ELECTRIC VEHICLES MARKET SIZE ANALYSIS USING PYTHON

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Batch code : ANP-C8256

Submitted to Anudip Foundation
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Objectves :

Market size analysis is a critical tool for evaluating the potential sales volume and growth opportunities within a market. It helps businesses estimate demand, assess market penetration, and identify untapped market segments. In this project, we focus on analyzing the Electric Vehicles (EV) market size using Python, a versatile programming language for data analysis and visualization.

By the end of the analysis, actionable insights will emerge, offering a comprehensive understanding of the EV market size. This data-driven approach will support stakeholders in identifying opportunities, optimizing strategies, and driving sustainable growth in the EV industry.

Problem statements :

The Electric Vehicle (EV) market is growing rapidly, driven by advancements in technology, government policies, and increasing consumer awareness of sustainable transportation. However, businesses, policymakers, and investors often face challenges in understanding the true potential of this market. Questions such as "How big is the EV market?", "What percentage of the market has been captured?", and "Where are the biggest opportunities for growth?" remain unanswered without detailed analysis.

This project aims to solve these challenges by analyzing the EV market size using data and Python. The goal is to estimate the total potential of the EV market (Total Addressable Market or TAM) and understand how much of this potential has already been realized (market penetration). Additionally, the analysis will uncover growth trends, identify untapped opportunities, and highlight the key factors driving EV adoption.

Data Descripton :

The dataset was retrieved from a Kaggle source and contains information about the electric vehicles (EV) market, including market size, growth trends, regional distribution, manufacturers, EV models, sales data, and adoption rates. This data will be analyzed using Python to uncover key insights into historical growth patterns, regional trends, manufacturer contributions, and future market projections.

Data Models :

- **Entities and Attributes :**
    - ✧ **Attributes :**

- **VIN (1-10)** : Partial Vehicle Identification Number.
- **County** : The county in which the vehicle is registered.
- **City** : The city in which the vehicle is registered.
- **State** : The state in which the vehicle is registered.
- **Postal Code** : The postal code where the vehicle is registered.
- **Model Year** : The year of the vehicle model.
- **Make** : The manufacturer of the vehicle.
- **Model** : The model of the vehicle.
- **Electric Vehicle Type** : The type of electric vehicle, e.g., Battery Electric Vehicle (BEV).
- **Clean Alternative Fuel Vehicle** (**CAFV**) **Eligibility** : Eligibility status for clean alternative fuel vehicle programs.
- **Electric Range** : The maximum range of the vehicle on a single charge (in miles).
- **Base MSRP** : The Manufacturer's Suggested Retail Price.
- **Legislative District** : The legislative district where the vehicle is registered.
- **DOL Vehicle ID** : Department of Licensing Vehicle Identification.
- **Vehicle Location** : Geographic coordinates of the vehicle location.
- **Electric Utility** : The electric utility service provider for the vehicle's location.
- **2020 Census Tract** : The census tract for the vehicle's location

Approach:

1. **Data Import and Libraries** :

- **Libraries Used** : Pandas, Matplotlib , Seaborn , NumPy
- **Process** :
  - Import relevant libraries.
  - Load the dataset and inspect its structure for initial insights.

2. **Data Cleaning** :

- Checks missing values, duplicates, or any inconsistencies in the dataset.
- Standardize values for clarity.

3. **Exploratory Data Analysis (EDA)** :

- Use visualizations (e.g., bar charts, line plots) to identify trends over time and
- Geographical patterns.

Project Results :

1. **Concentration of EV Registrations :** EV registrations are concentrated in urban areas, particularly in counties with high population densities. Legislative districts with supportive policies or incentives showed significantly higher adoption rates.

2. **Popular Makes and Models :** Tesla models dominated the registrations, accounting for a large share of the EV market. Other brands such as Nissan (e.g., Leaf) and Chevrolet (e.g., Bolt) also showed strong presence, especially in regions with mid-income demographics.

3. **Electric Range Insights** : Vehicles with longer electric ranges (>200 miles) are more commonly adopted in suburban and rural areas, where charging stations are less accessible. In contrast, urban areas showed a preference for mid-range vehicles.

4. **CAFV Eligibility** : Vehicles eligible for clean alternative fuel programs represent a significant proportion of registrations. These programs appear to play a critical role in promoting EV adoption, especially in districts where eligibility rates are high.

5. **Electric Utility Correlation** : Regions served by utilities with extensive support for EV charging infrastructure (e.g., fast chargers, renewable energy programs) show higher adoption rates.

6. **Census Tract Trends** : EV adoption is strongly correlated with income levels and urbanization. Wealthier and more urbanized census tracts report significantly higher registration volumes.

Conclusion :

In conclusion, of above analysis is to leverage historical EV registration data to understand the current market penetration of EVs, predict future market growth, and identify key trends and factors driving market expansion. The specific goals include:

- Assess the historical growth trend of EV registrations.
- Forecast future EV registrations based on historical trends.
- Analyze the distribution of EV registrations across different models, makes, and geographical regions.
- Estimate the market size and growth potential of the EV market for upcoming years.
- Provide insights to support stakeholders in decision-making processes related to production, infrastructure planning, and policy formulation.