EV ANALYSIS Dashboard

The domain of the Project

Electric Vehicle anlysis

Dashboard

(Power BI)

Under the guidance of
Mrs.Siddhika Shah

By
Mr. Yuvaraj Podili (B.tech)

Period of the project
February 2025 to March 2025

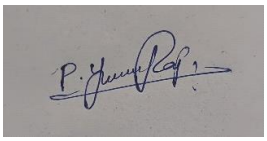
SURE TRUST PUTTAPARTHI,
ANDHRA PRADESH

DECLARATION

The project titled **"*Electric Vehicle Analysis Dashboard With Power BI*"** has been mentored by **Mrs.Siddhika Shah** and organized by SURE Trust from February 2025 to March 2025**.** This initiative aims to benefit educated unemployed rural youth by providing hands-on experience in industry-relevant projects, thereby enhancing employability.

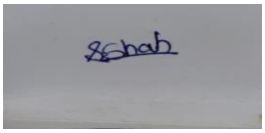
I, **Mrs.Siddhika Shah,** hereby declare that I have solely worked on this project under the guidance of my mentor. This project has significantly enhanced my practical knowledge and skills in the domain.

Name **Signature**



Mr. Yuvaraj Podili

Mentor **Signature**



Mrs.Siddhika Shah

Seal & Signature

Prof.Radhakumari
Executive Director &
Founder
SURE Trust

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Executive Summary

In this dashboard we studied about Electric Vehicle (EV) Analysis, presenting insights into total EV adoption, vehicle types, model years, manufacturers, state-wise distribution, and policy eligibility. The dashboard shows a total of **150.42K EVs**, with an average electric range of **67.83 km**. Battery Electric Vehicles (BEVs) make up **78% (117K)**, while Plug-in Hybrid Electric Vehicles (PHEVs) account for **22% (34K)**. The **trend analysis** of total vehicles by model year

reveals a sharp rise, peaking at **37K** around 2021 before dropping. A **state-wise heatmap** visualizes geographical distribution, while Tesla dominates the EV market with **69K vehicles**, followed by Nissan (13K) and Chevrolet (12K). Additionally, the **CAFV eligibility breakdown** categorizes vehicles based on incentives, with **46.33% eligible**, **41.81% clean alternatives**, and **11.86% not eligible**. A **model-wise distribution** highlights Model 3 (29K) and other popular variants. This dashboard serves as a comprehensive tool for analyzing EV adoption trends, manufacturer market share, and regulatory impact across different states.

Introduction

Background and Context

The rapid global shift toward sustainable mobility has led to increased adoption of electric vehicles (EVs). Governments, manufacturers, and utility providers are under pressure to monitor and accelerate this transition by understanding where and how EVs are being adopted. However, data on EV distribution by make, model, location, and eligibility is often scattered, inconsistent, or difficult to interpret for quick decision-making. This makes it challenging for stakeholders to identify adoption trends, gaps in infrastructure, policy impact, and consumer behavior.

Problem Statement

Despite the availability of EV registration data, stakeholders face challenges due to the absence of a centralized, interactive, and visual platform that effectively presents this information. This makes it difficult to track EV adoption trends by state and model, assess manufacturer market dominance, identify underrepresented regions or vehicle types, and evaluate the impact of policies like CAFV eligibility. As a result, infrastructure planning and investment decisions are often fragmented and reactive, limiting the ability to drive informed, data-backed growth in the electric vehicle ecosystem.

Scope

The dashboard focuses on visualizing and analysing electric vehicle (EV) registration data across the United States. It covers key variables such as vehicle make, model, type (BEV, PHEV), model year, state-wise distribution, and CAFV eligibility status. The scope includes:

- Tracking **EV adoption trends over time** based on model year
- Identifying **market leaders** and analysing **manufacturer dominance**
- Visualizing **geographic distribution** of EVs across states
- Filtering by **vehicle type, make, and eligibility** for targeted analysis
- Assessing the **policy impact** through CAFV eligibility mapping
- Supporting **strategic decisions** related to infrastructure, incentives, and market targeting

This dashboard is designed for use by policymakers, transportation planners, automakers, researchers, and sustainability advocates to support informed, data-driven decisions in the growing EV landscape.

Non-ML Approach

This project relies entirely on Power BI's data modeling, DAX calculations, and visualization features without the use of machine learning. Insights are derived through descriptive analysis and graphical representation of time-series, categorical, and numerical data.

Limitations

- The analysis is limited to static datasets and does not include real-time sales updates.
- Data quality and insights are constrained by the completeness and accuracy of the input data.
- External factors such as promotions, market trends, or supply chain disruptions are not considered.
- The dashboard does not include predictive or prescriptive analytics.

Innovation

This project the Electric Vehicle Analysis dashboard lies in its ability to transform complex EV data into a dynamic, intuitive, and visually compelling tool for decision-making. By integrating multiple dimensions—such as vehicle make, model, type, state-wise distribution, model year, and CAFV eligibility—the dashboard enables users to quickly extract actionable insights. Its real-time, interactive design supports both technical and non-technical audiences, while features like brand dominance visualization and eligibility mapping highlight key market gaps and policy opportunities. Overall, the dashboard serves as a forward-thinking platform that not only informs but actively supports strategies.

Project Objectives

Project Objectives:

- **Data Cleaning and Preparation**

To preprocess and transform raw datasets into a structured format suitable for analysis in Power BI. This includes handling missing values, renaming columns, changing data types, and creating calculated columns/measures using DAX.

- **Data Modeling**

To establish relationships between different tables such as sales data, product details, and shipping status. This step ensures that slicers and visuals work cohesively and allows for dynamic filtering across the dashboard.

- **Visual Design and Layout**

To create an intuitive and visually appealing dashboard by organizing charts, tables, slicers, and KPIs in a clean layout. Emphasis is placed on clarity, interactivity, and ease of navigation between multiple report pages.

- **DAX Measures and Calculations**

To develop meaningful calculations using DAX formulas, such as total sales, total units, returns, and customer reviews. These measures provide business-specific insights and allow users to compare performance across different dimensions.

- **Interactive Features and Filters**

  To enable interactivity through slicers (e.g., date, category, status) and navigation buttons. These features empower users to explore data dynamically and focus on specific subsets of interest without modifying the underlying dataset.

Expected Outcomes:

1. Strategic Planning for EV Infrastructure
   - Charging station deployment can be optimized by identifying states with growing EV numbers or low adoption (gray areas on the map).
   - Urban planning and utilities can better forecast energy demand shifts based on EV concentration.
2. Informed Policy Decisions
   - Policymakers can:
     - Promote CAFV eligibility expansion to convert the 41.81% of non-eligible EVs.
     - Offer state-level incentives where adoption is low.
   - Environmental regulators can track progress toward clean transportation goals.
3. Market & Sales Strategy Insights
   - Automakers and dealerships can focus marketing on:
     - Popular models (e.g., Tesla Model Y, Model 3)
     - States with high adoption or potential growth.
   - Identify declining models or brands with lower traction for re-evaluation.
4. Consumer Behavior Analysis
   - Understand consumer preferences over time:
     - Rise of BEVs over PHEVs.
     - Spike in adoption in recent years (especially 2022).
   - Predict future purchase trends based on historical model year data.
5. Investment & Funding Justification
   - Utilities or government bodies can use this dashboard to justify:
     - Investments in EV incentives, rebates, or infrastructure.
     - Funding for clean energy projects aligned with EV growth.
6. Benchmarking & Performance Tracking
   - Compare year-on-year growth.
   - Benchmark adoption against national goals or emission reduction targets.

Operational Benefits:

- Improved business insights for stakeholders through intuitive visuals and dynamic filters
- Enhanced decision-making by minimizing the need for manual data analysis
- A scalable Power BI solution that can be updated easily with new datasets or extended with features like trend forecasting or automated alerts.

Methodology and Results

Methods/Technology Used:

The project applies Data Analytics and Business Intelligence (BI) methodologies to transform raw Amazon sales data into meaningful insights. It includes:

- **Data preprocessing**: Cleaning and transforming the sales, product, and order status data using Power Query Editor in Power BI.
- **Data modeling**: Establishing relationships between tables (e.g., sales, products, reviews, and shipping), and creating DAX measures for calculations like total sales, units, and returns.
- **Interactive visualization**: Utilizing bar charts, line graphs, slicers, and buttons to uncover patterns in sales trends, product performance, and regional distribution.
- **Descriptive analysis**: Summarizing sales history to show what products and locations contributed most to revenue and units sold.
- **Diagnostic analysis**: Analyzing returns, reviews, and delivery statuses to understand potential issues in sales or logistics performance.

Tools/Software Used:

- **Microsoft Power BI Desktop**: Primary tool for dashboard creation, data modeling, and interactive visualization.
- **Power Query Editor**: Used for cleaning, filtering, and shaping the data before analysis.

- **DAX (Data Analysis Expressions)**: For creating custom KPIs, aggregations, and calculations.
- **Excel/CSV Files**: Data source format used for importing Amazon sales and product data.
- **MS Excel or Google Sheets**: For initial inspection or minor data adjustments before loading into Power BI.

All data was static and imported in CSV format. No real-time APIs were integrated.

Project Architecture:

Data Source Layer

CSV files containing structured data related to sales, products, order statuses, and customer reviews.

Data Preparation Layer

Power Query Editor was used for cleaning and transforming the data. This included removing duplicates, changing data types, splitting columns, and renaming headers for clarity.

Data Modeling Layer

Logical relationships were created between tables. Calculated columns and DAX measures were developed to compute metrics like total sales, returns, filtered sales, and number of reviews.

Visualization Layer

Dashboards were designed using various Power BI visuals such as bar charts, line graphs, cards, slicers, and tables to showcase sales trends, product performance,and location-wise analysis.

User Interaction Layer

Slicers and buttons were added to enable end-users to interact with the report—filtering by date, product category, city, or order status for dynamic data exploration.

Results

- **EV Dashboard Outcomes:**

  Tesla dominates the EV market by a large margin, both in make and model.

  There is **consistent and accelerating growth** in EV adoption, especially post-2020.

  The majority of EVs are BEVs, showing a **strong shift toward full electrification** rather than hybrids.

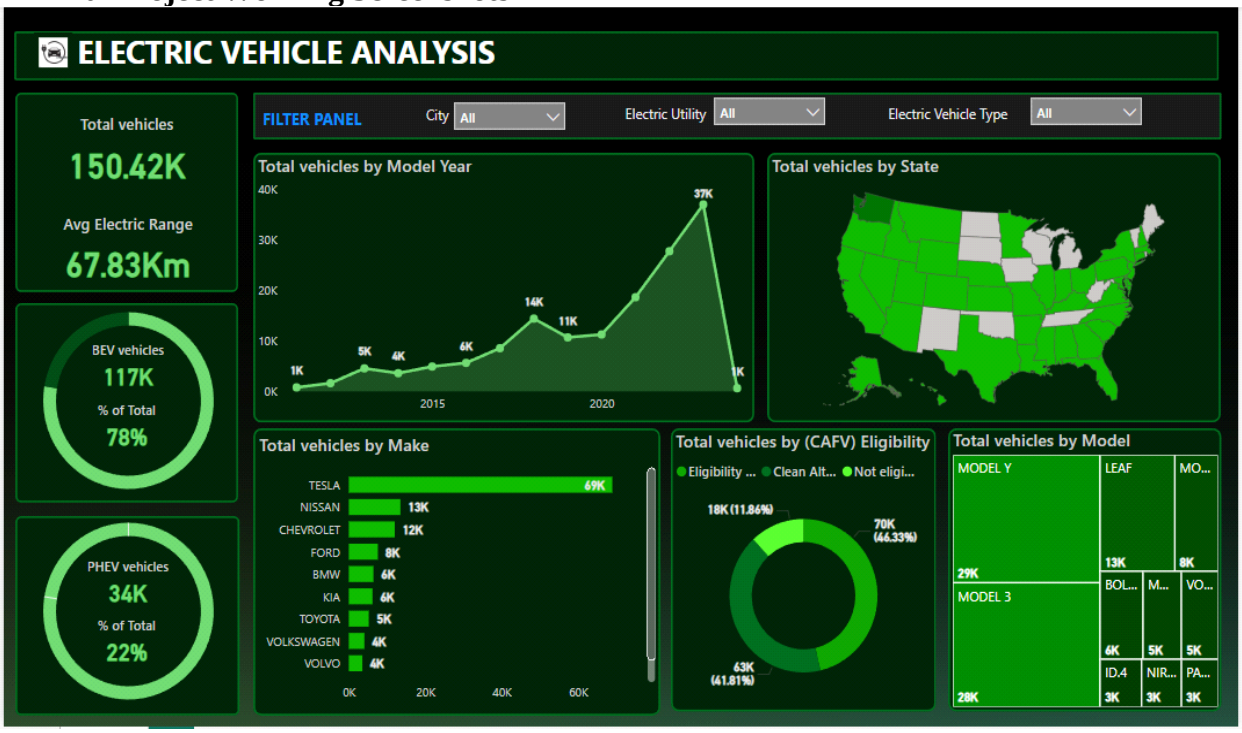
  While **eligibility for clean vehicle programs is high**, a notable portion still falls short.

  Geographic distribution highlights widespread adoption but also shows **opportunities in underrepresented states**.

  This analysis provides **valuable insights for policymakers, utility companies, and EV manufacturers** on market penetration, eligibility programs, and model performance.

- **Dashboard:**

Final Project Working Screenshots



GitHub Link

https://github.com/sure-trust/YUVARAJ-PODILI-g16-sql/tree/main

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Learning and Reflection

Learning and Reflection

This project has been a valuable learning journey, helping me grow both technically and analytically. By working with Power BI to build an Amazon Sales Dashboard, I gained hands-on experience in data visualization, dashboard creation, and business intelligence. I learned how to clean and structure raw sales data, build relationships between tables, write DAX formulas, and design visuals that present insights in a clear and impactful way.

One of the most important lessons was learning how to communicate stories through data. By using interactive elements like slicers, buttons, and filters, I discovered how to let users explore different views of the data, enabling them to make informed business decisions more efficiently.

I also came to understand the critical role of data accuracy and consistency. Every chart, card, and table needed to be precise to ensure users could trust the insights they were seeing. Whether analyzing sales by city or tracking returns, it was essential that the visuals were both accurate and user-friendly.

On a personal level, this project sharpened my problem-solving abilities, improved my attention to detail, and boosted my confidence in using Power BI. I now feel more equipped to apply these skills in real-world scenarios and contribute to data-driven strategies in business environments.

Overall, this project not only improved my technical capabilities but also deepened my understanding of how data can be transformed into actionable insights that support smarter business decisions.

Conclusion and Future Scope

The Electric Vehicle Analysis dashboard successfully consolidates complex EV registration data into an interactive and intuitive platform, offering valuable insights into adoption patterns, market distribution, and policy eligibility. By enabling multi-level filtering across vehicle type, make, model year, and geographic regions, the dashboard empowers stakeholders to make informed decisions in real time. It highlights brand dominance, regional gaps, and policy impact—especially through the visualization of CAFV eligibility—making it a powerful tool for strategic planning in the evolving EV ecosystem.

Future Scope

To enhance its functionality and impact, the dashboard can be expanded in several ways:

- **Incorporate real-time or regularly updated data** for ongoing analysis
- **Integrate charging infrastructure data** to correlate EV adoption with charger availability
- Add **demographic and income-level filters** to understand user profiles and target outreach
- Include **carbon emission reduction estimates** to show environmental benefits
- Implement **predictive analytics or forecasting models** to project future EV trends
- Enable **county- or city-level breakdowns** for hyperlocal policy planning

These enhancements will make the dashboard even more robust, supporting not just analysis but proactive decision-making and long-term strategic development in the EV domain.

Achievements

 Successfully Designed Electric Vehicle Dashboard

Developed an interactive Power BI dashboard that visualizes electric vehicle (EV) registration

data across the U.S., uncovering adoption trends, manufacturer market share, model distribution, and policy eligibility.

 Advanced Data Modeling

Created a well-structured data model with defined relationships between EV attributes such as vehicle type, make, model year, state, and CAFV eligibility. Implemented DAX measures to compute dynamic KPIs and comparative metrics.

 Data Transformation and Cleaning

Utilized Power Query Editor to prepare raw EV datasets by removing null values, correcting data types, renaming inconsistent column headers, and transforming fields for accurate and efficient analysis.

 Insightful Visualizations

Designed meaningful visual elements including clustered bar charts, line graphs, map visuals, pie charts, and KPIs that illustrate top manufacturers, eligible vs. non-eligible vehicles, state-wise adoption, and model year trends.

 User-Friendly Interface

Crafted a clean, logical layout that enables users to interact with data through slicers and filters for make, model, type, CAFV eligibility, and state, making exploration intuitive and focused.

 Demonstrated Analytical Thinking

Revealed key insights such as Tesla's market dominance (69%), state-wise disparities in EV adoption, and gaps in CAFV eligibility—highlighting strategic areas for policy, marketing, and infrastructure improvement.

 Scalability and Future-Readiness

Designed the dashboard to support future integration of real-time data sources, advanced analytics like trend forecasting, and additional layers such as charging infrastructure or emission savings.

 Skill Development

Strengthened expertise in Power BI, DAX, data modeling, and interactive visual storytelling—enhancing technical proficiency and real-world data interpretation capabilities in the sustainability and mobility domain.

Conclusion

The Electric Vehicle (EV) Analysis Dashboard provides a comprehensive and interactive platform to explore EV registration trends across the United States. By integrating key variables such as vehicle make, model, type, model year, state-wise distribution, and CAFV eligibility, the dashboard delivers clear, data-driven insights that aid in understanding market dynamics, identifying regional adoption gaps, and evaluating policy effectiveness. With its user-friendly design and powerful visual storytelling, the dashboard not only highlights current adoption patterns but also equips stakeholders—such as policymakers, manufacturers, and planners—with the tools needed for strategic decision-making. Overall, it serves as a forward-thinking solution that bridges the gap between raw EV data and impactful action in support of sustainable mobility.

Future Scope

- **Real-Time Data Integration**
  Connect the dashboard to live data sources like SQL databases, web APIs, or cloud platforms to enable real-time monitoring of sales, returns, and delivery status, helping teams respond quickly to changes.

- **Predictive Analytics and Forecasting**
  Incorporate predictive models using Python or R to forecast future sales, identify high-demand periods, or detect products likely to be returned. These models can help improve planning and strategy.

- **Geospatial Sales Analysis**
  Enhance the dashboard with map-based visuals (using Power BI Map or ArcGIS) to analyze regional sales distribution and identify high-performing and underperforming areas geographically.

- **User Alerts and Threshold-Based Notifications**
  Set up automated alerts for specific events such as sudden sales drops, high return rates, or low inventory levels, enabling quicker decisions and better issue management.

- **Role-Based Access and Custom Views**

Implement role-based dashboard views for different users such as category managers, sales heads, and logistics teams. This makes the tool more secure and relevant to each department's needs.

- **Mobile-Friendly Dashboards**
  Optimize the dashboard design for mobile use, ensuring that users can access insights anytime and anywhere, enhancing usability and accessibility.

- **Expansion to Other Retail Data**
  Extend the dashboard to include additional datasets like customer feedback, marketing performance, or seasonal sales trends, making it a more comprehensive and scalable BI solution for retail analytics.