# Electric Vehicle Population Data report

By: Shahana Anjum

# About me

- Background in engineering, with a focus on data analysis and financial modelling.
- Skilled in Excel, data visualization, and financial reporting.
- Passionate about understanding market behavior through statistical techniques.
- Currently exploring the intersection of finance, analytics, and decision making.

# Content

- Introduction
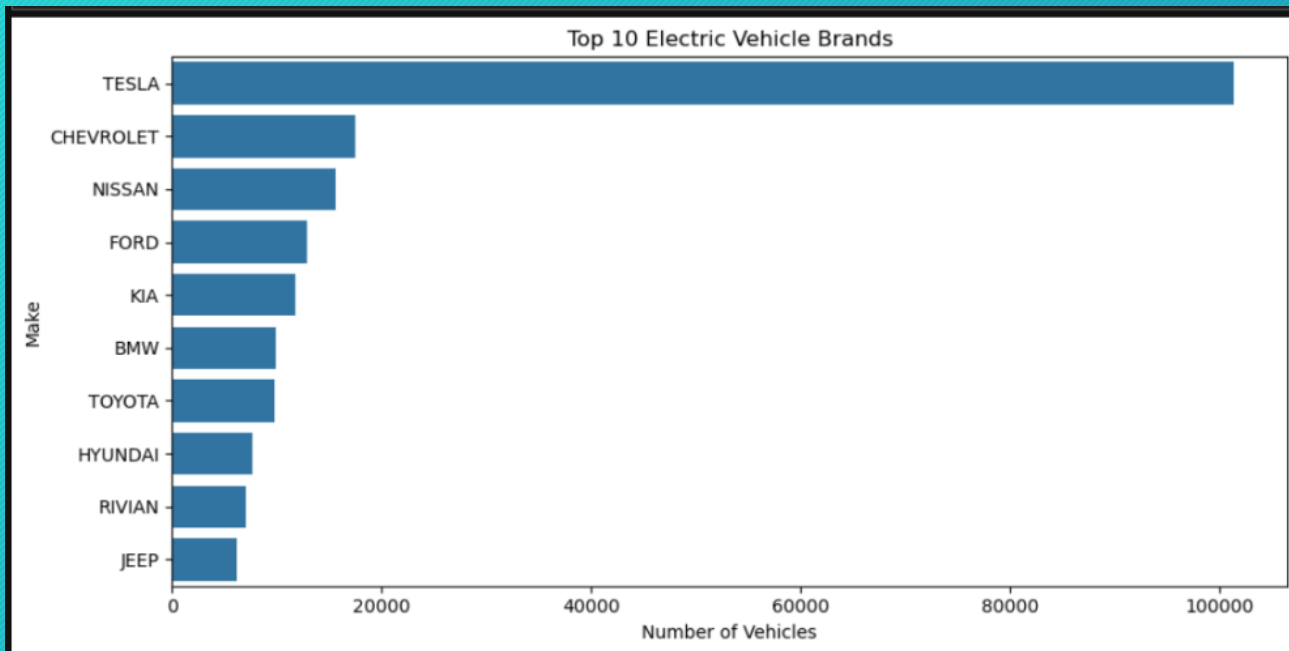- Dataset description
- Data Analysis
- Conclusion

# Introduction

- This project focuses on analyzing the Electric Vehicle Population Data registered in Washington State, sourced from the Department of Licensing (DOL).

- The dataset includes two major categories: Battery Electric Vehicles (BEVs)Plug-in Hybrid Electric Vehicles (PHEVs).

- Objective is to explore registration trends, vehicle distribution by city and model, electric range patterns, and brand popularity.

- Using Python and Jupyter Notebook, I will perform data cleaning, preprocessing, and exploratory data analysis to uncover insights valuable to stakeholders in EV sales, policy, and infrastructure planning.

- This analysis helps understand how electric vehicle adoption is progressing and highlights potential areas for market growth and infrastructure development.
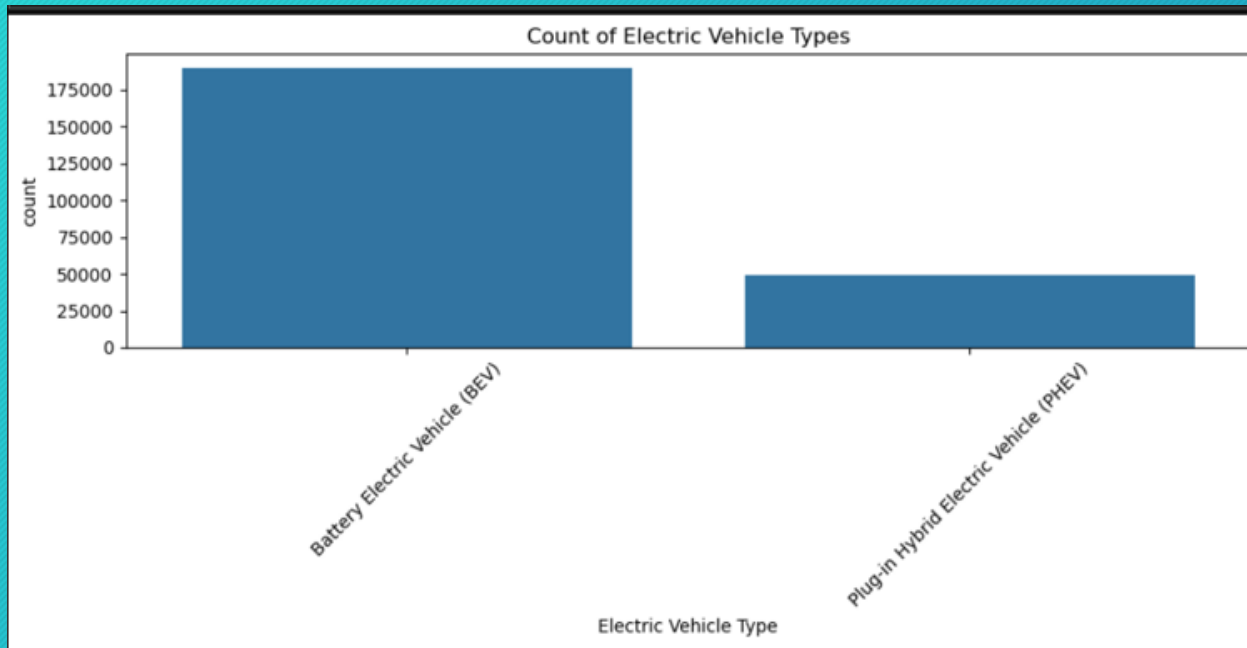
# Dataset Description

- Source: Washington State Department of Licensing (DOL)
- Dataset Link: Electric Vehicle Population
- Datatype of Data: Real-time registration data for electric vehicles in Washington State
- Coverage: Includes both Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs)
- Key Columns:
  - VIN (Vehicle Identification Number) – Unique vehicle identifier
  - Make – Vehicle manufacturer (e.g., Tesla, Nissan, Ford)
  - Model – Specific vehicle model (e.g., Model Y, Leaf)
  - Electric Range – Estimated range on a full charge (in miles)
  - City, State, Postal Code – Location of registration
  - Model Year – Manufacturing year of the vehicle
  - Electric Vehicle Type – BEV or PHEV classification

# Data Analysis – Top 10 Electric Vehicle Brand



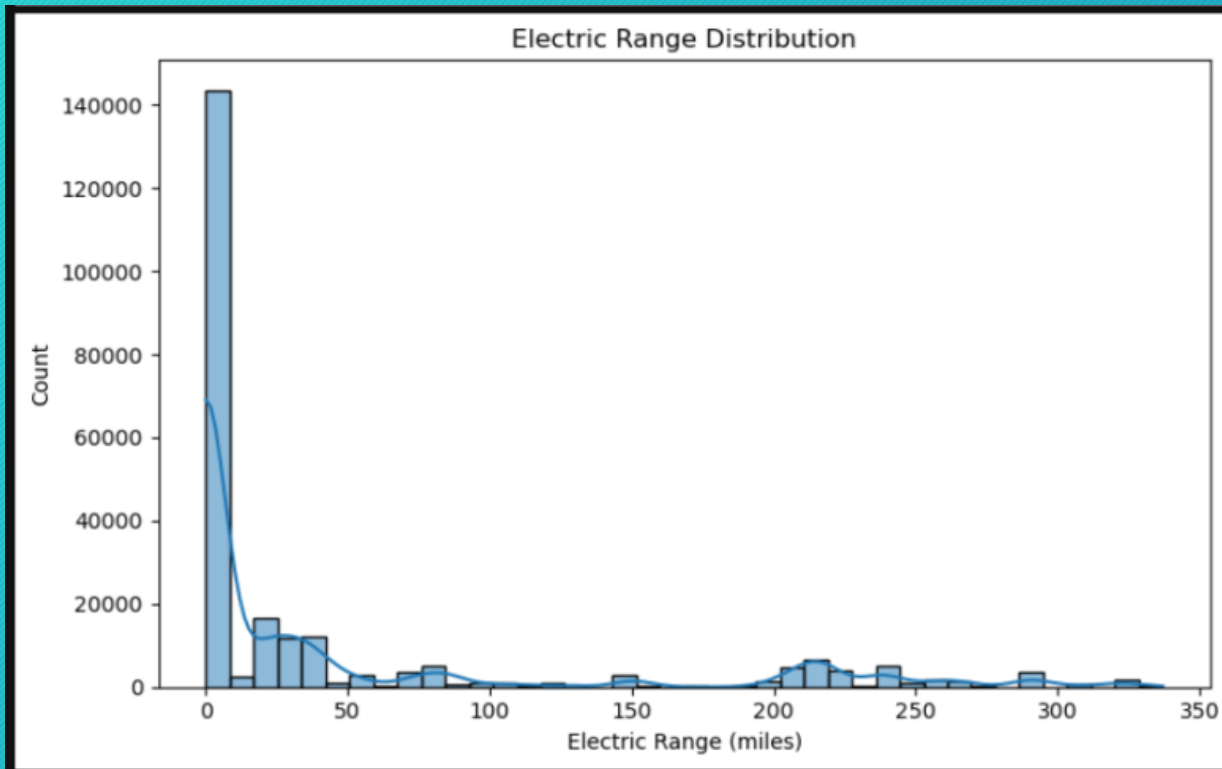Top 10 Electric Vehicle Brands

- Tesla leads by a significant margin: its count is nearly five times that of the second-ranked brand.

- Chevrolet, Nissan, and Ford follow Tesla, but with much smaller numbers, indicating a highly skewed distribution.

- The remaining brands: Kia, BMW, Toyota, Hyundai, Rivian, and Jeep have relatively similar, lower counts.

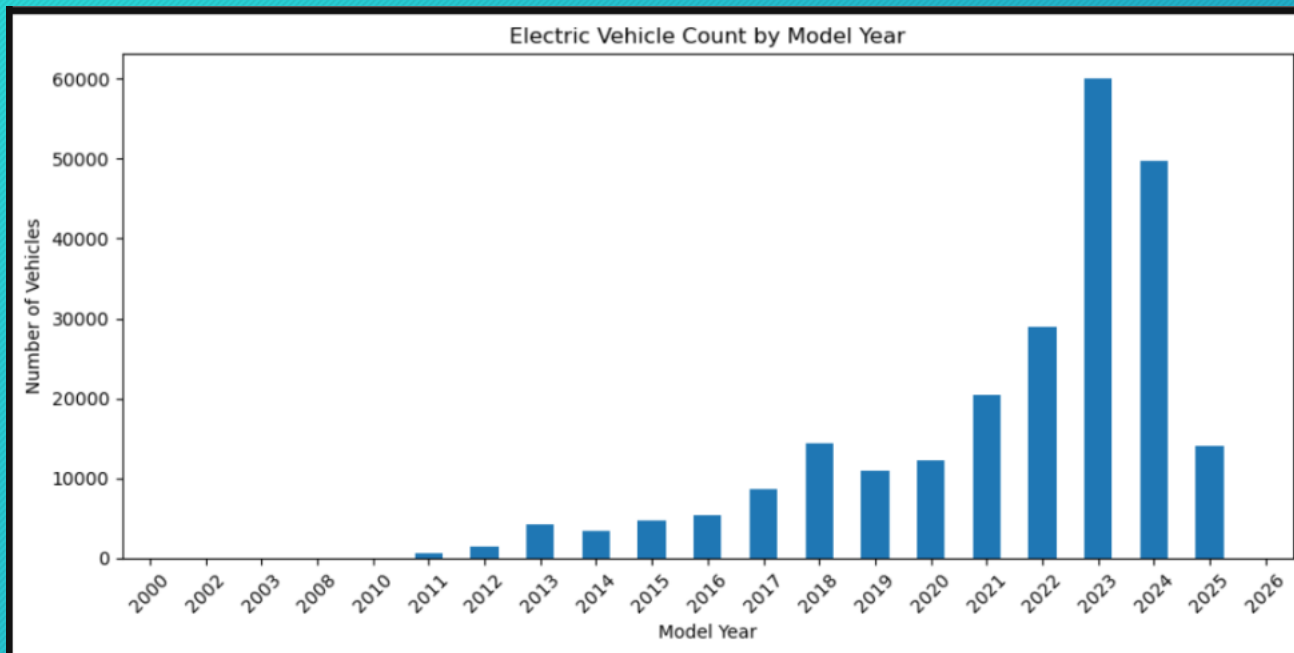# Data Analysis – Count of Electric Vehicle Type



- This bar chart shows how many times each vehicle type appears.

- Each bar represent the total number of registered vehicles for a specific EV type.

- Battery Electric Vehicles are most commonly used Vehicles in our dataset.

- The Battery Electric Vehicle is used twice as compared to the Plug-in Hybrid Electric Vehicle.

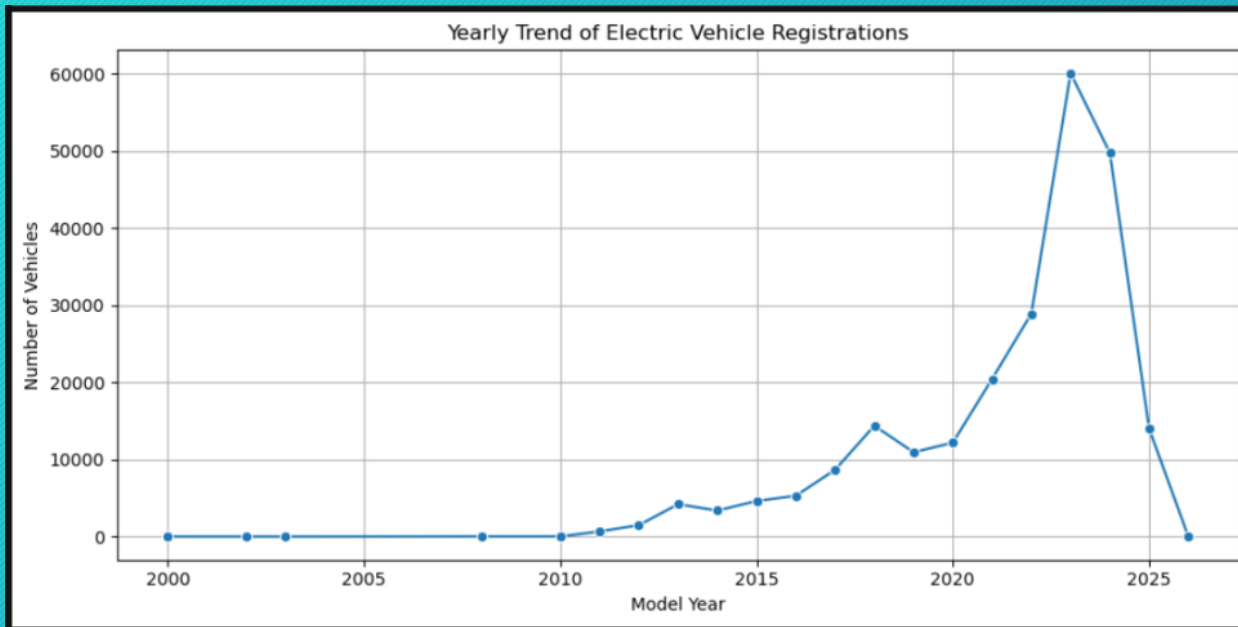# Data Analysis – Electric Range Distribution


Electric Range Distribution

- A very large number of vehicles have an electric range near 0 miles, suggesting many vehicles in the dataset are either plug-in hybrids with minimal electric-only range or possibly entries with missing/placeholder data.

- The data is right-skewed, with a long tail extending toward higher electric ranges, indicating fewer vehicles achieve those longer ranges.

- There are several peaks in the distribution at more usable ranges like:
  - Around 20-40 miles: common for plug-in hybrids.
  - Around 100 miles and 150 miles: earlier-generation EVs.
  - Around 200–300 miles: modern fully electric vehicles like those from Tesla, Rivian, etc.

# Data Analysis – Electric Vehicle Count by Model Year
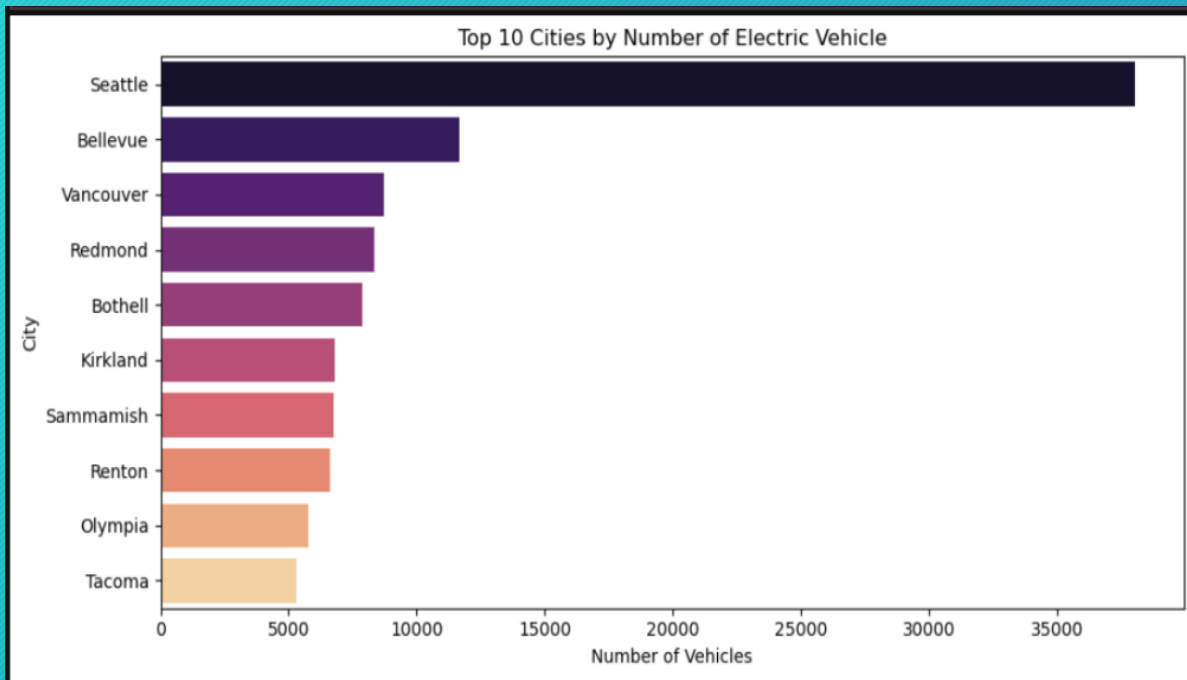


Electric Vehicle Count by Model Year

- Steady Growth Until 2020:From 2011 to 2020, the number of EVs grows steadily. This reflects the early adoption phase and increasing consumer interest in electric vehicles, likely driven by:
  - Early models like the Nissan Leaf and Chevy Volt.
  - Gradual improvements in battery tech.
  - Introduction of EV incentives and emissions regulations.2.
- Rapid Acceleration After 2020:There is a sharp increase in 2021, and an even more dramatic spike in 2022 and 2023, where:
  - 2023 hits the peak with over 60,000 vehicles.
  - This aligns with the rise in Tesla sales, entry of newer players like Rivian and Lucid, and expansion of EV offerings by legacy automakers.3.
- Drop in 2024 and 2025:A drop is seen in 2024 and even more in 2025 (which may be incomplete data, as it's an ongoing or future model year at the time of data collection).

# Data Analysis – Yearly Trend of Electric Vehical
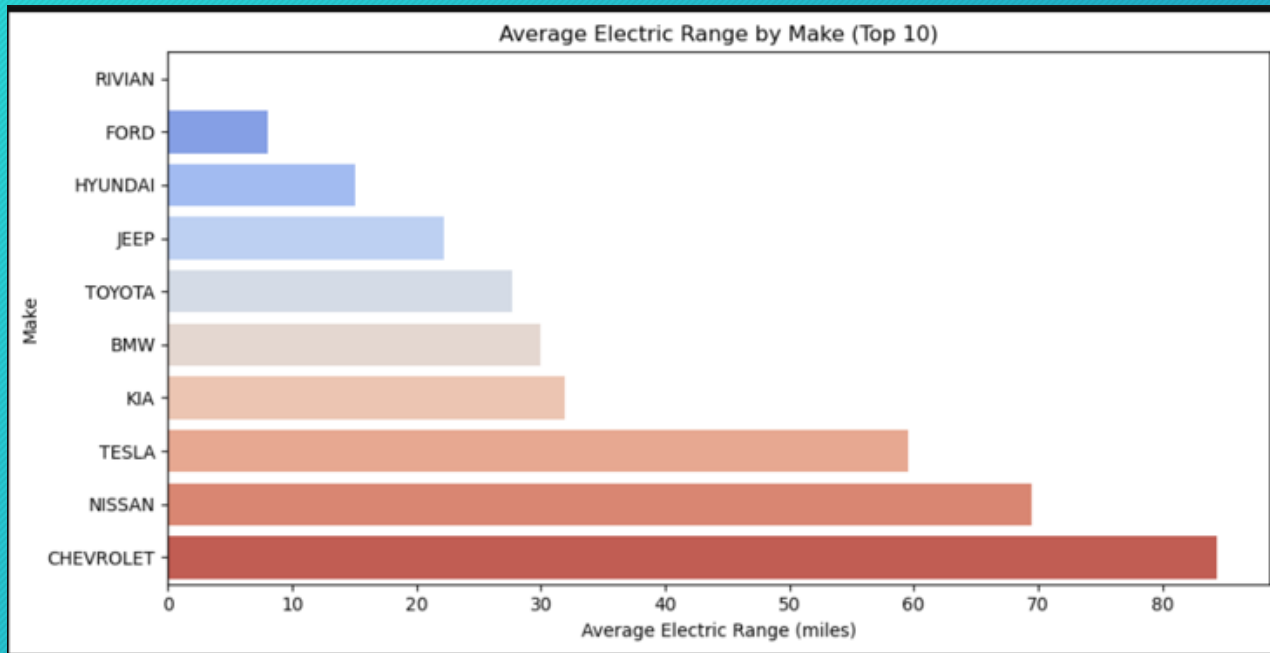


Yearly Trend of Electric Vehicle Registrations

- Flat Trend Until ~2010:
  - From 2000 to around 2010, EV registrations remained negligible or zero.
  - This reflects the pre-commercialization era of EVs, when few or no consumer models were available.

- Gradual Uptake (2011–2017):
  - 2011 onwards, the graph shows a steady increase in registrations.
  - Likely driven by the launch of early EVs like the Nissan Leaf, Tesla Model S, and Chevy Volt, and growing consumer interest.
  - Public and private investment in EV charging infrastructure also contributed.

- Rapid Growth Phase (2018–2023):
  - Significant rise from 2018, with a sharp upward spike peaking in 2023 at over 60,000 vehicles.

- Drop-Off After 2023:
  - A steep decline in 2024 and 2025.2024 shows reduced registrations (~50,000).2025 sees a dramatic drop to below 20,000, approaching pre-2020 levels.

# Data Analysis – Top 10 Cities by Number of Electric Vehicle



Top 10 Cities by Number of Electric Vehicle

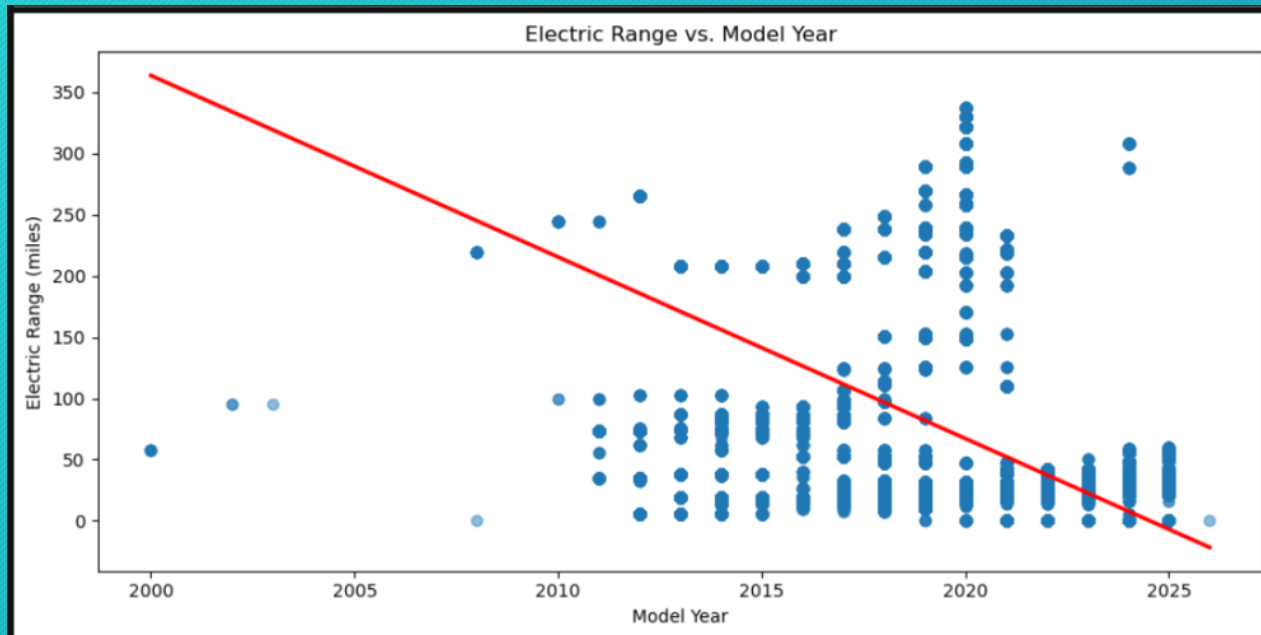- Seattle Leads Significantly. Seattle is by far the top city with close to 38,000 EVs. Its lead is more than double that of the second-ranking city. Reflects Seattle's: Urban density and progressive population. Strong EV infrastructure (e.g. charging stations).Local government support for sustainability.

- Bellevue, Vancouver, Redmond Follow Bellevue ranks second (~13,000 EVs), followed closely by: Vancouver  Redmond These cities are suburban and affluent, with residents more likely to adopt EVs early due to income and environmental awareness.

- Other Cities with Moderate AdoptionBothell, Kirkland, Sammamish, Renton, Olympia, Tacoma round out the top 10.Each of these cities has between 5,000 and 9,000 EVs.

- Geographic & Economic Correlation All cities are in Washington State, many near Seattle (Puget Sound region).

# Data Analysis – Average Electric Range by Make


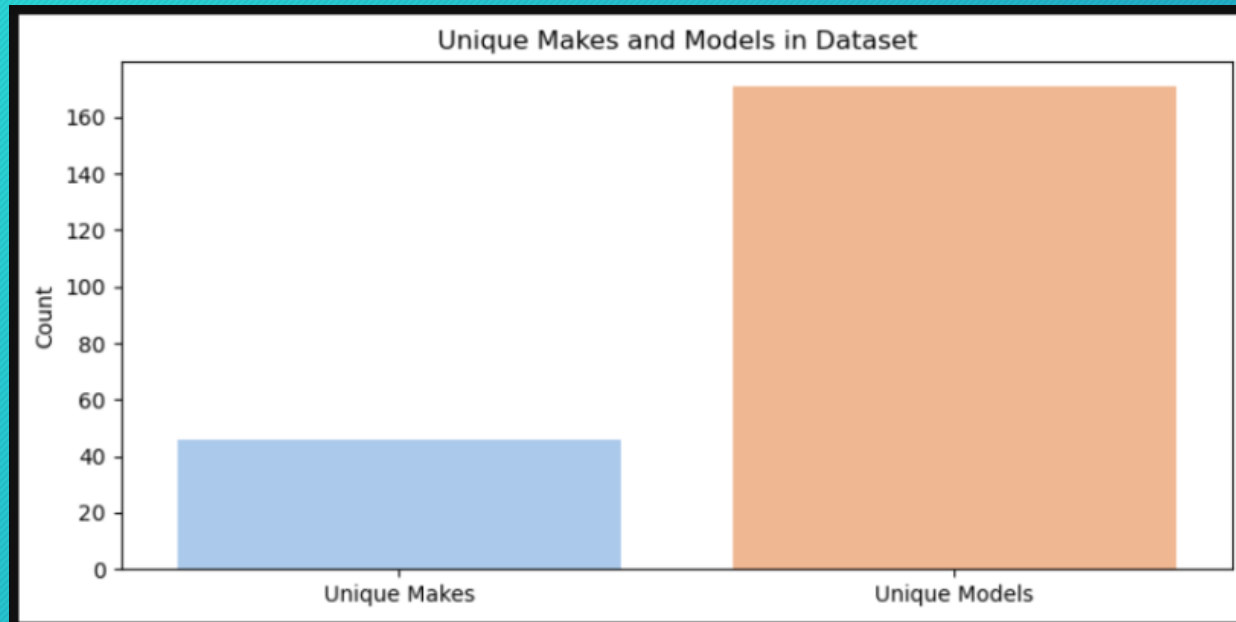
Average Electric Range by Make (Top 10)

- CHEVROLET has the highest average electric range, followed by NISSAN and TESLA.

- RIVIAN, FORD, and HYUNDAI have the lowest average ranges among the top 10.

- There's a noticeable variation in range among different manufacturers, suggesting differences in EV technology, battery capacity, and intended use cases.

# Data Analysis –Electric Range vs Model Year



Electric Range vs. Model Year

- Range Distribution by Model Year:
  - Early Years (2000–2010):Sparse data. Limited range, generally below 150 miles. Reflects first-generation EVs with low battery capacity.
  - 2011–2017:Increase in variety and range. Some vehicles reach 200–250 miles. Emergence of longer-range models like Tesla.
  - 2018–2021:Broader range spectrum, some vehicles exceed 300 miles. Continued dominance of mid-range models (~100–250 miles).Peak in both quantity and range variety.
  - 2022–2025:Dense clustering of vehicles in low to mid-range (0–150 miles).Fewer high-range vehicles compared to earlier peak years. May suggest growing share of budget or city EVs with modest range.
  - The red trendline shows a declining linear trend in electric range over time. This is counterintuitive — modern EVs are generally improving in range.
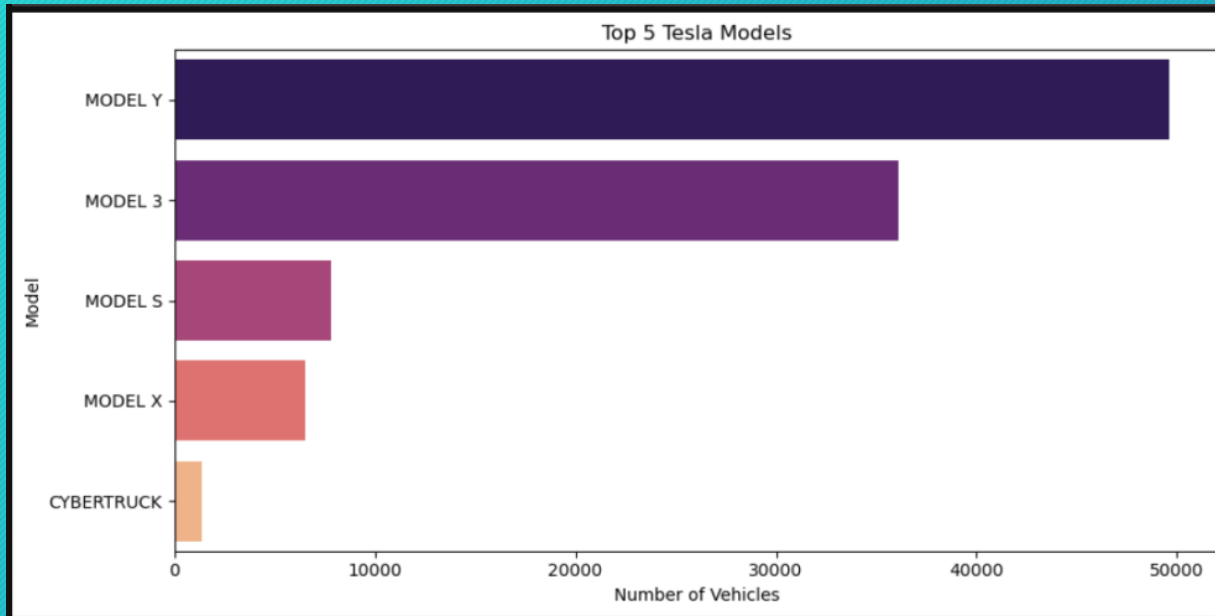
# Data Analysis – Unique Makes & Models



Unique Makes (Brands)

- There are approximately 45 unique makes.
- This indicates a broad participation of automotive manufacturers in the EV space.
- Reflects both legacy automakers (e.g., Ford, GM) and new entrants (e.g., Tesla, Rivian, Lucid).

**Unique Models:**

- There are around **170 unique models**.
- Suggests a **high level of product variation** within brands.
- Implies that on average, each make offers roughly **3 to 4 different EV models**.

# Data Analysis – Top 5 Tesla Model


Top 5 Tesla Models

- Model Y:Most popular Tesla model by a large margin. Registered count is close to 50,000 units. Reflects its success as a compact SUV with broad consumer appeal.

- Model 3:The second most popular, with approximately 36,000 units .Known for being Tesla's most affordable and widely adopted sedan.

- Model S and Model X:Both models have significantly fewer registrations (~6,000–8,000 range).Positioned as premium/luxury vehicles, likely resulting in lower volumes.

- Cybertruck: Smallest volume, under 2,000 units, possibly reflecting a recent launch or limited production availability.

# Conclusion

- EV range innovation exists, but market diversification is pulling down the overall average.

- The dataset shows a healthy and competitive EV ecosystem. Continued expansion in both makes and models is expected as technology improves, and demand grows.

- The lower registration numbers for the Cybertruck suggest it's still early in its product lifecycle.

- Tesla's Model Y and Model 3 dominate the EV landscape, driving the bulk of its registrations.

# Thank You

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