analysis of collected data. The following abbreviations are used below in hypothesis statements: Electric Vehicle (EV), Internal

Combustion Engine (ICE), Solar Photovoltaics (PV), Null Hypothesis (H_0), and Alternative Hypothesis (H_1).

Hypothesis 1: Higher household income statistically increases EV purchases.

Rationale: EVs have historically been more expensive than ICE vehicles.

H_0: Higher household income does not affect EV purchases.

H_1: Higher household income increases EV purchases.

Model: Logistic Regression with quantitative household annual income as the independent variable and categorical EV owner: (Yes, No) as the dependent variable.

Hypothesis 2: Higher household income statistically increases PV purchases.

Rationale: PVs are expensive, requiring more money to purchase.

H_0: Higher household income does not affect PV purchases.

H_1: Higher household income increases PV purchases.

Model: Logistic Regression with quantitative household annual income as the independent variable and categorical PV owner: (Yes, No) as the dependent variable.

Hypothesis 3: Educational attainment statistically increases EV purchases.

Rationale: EVs require different thinking and research to purchase, own, and operate.

H_0: Educational attainment does not affect EV purchases.

H_1: Educational attainment increases EV purchases.

Model: Logistic Regression with categorical education level as the independent variable and categorical EV owner: (Yes, No) as the dependent variable.

Hypothesis 4: Educational attainment statistically increases PV purchases.

Rationale: PVs require different thinking and research to purchase, own, and operate.

H_0: Educational attainment does not affect PV purchases.

H_1: Educational attainment increases PV purchases.

Model: Logistic Regression with categorical education level as the independent variable and categorical EV owner: (Yes, No) as the dependent variable.

Hypothesis 5: Longer commute times statistically increase EV purchases.

Rationale: EVs are cheaper than ICE vehicles to own and operate, including energy costs.

H_0: Longer commute times do not affect EV purchases.

H_1: Longer commute times increase EV purchases.

Model: Logistic Regression with quantitative commute time as the independent variable and categorical EV owner: (Yes, No) as the dependent variable.

Hypothesis 6: Longer commute distances statistically increase EV purchases.

Rationale: EVs are cheaper than ICE vehicles to own and operate, including energy costs.

H_0: Longer commute distances do not affect EV purchases.

H_1: Longer commute distances increase EV purchases.

Model: Logistic Regression with quantitative commute distance as the independent variable and categorical EV owner: (Yes, No) as the dependent variable.

Hypothesis 7: PV ownership statistically increases EV purchases.

Rationale: EVs are powered by electricity, which can conveniently come from PV.

H_0: PV ownership does not affect EV purchases.

H_1: PV ownership increases EV purchases.

Model: Logistic Regression with categorical PV owner (Yes, No) as the independent variable and categorical EV owner (Yes, No) as the dependent variable.

Hypothesis 8: EV ownership statistically increases PV purchases.

Rationale: EVs are powered by electricity, which can conveniently come from PV.

H_0: EV ownership does not affect PV purchases.

H_1: EV ownership increases PV purchases.

Model: Logistic Regression with categorical EV owner (Yes, No) as the independent variable and categorical PV owner (Yes, No) as the dependent variable.

Hypothesis 9: Equatorial home location statistically increases PV purchases.

Rationale: PV production potential is highest near the equator.

H_0: Equatorial home location does not affect PV purchases.

H_1: Equatorial home location increases PV purchases.

Model: Spatial Regression with quantitative home location as the independent variable and categorical PV owner (Yes, No) as the dependent variable.

Hypothesis 10: A high number of nearby EV owners statistically increases EV purchases.

Rationale: Exposure to EVs often educates people and makes EVs more acceptable.

H_0: A high number of nearby EV owners does not affect EV purchases.

H_1: A high number of nearby EV owners increases EV purchases.

Model: Spatial Regression with quantitative EV owner location as the independent variable and categorical PV owner (Yes, No) as the dependent variable.

Chapter 3

Data Collection Strategy

The primary objective of this research and analysis project is to identify the most effective geographic areas for a national advertising campaign promoting renewable energy and the purchase of vehicles powered by renewable energy (such as electric vehicles (EVs)) and solar photovoltaic systems (PVs). There will be three primary groups of data that need to be collected for this project: demographic data, clean energy production data (manmade and natural), and climate data. The timeframe for the advertising campaign is in the future, so the data collections must be as current as possible and only date back three to five years. The scope of this project is the continental United States, with granularity levels based on geographic regions, including states, cities, and zip codes. Therefore, data can be compiled and studied by these geographic regions and dates. Several publicly available, credible, and well-documented data sources will be utilized for the project, thereby eliminating the need for private data sources or generated data.

The source for the first group of data for this project, demographics, is PolicyMap at the website policymap.com. PolicyMap states that their "data warehouse contains 75,000+ geographic indicators across demographics, housing, economic conditions, infrastructure, education, environment, health, and social determinants of health from more than 170 public and proprietary sources" (All the data you need. All in one place., 2025). The data required for this project includes demographics such as educational attainment, median income, average travel time to work, percentage of driving commuters, average number of vehicles per household, and more, and each must be geographically referenced. The data source for the second group of data for this project is from the independent statistics and analysis of the U.S. Energy Information Administration at the website EIA.gov. This data source will be used for data identifying and locating clean energy production sources, including solar, wind, and other clean energy sources, and their production levels over time, and each must be geographically referenced. The data source for the third group of data for this project is from the National Oceanic and Atmospheric Administration at the website NOAA.gov. This data source will be used for climate data and other possibly relevant data, and must be geographically referenced. Additional data sources that may be used are the United States Government's open data website data.gov and possibly Kaggle at the website kaggle.com.

Once the data is collected, it will be analyzed for possible issues such as errors, anomalies, and missing or unexpected records and values. Many portions of the collected data are not expected to be useful to this project and will be discarded. Data intended for the three primary groups of data may be combined for simplicity and related by georeferenced values. Missing values may be replaced with averages or the records removed, depending on the relevance and significance of the values. If any data is not correctly geographically referenced or is located outside of the continental United States, it will be discarded. PolicyMap claims to "identify, collect, clean, and maintain accurate and timely data so you don't have to" (PolicyMap, 2025). Therefore, it is not expected that this data will require cleaning or preparation other than removing unnecessary data that won't be used in the project. The other public data sources should be of similar quality and require similar preprocessing.

Modeling Strategy

To answer the central question of where to focus a renewable energy and EV promotional advertising campaign, the collected data will be used with data models to make classifications and predictions about renewable energy sources and the populations of people who would be receptive to taking action after seeing the intended advertising. Geographic regions will be classified according to the current and future probable availability of renewable energy generation sources. The populations of geographic regions will be classified according to factors that make the purchase of EVs and PVs more likely.

A combination of classifier and regressor data models will be used for this research project. Classifiers are needed to classify people according to how receptive they are to purchasing EVs and solar systems. This will be derived from demographic data indicating income, commute times, commute distances, etc. Trends and predictions can be derived from regression models of renewable energy production data and demographic data to indicate which locations are predicted to be the best advertising locations in the next six months.

Logistic Regression models will be used to answer questions about possible correlating relationships between various data features, including income and EV and PV purchases; educational attainment and EV and PV purchases; commute times, commute distances, and EV purchases; and PV and EV ownership and EV and PV purchases. Spatial Regression models will be used to answer questions about possible correlating relationships between geographical data and PV purchases, and nearby EV owners and EV purchases. Patterns and trends over time and space need to be identified and predicted about six months into the future.

The outcome of the project will be classification and inferred predicted data points overlaid geographically to produce correlating groups, clusters, or hotspots of unused or potential renewable energy production sources near people who may be ready and able to purchase EVs and PVs. Hotspots and clusters will identify where the advertising campaign should be focused.

Chapter 4

Data Visualizations and Analysis

The primary objective of this research and analysis project is to identify the most effective geographic areas for a national advertising campaign promoting renewable energy and the purchase of vehicles powered by renewable energy (such as electric vehicles (EVs)) and solar photovoltaic systems (PVs). The data visualization strategy includes telling a story that leads the viewer to the intended conclusions clearly and understandably. This will be effectively accomplished by selecting, placing, and presenting charts and geographic maps with enough information to inform the viewer without overwhelming them. The story will conclude with the intended information on where to most effectively focus the advertising campaign.

The first part of the story focuses on what makes certain demographics more receptive to and able to purchase electric vehicles (EVs) and solar systems (PVs), as well as where these individuals are generally located. The second part of the story focuses on current and potential future renewable energy generation capacities, their general locations, and the average climate factors that affect renewable energy generation sources. The third part of the story focuses on showing where these factors come together, creating geolocated hotspots or clusters of candidate customers ready and willing to make the connection and switch to or increase their use and ownership of vehicles powered by renewable energy, and purchase PV systems that power them.

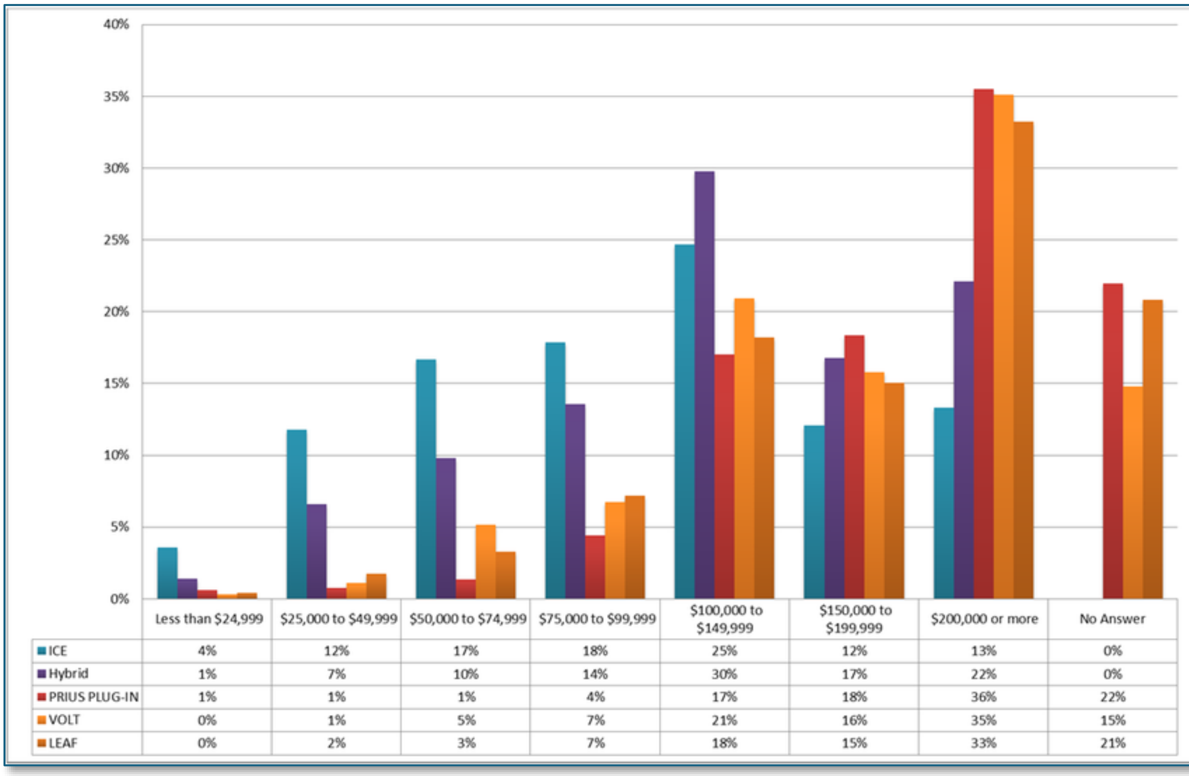
The dashboard for this project will initially explore primary demographic indicators of ability and motivation to purchase EVs and PVs, such as income, education, commuting distance, number of vehicles, commuting time, etc. Then, renewable energy generation capability indicators and predictors will be shown. Finally, all data indicators will be overlaid and come together to show easily recognizable geolocated hotspots or clusters of potential customers that the advertising campaign will target. The scope of this project is the continental United States, with granularity levels based on geographic regions, including states, cities, and zip codes. Therefore, slicers will be included to allow selection of these geographic regions.

The first section of the dashboard will include line charts of demographic data related to EV purchases. This data will also be shown geographically with heatmaps. The second section of the dashboard will include time-based line charts and simplistic bar charts showing renewable energy generation capacity by region. This data will also be shown geographically with heatmaps and average climate temperatures overlaid. The last section of the dashboard will show applicable demographic data and renewable energy generation capacity combined as geographic heatmaps.

The dashboard will also include slicers to enable users to make regional selections. Slicers will be easily accessible for the entire dashboard, and dashboard sections will be clearly marked and related. To enhance clarity, the layout and design will be simple and feature muted colors. However, clusters and hotspots will be highlighted on geographic visualizations to make them obvious to viewers.   Climate data will be combined into levels of effect on renewable energy production and colored to indicate positive and negative effects, but these colors should not stand out as much as hotspots.

One example graph (shown below) is typical of a chart that can indicate EV/PV adoption levels along with various demographics, such as household income levels. Graphs like this can indicate linear and non-linear relationships between EV/PV purchase and demographic data. However, when consistently linear relationships are expected, outliers may require explanations.

These graphs and others can be used to accept or reject the hypotheses related to demographics and EV/PV purchases, such as higher income and higher numbers of purchases.

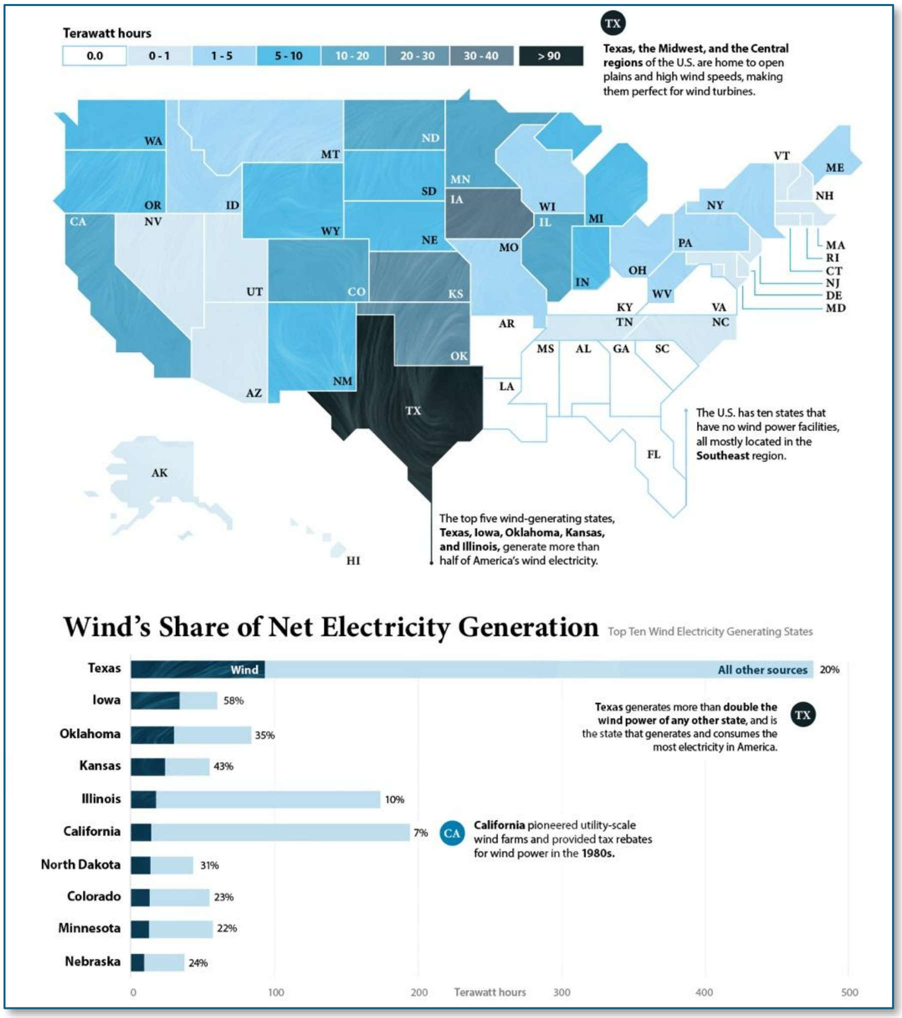


	Less than $24,999	$25,000 to $49,999	$50,000 to $74,999	$75,000 to $99,999	$100,000 to $149,999	$150,000 to $199,999	$200,000 or more	No Answer
ICE	4%	12%	17%	18%	25%	12%	13%	0%
Hybrid	1%	7%	10%	14%	30%	17%	22%	0%
PRIUS PLUG-IN	1%	1%	1%	4%	17%	18%	36%	22%
VOLT	0%	1%	5%	7%	21%	16%	35%	15%
LEAF	0%	2%	3%	7%	18%	15%	33%	21%

Typical Bar Chart Comparing Demographic and Vehicle Purchase Data

(Household Income by Vehicle Type, 2025)

To answer the central question of where to focus a clean power and EV promotional advertising campaign, datasets will be shown geographically to make it obvious to the viewer where things are located. The following chart shows how data can be overlaid geographically to indicate factors such as renewable energy production, or in this case, renewable wind power generation. The bar chart shown in this example makes it easy to see the relative differences of values displayed on the map, as well as the relative difference between the wind power generation and all other sources. Regional slicers for zip code, city, and state can be used to break down data into different applicable regions, enabling the viewer to see the data for the selected regions.



Typical Geographic Chart Comparing Renewable Wind Generation Capacities by State (Conte, 2022)

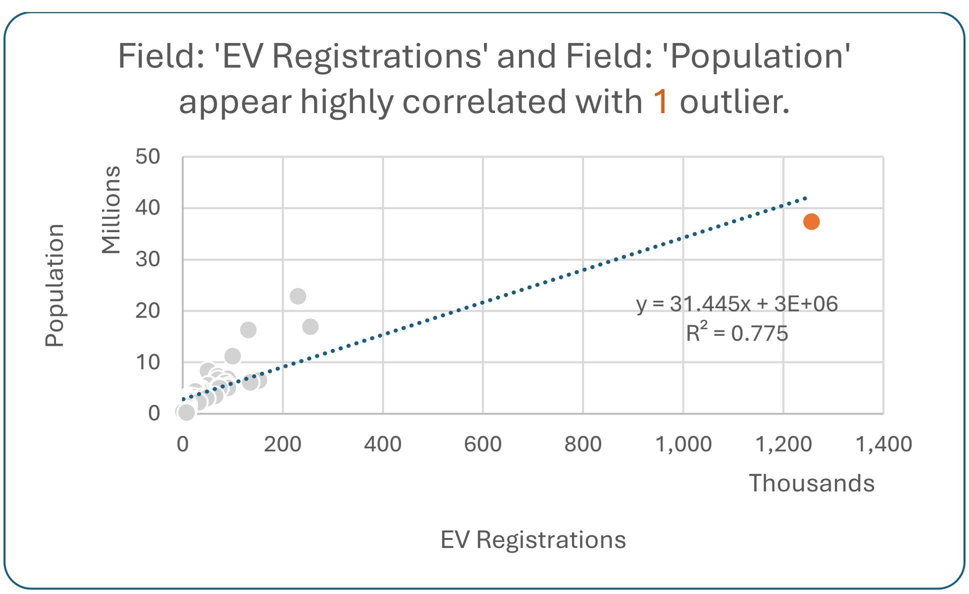
The dashboard may also include a top ten list to clearly indicate the primary locations where all aspects of the data converged for the advertising campaign. This will enable the viewer to easily retrieve a list of the top locations without having to manually compile any data.

Chapter 5

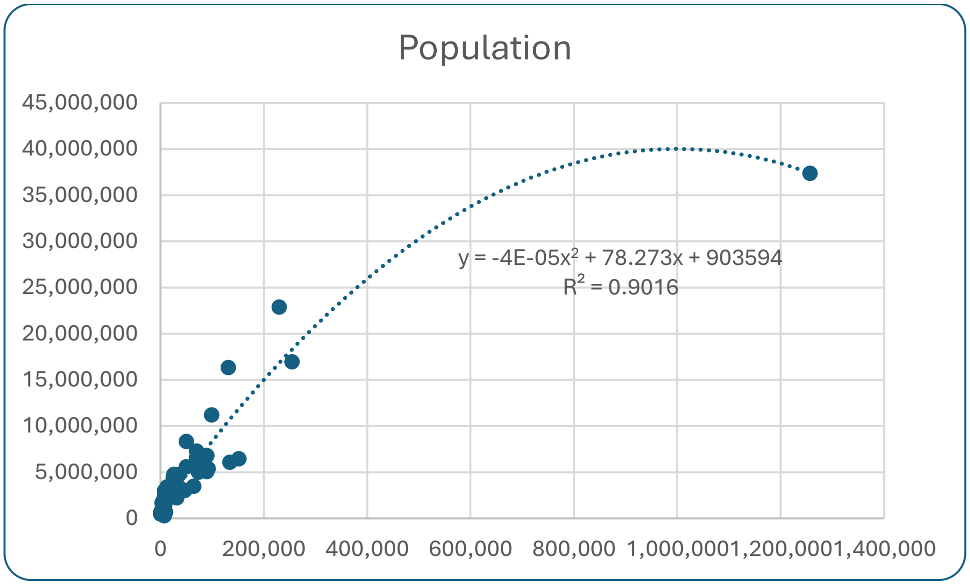
Summary of Hypotheses and Results

Ten assumptions and related hypothetical statements about EV purchasing motivations were described above, and most were examined using the data successfully obtained for the project, allowing the hypotheses to be accepted or rejected as statistically significant. However, not enough data were successfully obtained to analyze all assumptions and hypotheses. Additionally, data was not obtained for any analysis regarding PV purchases or any other aspect related to PV systems, and not enough data was obtained to analyze down to the regional city and state levels, as intended, so all results are based on states. Data repeatedly showed that California has been a leader in the EV transition, and therefore, it is often an outlier in the data, though its success can be modeled. Data for this project were primarily obtained from PolicyMap.com, with some data coming from NOAA.gov and afdc.energy.gov.

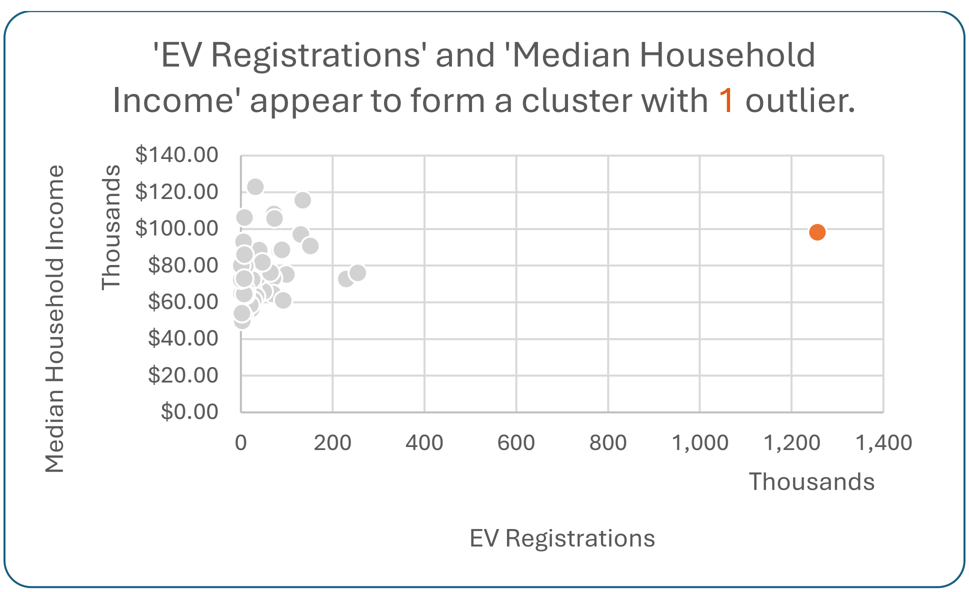
One seemingly obvious assumption that should have been described relates population to EV purchases. The relationship of those parameters is shown below with a linear trend line.



A polynomial trendline fit to the population and EV registration data, with the equation $y = -4E\text{-}05x^2 + 78.273x + 903594$ produced an R^2 value of 0.9016, as shown in the chart below.

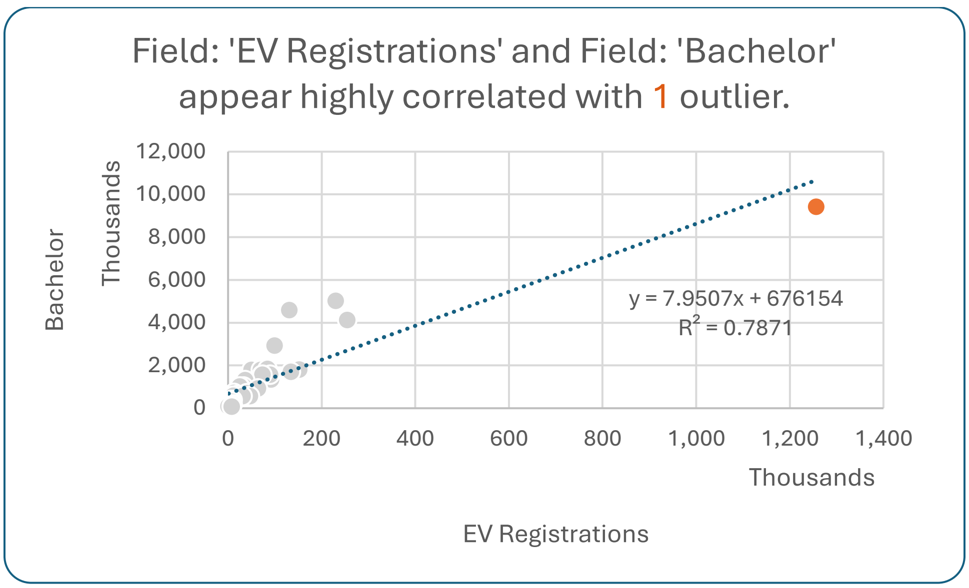


Hypothesis 1: Since EVs have historically been more expensive than ICE vehicles, higher household income statistically increases EV purchases. Interestingly, the household median income is clustered with one outlier, California, so this hypothesis is rejected, since many states with the highest income do not have the highest number of EVs.



Hypothesis 2: Higher household income statistically increases PV purchases. This hypothesis was not tested due to a lack of PV data.

Hypothesis 3: Since EVs require different thinking and research to purchase, own, and operate, educational attainment statistically increases EV purchases. EV ownership is highly correlated with one outlier, California, so this hypothesis is accepted, since states with the most bachelor's degrees typically have the highest number of EVs. The population percentage of bachelor's degrees tracks differently from the number of bachelor's degrees.



Hypothesis 4: Educational attainment statistically increases PV purchases. This hypothesis was not tested due to a lack of PV data.

Hypothesis 5: Since EVs are cheaper than ICE vehicles to own and operate, including energy costs, longer commute times statistically increase EV purchases. This hypothesis was rejected because not much variance was found in the commute times between states.

Hypothesis 6: Since EVs are cheaper than ICE vehicles to own and operate, including energy costs, longer commute distances statistically increase EV purchases. This hypothesis was not tested due to a lack of commute distance data.

Hypothesis 7: PV ownership statistically increases EV purchases. This hypothesis was not tested due to a lack of PV data.

Hypothesis 8: EV ownership statistically increases PV purchases. This hypothesis was not tested due to a lack of PV data.

Hypothesis 9: Equatorial home location statistically increases PV purchases. This hypothesis was not tested due to a lack of data relating state locations to the equator.

Hypothesis 10: Since exposure to EVs often educates people and makes EVs more acceptable, a high number of nearby EV owners statistically increases EV purchases.

Project Summary and Reflection

This data analysis research project completed many of its original goals, while some remained unfulfilled. The primary objective was to focus an advertising campaign on the people who would be most receptive to it and most likely to act on its messages. An advertising campaign targeting tool was created based on the data, and it can be used to successfully design a target audience with several factors selected by the user. It assumes a 5% EV registration objective and shows the target number of states, population, EV registrations, map, and more, allowing the user to develop a target audience while they see the effects of their selections.

With the data that was captured, some assumptions proved productive while some did not. The most useful data were current EV registrations, state populations, state populations with at least a bachelor's degree, and state median household incomes. Some data related to commute times and average vehicles per household did not prove useful with little variation. Additionally, while PV systems are more productive near the equator, most power is generated away from EV owners and then transmitted across states or regions of the country. That fact, along with not obtaining PV data for this project, made the concept of EV purchase and proximity to the equator moot.

The most challenging task for the project was obtaining the correct data. The primary source of data (PolicyMap.com) showed much promise during initial reviews, but then difficulties were encountered in learning how to obtain the data shown through its mapping and data download user interfaces. Eventually, most of the data was obtained after figuring out how to operate the website and download the data files. Additionally, the intention was to obtain recently recorded data, but this proved to be an obstacle, with many datasets containing data that date back several years or more. There were also significant personal life events that affected the project development time allotment and timeline.

This project was a good real-world example of how to conduct a research project and what it can accomplish, as well as revealing what can go wrong in the process of creating lofty goals and producing the final output. The primary objective or minimum viable solution was accomplished, but the details and envisioned output were not successfully produced.

Real-World Implications

Any project that helps keep the environment clean and eliminates or reduces greenhouse gas emissions or uses or generates renewable energy has a real-world impact on every living thing on the planet. Climate change is a largely ignored existential threat. Earth's climate continues to warm as human-created carbon dioxide (CO_2) is continuously released into the atmosphere. Storms are increasing in size and severity, and oceans are warming and rising. Earth will become increasingly inhospitable to life of all kinds unless humans actively address their significant contributions to the problem. A well-focused advertising campaign that alerts people to the danger of climate change while providing them with common solutions that they can act on has immense real-world global implications. Advertising campaigns should include the many health benefits of EVs, so people can make smarter decisions and abandon their polluting ICE vehicles as soon as possible. The primary focus of this research project is to increase EV purchases. The clean technology in EVs has been available for decades, which can slow down and reverse humanity's impact on the environment.

Further reading of literature indicates that politics now significantly influences decisions regarding EV purchases and thoughts about climate change, EVs, and other clean technologies, and the science behind climate change studies. As EVs "move closer to the mainstream, EVs have become the latest culture war flashpoint between Republicans and Democrats" (Hughes, 2024). This is extremely unfortunate as these technologies will eventually become the predominant source of energy and type of energy used in vehicles, and, as scientists warn, the transition to renewable clean energy can't come soon enough. Other countries, such as Norway and China, are far ahead of the U.S. in EV new car sales percentage and volume, and many are transitioning to renewable energy faster than the United States. "The top 5 countries with the highest share of EV sales are Norway (all-electric vehicles made up 80% of passenger vehicle sales in 2022), Iceland (41%), Sweden (32%), the Netherlands (24%), and China (22%)" (Jaeger, 2023). Additionally, Norway recently reported EV new car sales reached a new record in September 2025 at 98.3% (Gasnier, 2025), and China is leading global EV production while having the biggest car market in the world. The U.S. needs to get moving with meaningful increases in EV sales and an understanding of the technologies and how they are used.

Many early technology adopters and people who learned about EVs early on and decided to adopt and grow with the evolving technology have been driving electric vehicles for over a decade. Most early adopters had to deal with EVs that were very expensive or had very limited range. Many people have also invested heavily in companies that are producing the latest clean technologies and renewable energy. Other early adopters have gone all in with EVs and solar systems and closed the gap between renewable electricity generation and use. These adopters have acted on the realization that they can contribute more than just another EV, but also a whole clean, renewable energy system that generates electricity to be used in their homes and vehicles. They have removed all the middlemen collecting fees and causing more pollution from ICE vehicles and EV drivers who rely on gas companies and power companies. They simply collect the sunlight already landing on their houses and convert it to usable energy. Some have enough renewable electricity production and storage capacity to power vehicles and the entire house, including all heating and cooling. The best systems are large enough to require minimal external power during the summer, have full-home power backup, and help the power companies by adding power to the grid during demand peaks.

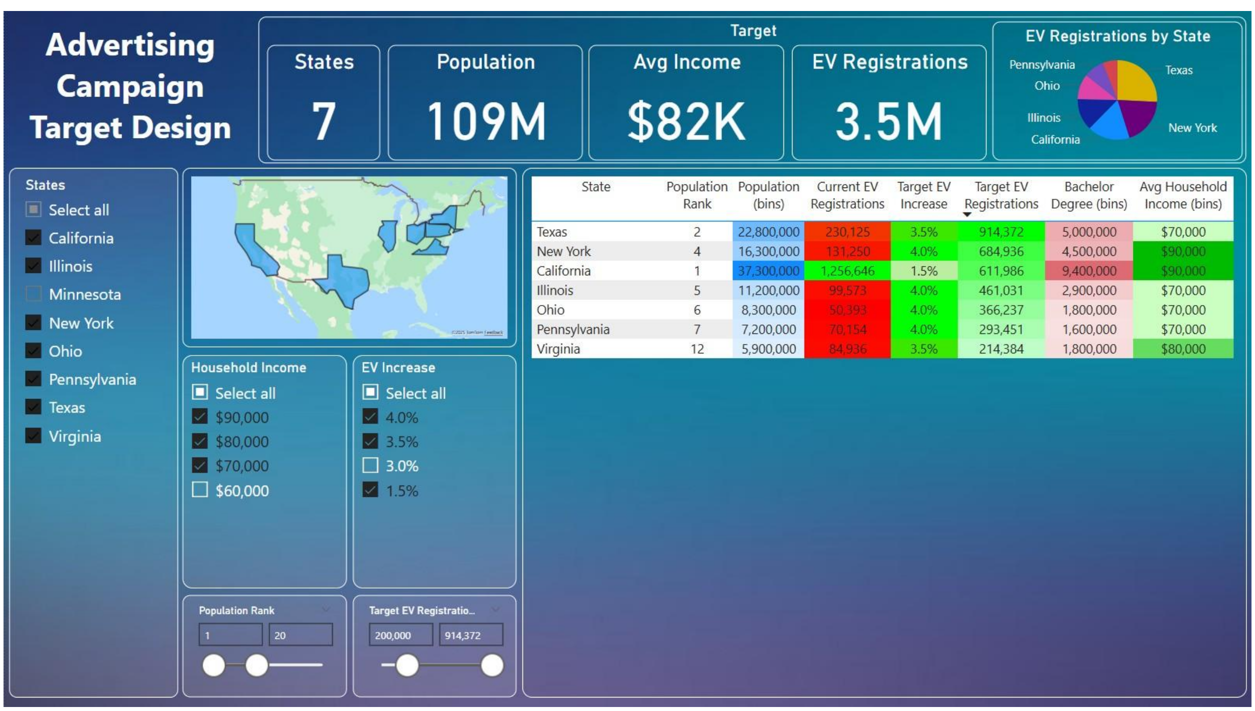
Many people in the U.S. have not gotten on board, nor have any idea how EVs work or have flawed views based on inexperience, politics, lies from competing industries, or the misinformation spread through social media. They all need to be educated and start using the transportation of this century. Data analysis projects like this one can help spread truthful information and education to the best regions based on demographics and other criteria.

Large-scale EV adoption will have many health benefits globally. One major additional benefit of cleaner environments, from the local home garage to the streets and freeways, and everywhere else, is air that is healthier to breathe. "Transitioning to 100% sales of zero-emission vehicles and 100% non-combustion electricity generation over the next 30 years could generate over $1.2 trillion in health benefits in the United States. Other benefits include approximately 110,000 lives saved, over 2.7 million childhood asthma attacks avoided, and 13.4 million lost workdays avoided" (Electric Vehicles 101: Understanding Health and Climate Benefits, 2022). EVs are expected to reduce pollution from brake pads since they regenerate electricity instead of burning brake pads when they stop. EVs will reduce premature deaths linked to air pollution and reduce heart attacks, strokes, and other cardiovascular issues. EVs are also much quieter than ICE vehicles, which reduces noise pollution and creates more peaceful environments for everyone around homes, restaurants, businesses, hospitals, etc.

Eventually, EVs will also positively impact income disparities because EVs are cheaper to own, maintain, and operate than their ICE counterparts. The prices of EVs started very high over a decade ago, but as development and manufacturing costs continue to decrease, so do EV prices. Additionally, used EVs are readily available today, allowing people to purchase EVs at significantly reduced prices on the used market. EVs are known to consume tires, but that is largely a result of aggressive driving tendencies. If owners drive carefully, the cost to maintain EVs is minimal. Besides replacing tires, the most common things to maintain on EVs are windshield wiper fluid and windshield wipers. Cleaner air and less pollution are also expected to positively affect income disparities. "Research has shown that underserved communities, such as lower-income neighborhoods, tend to face worse pollution and associated respiratory problems than more affluent areas. If ZEVs replace gas-powered cars in those neighborhoods, they could stand to benefit substantially." (Abrams, 2023).

Public policies regarding EV charging infrastructure, EV subsidies, and EV HOV lane access, among other things, can be affected by research projects like this. When advertising moves people to learn about and purchase EVs, it makes people think about and react to discussions regarding EV public policies. At the current stage of EV adoption, public policy is most needed for developing EV charging infrastructure because it is still inadequate for the vehicles coming soon. EVs are expected to hit critical mass in the next five to ten years, and the EV charging infrastructure will need to be substantially expanded and developed by then.

This research and analysis project investigated available data sources and gleaned results indicating the most productive areas of the U.S. to focus an advertising campaign promoting the purchase of vehicles that use renewable energy. Most objectives of the project were met. Below is an example of a targeted advertising campaign constructed with the Power BI interface.



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