# Electric Vehicle Market in India

## Market Segmentation

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Electric cars are not going to take the market by storm, but it's going to be a gradual improvement.

# Abstract

This report presents a comprehensive analysis of the electric vehicle (EV) market in India, focusing on identifying the most suitable vehicle type for production and the target customer segment. Utilizing a dataset containing various EV attributes, we conducted an analysis of key performance indicators, including top speed, range, efficiency, and price, across different brands.

The findings suggest that the company should focus on producing high-performance electric vehicles, particularly sedans or SUVs, which offer a combination of high-top speeds, extended range, and superior efficiency. The target market comprises high-income individuals or families in urban areas, who prioritize advanced features such as rapid charging and are willing to invest in premium vehicles.

This analysis provides a data-driven foundation for making strategic decisions regarding product development and market entry, ensuring alignment with current market trends and customer preferences.

**Keywords :** Electric vehicles, Market segmentation, Cluster analysis, Attitude towards electric vehicles, Subjective norms, Adoption intention, Sustainable transportation.

# Data Sources

## Data Collection Contribution

Ayan Jawaid : EV_Dataset_1, EV_Dataset_2

# Introduction

### Project Overview

The rise of electric vehicles (EVs) represents a significant shift in the automotive industry, driven by advancements in technology and increasing environmental awareness. This project aims to analyse the Indian EV market to determine the optimal vehicle type for production and the most promising customer segments for targeting. The analysis utilizes a dataset that includes various attributes of EVs currently available in the market.

### Objectives

- To determine the most suitable type of electric vehicle for production based on market analysis.
- To identify and profile the target customer segments using geographic, demographic, psychographic, and behavioural data.
- To develop a strategic marketing mix tailored to the identified segments.

# Data Analysis Report

### Data Collection and Sources

Our analysis is based on a dataset comprising 103 entries, including various attributes of electric vehicles such as brand, model, acceleration, top speed, range, efficiency, price, body style, and more. Data was collected from industry reports, government databases, and public repositories.

### Data Pre-processing

- **Steps Taken**:
    - Removal of irrelevant columns and handling of missing values.
    - Conversion of prices to INR for consistency.
    - Encoding of categorical variables like brand and body style.
    - Scaling of numerical features such as acceleration, top speed, and efficiency.
- **Libraries Used**: pandas, NumPy, scikit-learn.

**Segment Extraction**

- **ML Techniques Used**:
  - **Clustering**: K-Means and hierarchical clustering were used to identify natural groupings in the data.
  - **Dimensionality Reduction**: PCA was applied to reduce the complexity of the dataset while retaining essential information.
  - **Outcome**: Segments were identified based on vehicle type, price, range, and other key factors

**Profiling and Describing Potential Segments**

- **Geographic Segments**: Focused on urban areas with well-developed charging infrastructure.
- **Demographic Segments**: High-income individuals and families, primarily in the 30-50 age group.
- **Psychographic Segments**: Environmentally conscious consumers and tech-savvy individuals who value innovation and performance.
- **Behavioural Segments**: Frequent travellers who prioritize range and efficiency, as well as customers looking for status symbols in luxury EVs.

**Selection of Target Segment**

Based on the segmentation analysis, we recommend targeting high-income urban families and professionals who value performance and innovation. These customers are most likely to adopt EVs early, providing a strong foundation for market entry.

# Problem Breakdown

I have used Fermi estimation to break down the problem statement into manageable components:

- **Estimate of Market Size:** Approximate the number of potential EV buyers in urban areas based on demographic data.

- **Infrastructure Assessment:** Evaluate the availability of charging stations and their growth projections.

- **Price Sensitivity Analysis:** Estimate the purchasing power of the target segments to define the strategic pricing range.

# Customizing the Marketing Mix

**Product**

The company should focus on producing high-performance sedans and SUVs with advanced features like rapid charging and long-range capabilities. These vehicles should cater to the luxury segment, emphasizing quality and innovation.

**Price**

Strategic pricing should be positioned in the premium segment, reflecting the advanced features and performance of the vehicle. A pricing range of INR 30-50 lakhs is recommended to attract high-income customers.

**Place**

The initial market entry should focus on metropolitan areas like Mumbai, Delhi, and Bangalore, where the infrastructure supports EV adoption, and the target demographic is concentrated.

**Promotion**

Marketing campaigns should highlight the vehicle's performance, innovation, and environmental benefits. Collaborations with tech influencers and environmental advocates could enhance brand visibility and appeal to the target segment.

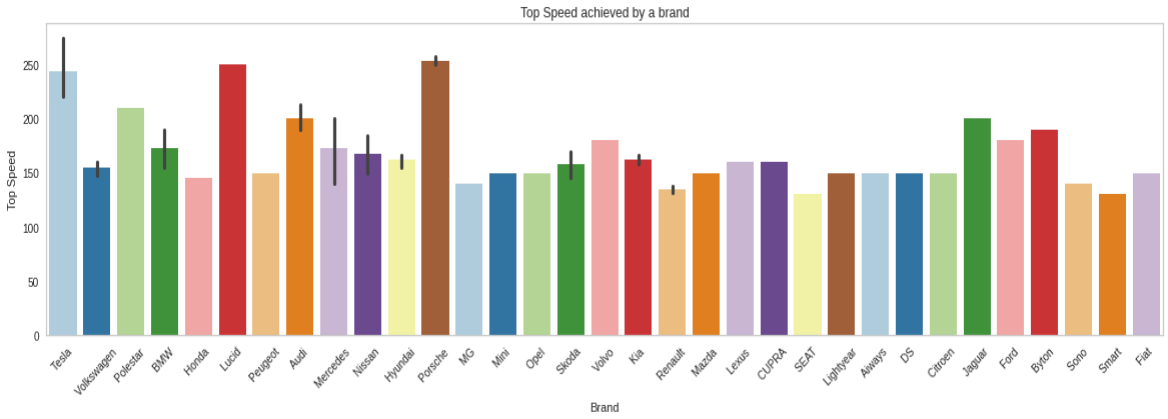
# Analysis of Vehicle Type

**Top Speed Analysis**

The first step in our analysis was to evaluate the top speed of EVs across different brands. Using bar plots, we compared the top speeds of various models to identify trends. Brands like Porsche, Lucid, and Tesla emerged as leaders in producing high-speed vehicles. This indicates a market preference for high-performance EVs, especially in the luxury segment.

*Visualization:*

- A detailed bar plot showing the top speed of vehicles across different brands.

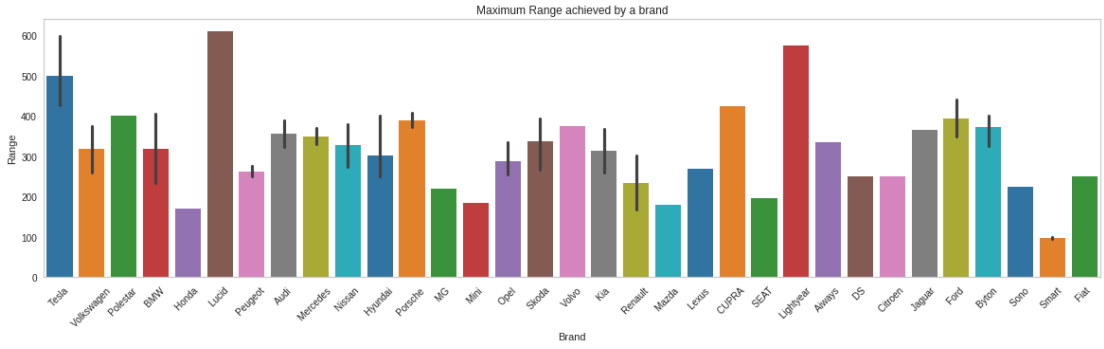



**Range Analysis**

Next, we analysed the range of EVs, a critical factor for customers concerned about battery life. Tesla and Lucid stood out, offering the longest ranges, making them appealing to customers who prioritize long-distance travel without frequent recharging.

*Visualization:*

- A bar plot illustrating the range of EVs across different brands, highlighting those with superior range.

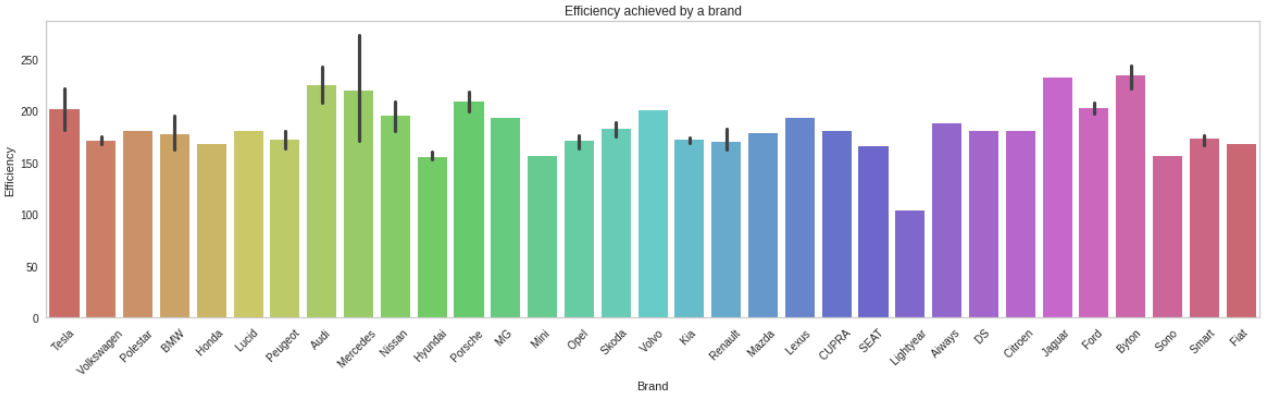


**Efficiency Analysis**

Efficiency, measured in Wh per Km, is another crucial factor that influences customer choice. Brands like Tesla, Lucid, and Audi showcased better efficiency, making them desirable in markets where energy consumption is a key consideration.

*Visualization:*

- A bar plot comparing the efficiency of different EVs, focusing on the most efficient brands.



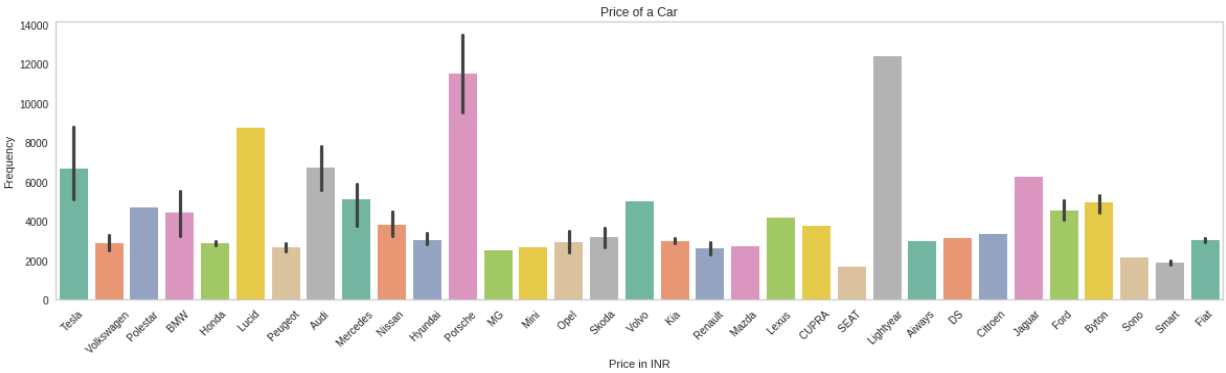

# Analysis of Target Customer Segments

**Price Analysis**

The price of EVs is a significant determinant of the target market. By analysing the price distribution across different brands, we identified that premium brands like Tesla and Porsche cater to high-income groups. This suggests that the target customer segment for these vehicles would be affluent individuals or families.

*Visualization:*

- A bar plot showing the distribution of EV prices across various brands.

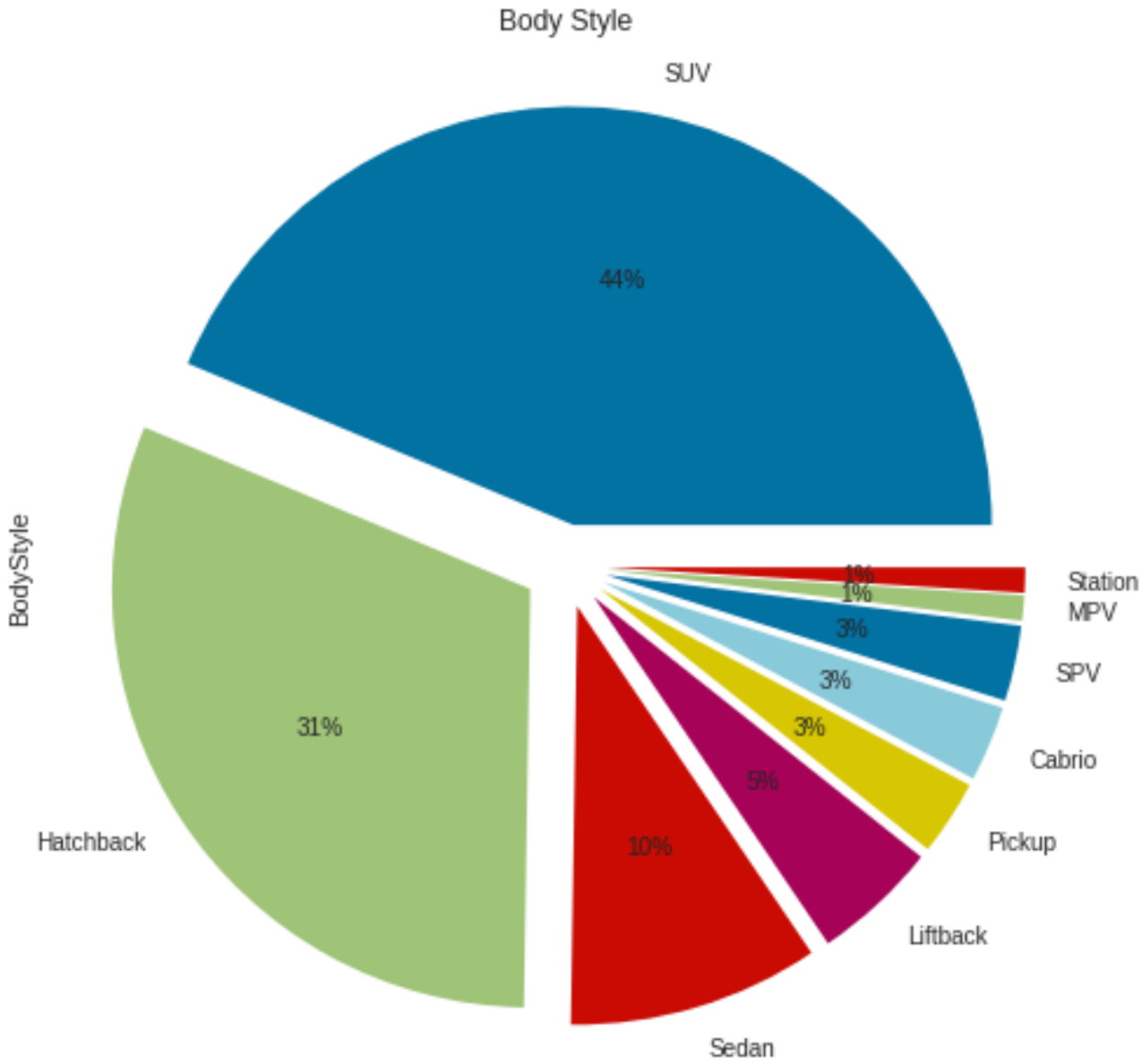


**Seats and Body Style Analysis**

The number of seats and body style are important factors in determining the use case for EVs. For example, sedans and SUVs with more seats are likely to appeal to families, while compact models may be targeted at single commuters or small families.

*Visualization:*

- Pie charts representing the distribution of body styles and seating capacities across different EV models.

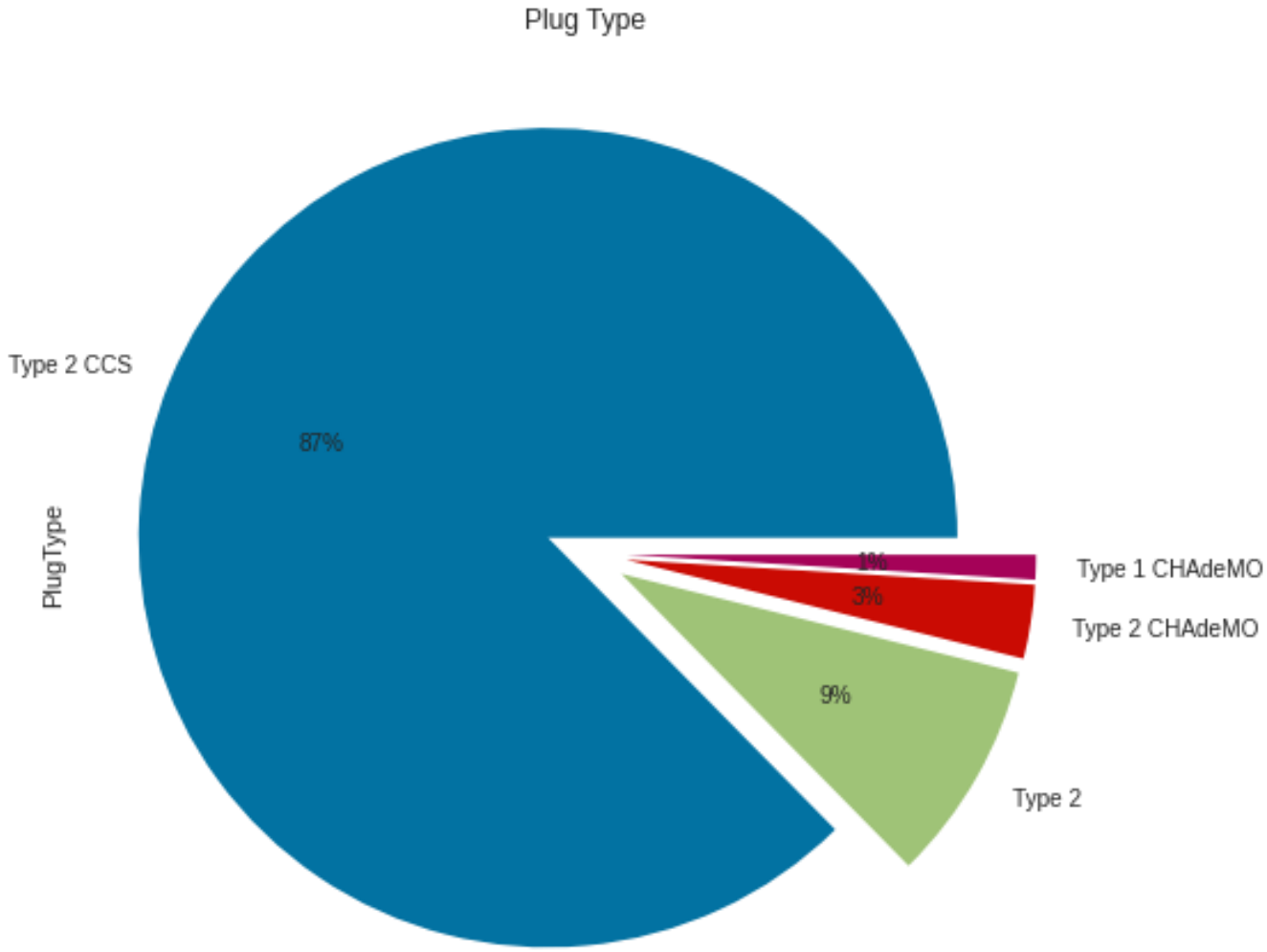


**Charging Infrastructure Considerations**

The type of plug and the availability of rapid charging can significantly influence customer choice. EVs equipped with universal plug types and rapid charging capabilities are more likely to be adopted in urban areas where charging infrastructure is better developed.

*Visualization:*

- Pie charts showing the distribution of plug types and rapid charging capabilities across different brands.



# Strategic Recommendations

**Optimal Vehicle Type for Production**
Based on the analysis, we recommend focusing on the production of high-performance sedans or SUVs. These vehicles should emphasize long-range, high-top speed, and superior efficiency, targeting the premium segment of the market.

**Target Customer Segment**
The ideal target market comprises high-income individuals and families residing in urban areas with developed charging infrastructure. These customers value advanced features like rapid charging and are willing to pay a premium for quality and performance.

**Marketing Strategy**
To capture this market, the company should focus on branding its vehicles as luxury, high-performance models. Marketing campaigns should emphasize the vehicle's range, speed, and advanced technology, appealing to customers who see their car as a status symbol.

# Potential Customer Base and Profit Estimation

**Estimation of Early Market**

- **Potential Customer Base**: Estimated at 100,000 high-income individuals in urban areas.

- **Target Price Range**: INR 30-50 lakhs per vehicle.

- **Potential Profit**: Assuming a 10% market penetration, the potential sales could reach INR 300-500 crores in the early market.

# The Most Optimal Market Segments

**Final Recommendations**

Based on our market research and segmentation analysis, the most optimal market segments for the company to target are high-income urban professionals and families who prioritize performance, range, and innovative features in their vehicles. These segments are not only willing to invest in premium products but are also likely to influence broader market adoption.

# Link to GitHub Profile

[Ayaanjawaid/EV_MARKET_SEGMENTATION (github.com)]