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**PG DEPARTMENT OF MATHEMATICS**

**PROJECT TITLE: VISUALIZATION TOOL FOR ELECTRIC VEHICLE**

**CHARGE AND RANGE ANALYSIS**

**SUBMITTED BY:**

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# **1.INTRODUCTION:**

## **1.1 OVERVIEW:**

A vehicle that can be powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source and have an electric motor instead of an internal combustion engine.

The Electric Vehicle (EV) is not new, but it has been receiving significantly more attention in recent years. Advances in both EV analytics and battery technologies have led to increased automotive market share. However, this growth is not attributed to hardware alone. The modern mechatronic vehicle marries electrical storage and propulsion systems with electronic sensors, controls, and actuators, integrated closely with software, secure data transfer, and data analysis, to form a comprehensive transportation solution. Advances in all these areas have contributed to the overall rise of EV's, but the common thread that runs through all these elements is data analytics.

The new EV's are combined Electrical storage and propulsion systems with electronic sensors, controls, and actuators, integrated closely with software, secure data transfer to form a comprehensive transportation solution


## **1.2 PURPOSE:**

The purpose of electric vehicles is to provide an environmentally-friendly alternative to traditional gasoline-powered vehicles, as they produce significantly fewer emissions and pollutants. Electric vehicles run on electricity stored in batteries, which can be charged using a variety of sources, including solar power, wind power, and grid electricity from renewable sources. By using electricity to power vehicles, we can reduce our dependence on fossil fuels and help mitigate the negative effects of climate change. Additionally, electric vehicles offer the potential for cost savings over the long term, as they require less maintenance and can be charged for a fraction of the cost of gasoline.

## 2. PROBLEM DEFINITION & DESIGN THINKING:

### 2.1 EMPATHY MAP:

Template



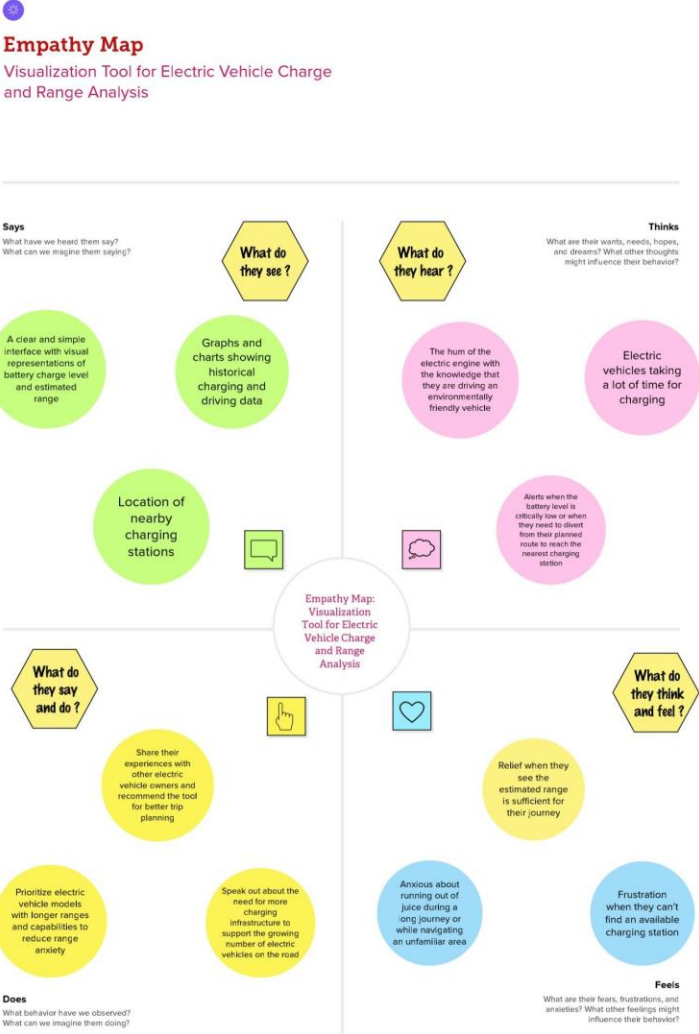
## Empathy map

Use this framework to develop a deep, shared understanding and empathy for other people. An empathy map helps describe the aspects of a user's experience, needs and pain points, to quickly understand your users' experience and mindset.

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### Empathy Map

Visualization Tool for Electric Vehicle Charge and Range Analysis



**Says**  
What have we heard them say?  
What can we imagine them saying?

**Thinks**  
What are their wants, needs, hopes, and dreams? What other thoughts might influence their behavior?

**Does**  
What behavior have we observed?  
What can we imagine them doing?

**Feels**  
What are their fears, frustrations, and anxieties? What other feelings might influence their behavior?


**What do they see?**  
A clear and simple interface with visual representations of battery charge level and estimated range.  
Graphs and charts showing historical charging and driving data.  
Location of nearby charging stations.

**What do they hear?**  
The hum of the electric engine with the knowledge that they are driving an environmentally friendly vehicle.  
Electric vehicles taking a lot of time for charging.  
Alerts when the battery level is critically low or when they need to divert from their planned route to reach the nearest charging station.


**What do they say and do?**  
Share their experiences with other electric vehicle owners and recommend the tool for better trip planning.  
Prioritize electric vehicle models with longer ranges and capabilities to reduce range anxiety.  
Speak out about the need for more charging infrastructure to support the growing number of electric vehicles on the road.

**What do they think and feel?**  
Relief when they see the estimated range is sufficient for their journey.  
Anxious about running out of juice during a long journey or while navigating an unfamiliar area.  
Frustration when they can't find an available charging station.

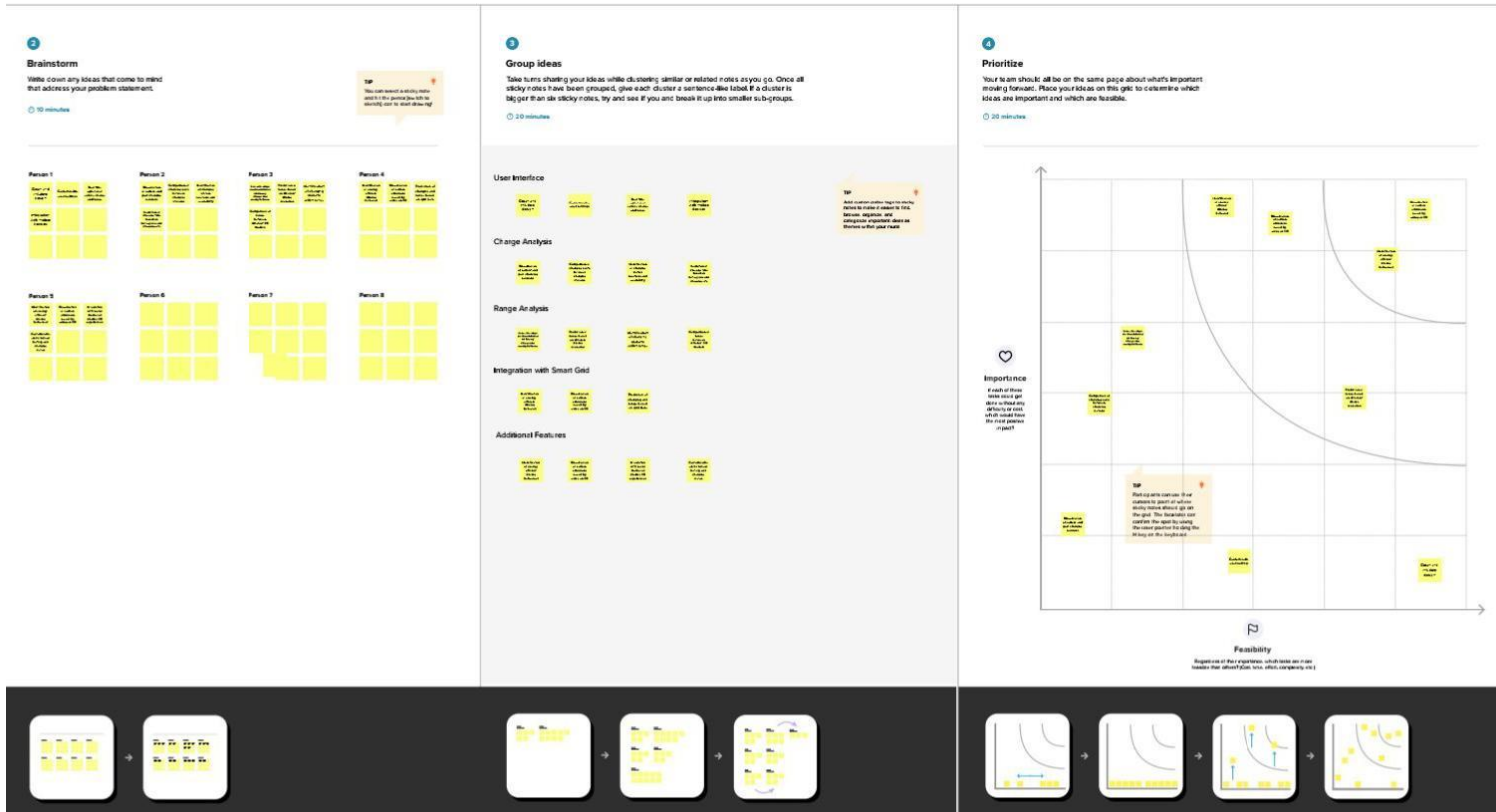
Empathy Map: Visualization Tool for Electric Vehicle Charge and Range Analysis



**Need some inspiration?**  
See a finished version of this template to kickstart your work.  
[Open example](#)



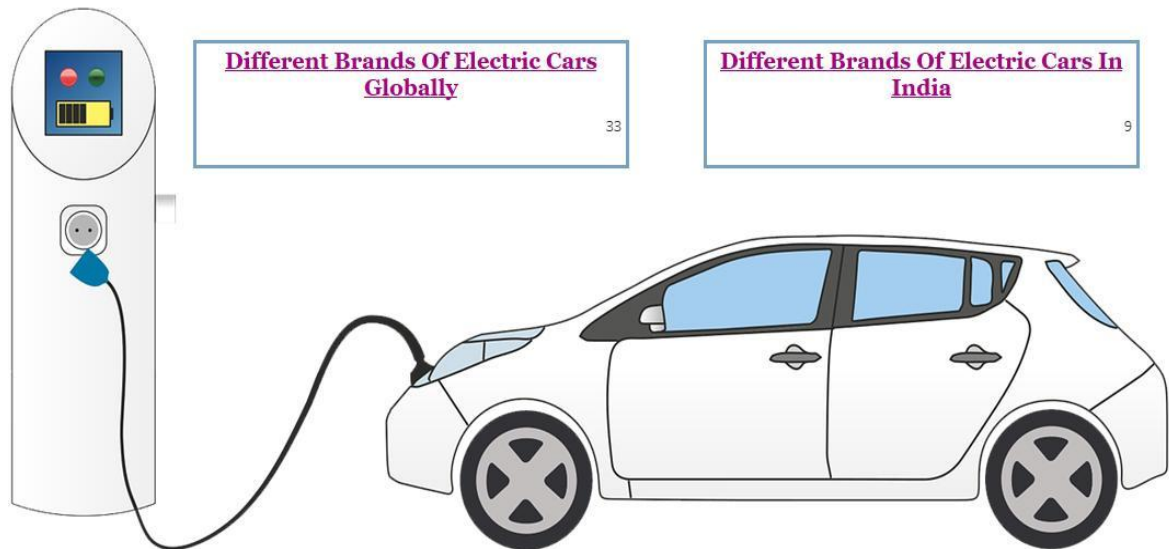
## 2.2 IDEATION & BRAINSTORMING MAP:



### 3. RESULT:

#### DASHBOARDS AND STORIES:

## Electric Cars Analytics Dashboard



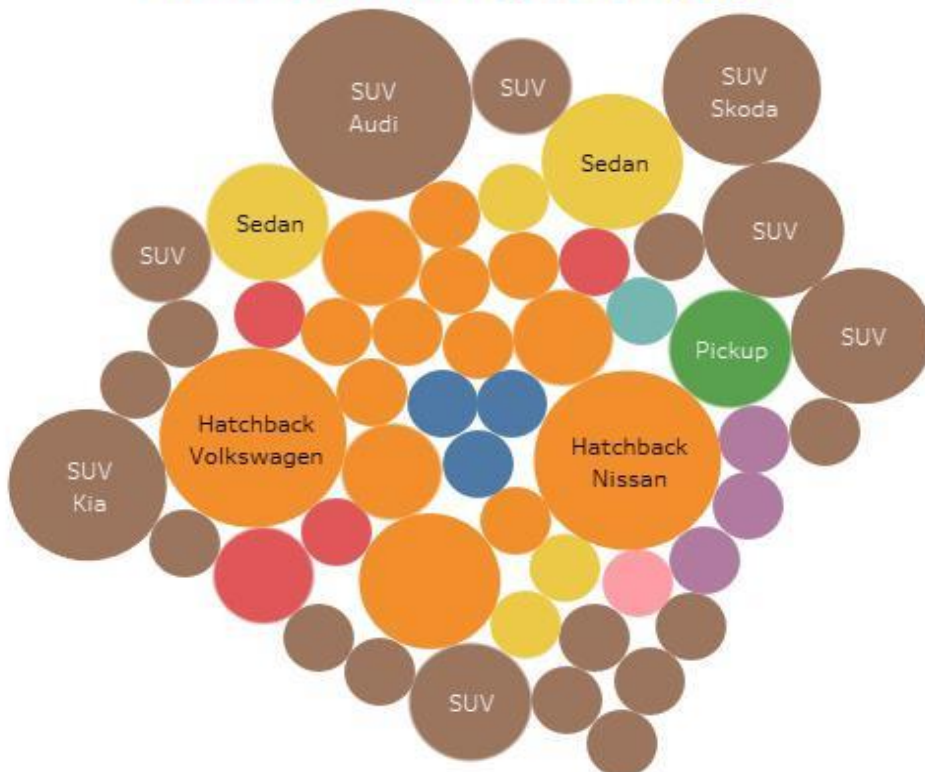
Different Brands Of Electric Cars Globally

33

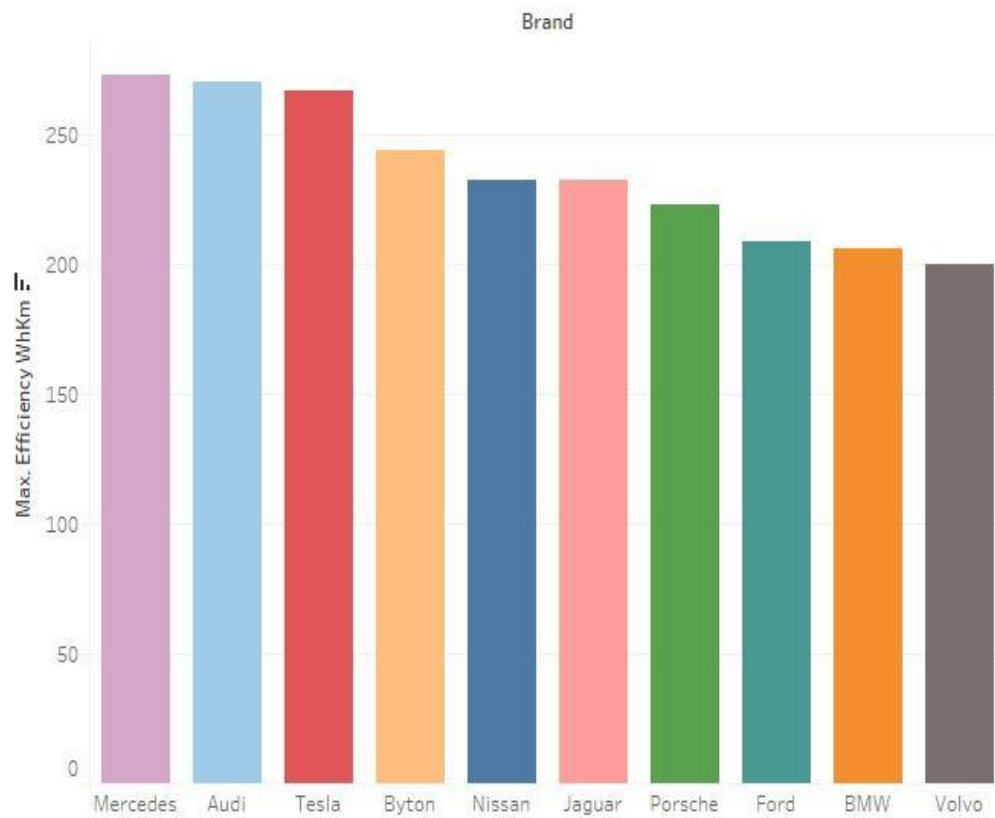
Different Brands Of Electric Cars In India

9

### Brands According To Bodystyle



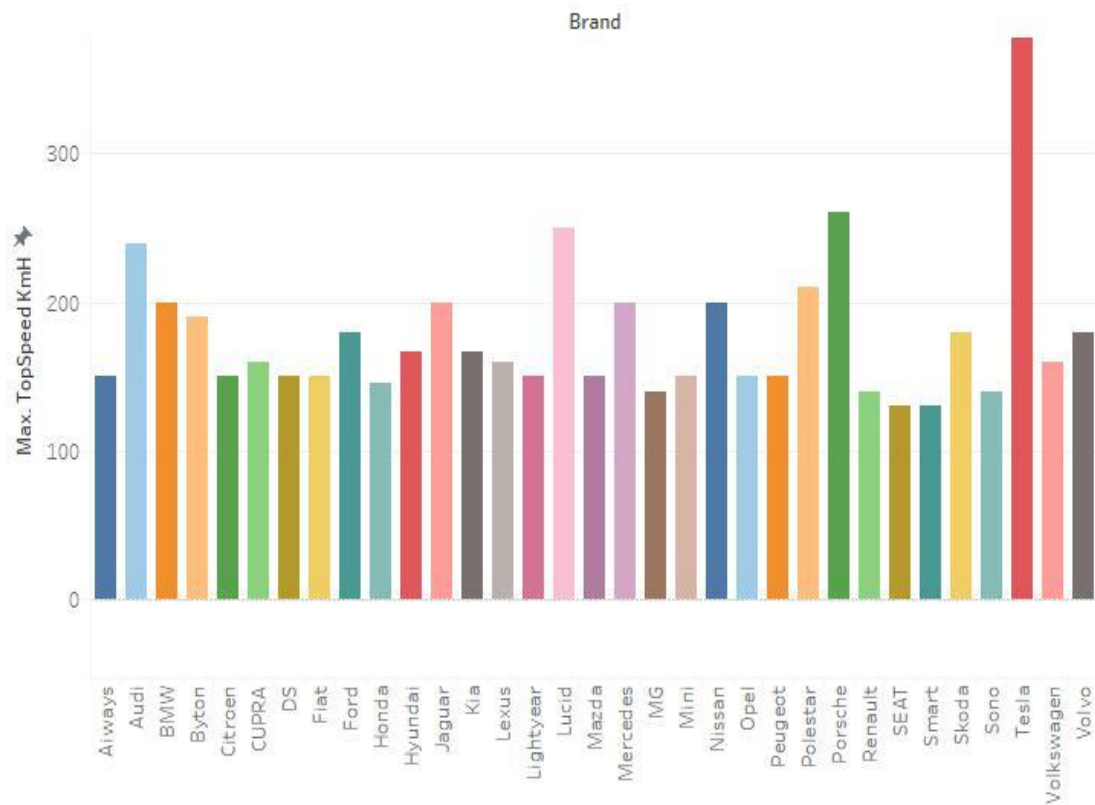
## Top 10 Most Efficient Brands



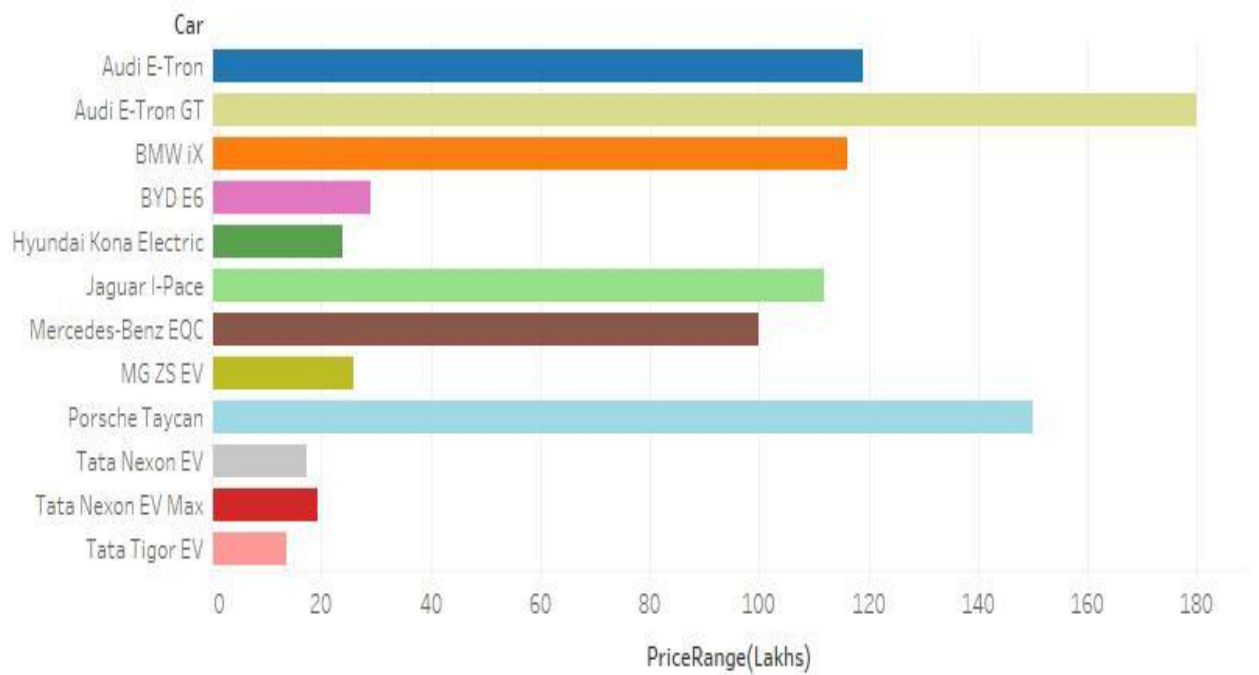
## Different EV Cars in India

Audi E-Tron	BYD E6	MG ZS EV	Tata Nexon EV	Tata Nexon EV Max
Audi E-Tron GT	Hyundai Kona Electric	Mercedes-Benz EQC		
BMW iX	Jaguar I-Pace	Porsche Taycan	Tata Tigor EV	

## Top Speed For Different Brands



## Price For Different Cars In India



# Story of Electric Cars in India

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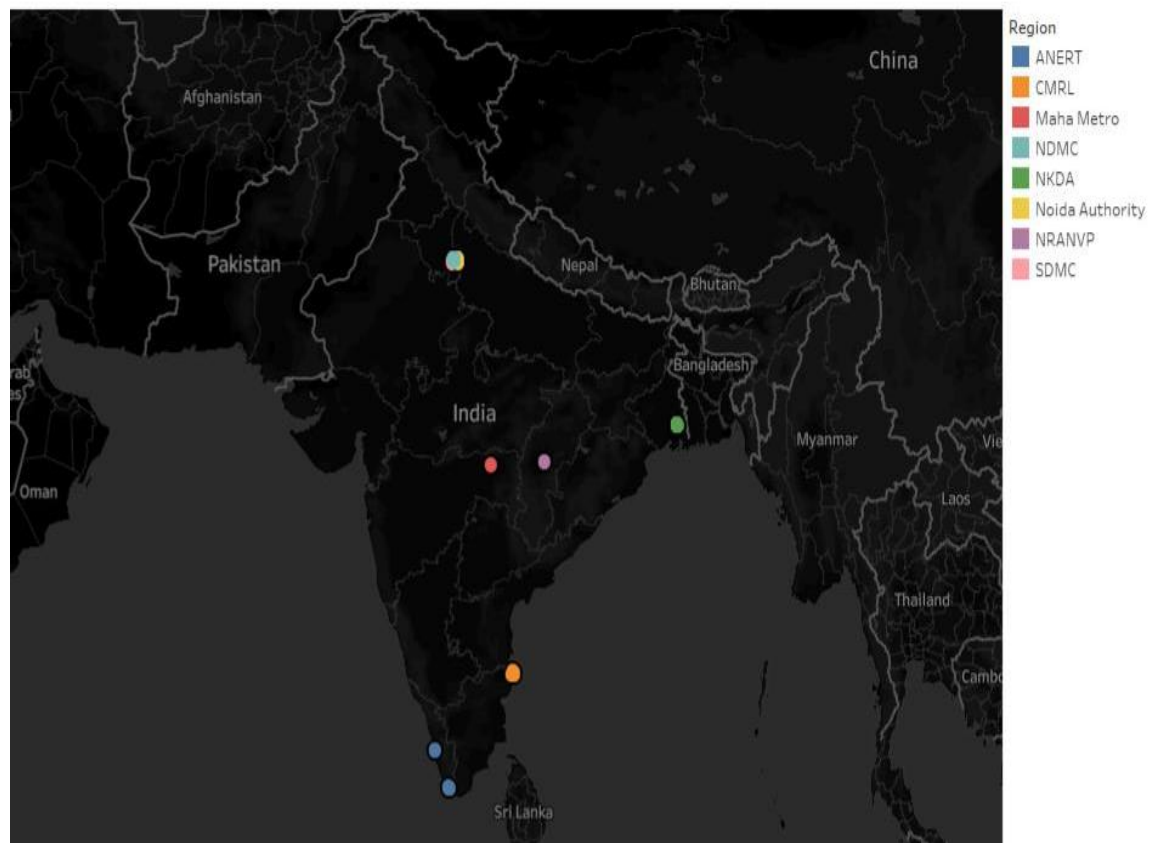
Charging Stations In India

Charging Stations By Region & Type

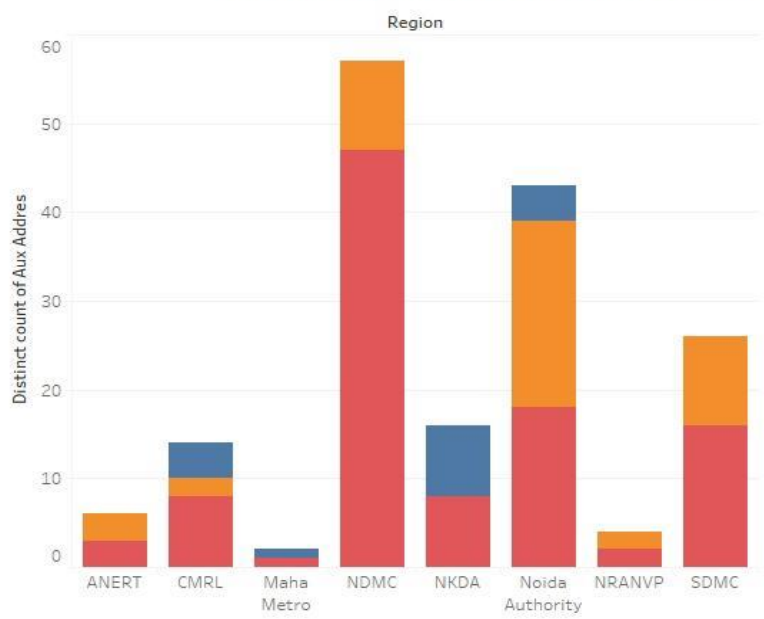
Price Of Electric Cars By Different Brands

Different Brands & No. Of Models

>

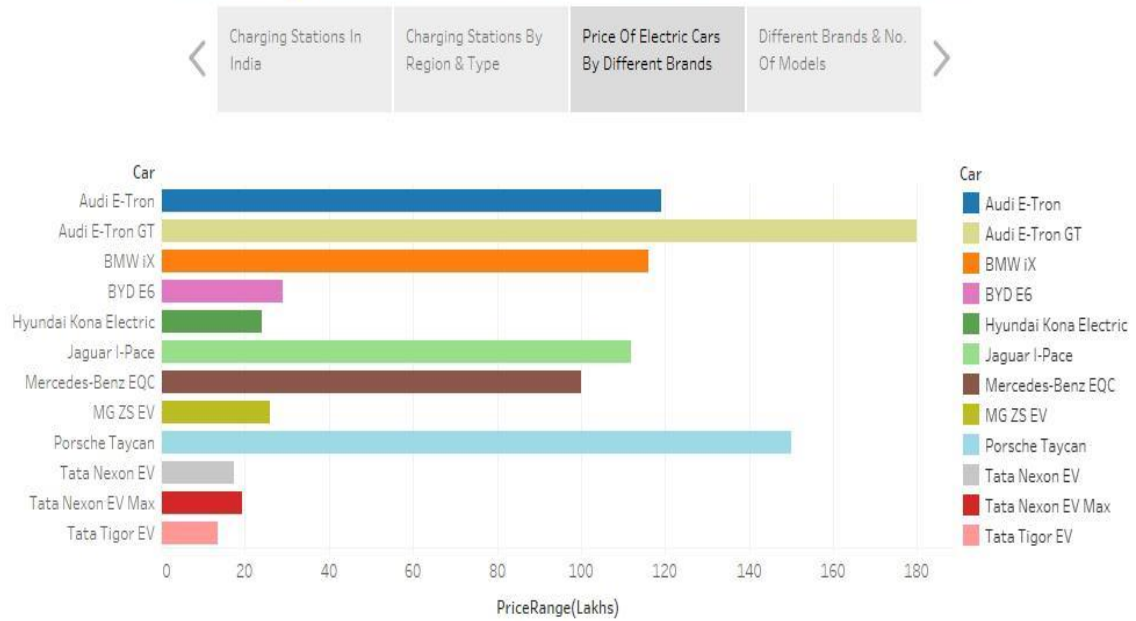


Charging Stations By Region And Type In India





# Story Of Electric Cars In India



# Story Of Electric Cars In India



## **4. ADVANTAGE & DISADVANTAGE:**

### **ADVANTAGE OF POPULATION:**

#### **1. Low Noise Pollution:**

No one loves the harsh noise made by cars running on petrol. Using electric vehicles can help to minimize noise pollution. The advantage of electric vehicles is that they produce no noise.

#### **2. Secure Environment:**

Every human being's primary priority is to protect the environment. Cars create toxic pollutants that have a direct impact on the environment. Every fuel-powered automobile causes environmental damage, as we are all aware.

#### **3. Low Maintenance Cost:**

Electric motors propel electric cars, necessitating less maintenance than conventional automobiles. Furthermore, the temperature of the electric engine does not require as much cooling as that of the combustion engine.

#### **4. Natural Resource Saving:**

We are not only conserving our natural resources by driving vehicles that don't use petrol or diesel, but we are also working to keep the environment pollution-free. Consider that if a dense population continues to exploit the natural resources available on earth at all times, there may be a resource deficit within a few centuries. Electric vehicles contribute significantly to the conservation of natural resources. By doing so, we are benefiting the environment and future generations.

#### **5. Parking for a Low Fee:**

Parking for fueled automobiles is expensive. Hundreds of vehicles are spotted running aimlessly on the roadways today. In such cases, a designated parking area is created to maintain traffic regulations. Electric car parking is paid for at a very low cost. Electric vehicles profit from parking in some areas, even if it is free.

## **6. Golden Investment Opportunities:**

Electric vehicle manufacturing companies face limited competition. The growing demand and popularity of electric cars suggest that, shortly, electric vehicles will supplant gasoline-powered vehicles. If money is invested in producing electric cars, it is possible to make a fortune. At the moment, this is a fantastic opportunity to invest in electric vehicles.

## **7. Subsidy Benefits:**

You might obtain a big discount if you buy an electric vehicle in cash. The Delhi government is also granting the subsidy for purchasing electric vehicles. Each electric car receives a different subsidy.

## **DISADVANTAGE OF POPULATION:**

### **1. Higher Purchase Cost:**

Compared to regular automobiles, electric vehicles are highly pricey. A gasoline vehicle costs between three and four lakh rupees. However, you would be surprised to learn that the beginning price of an electric vehicle is merely ten to twelve lakhs. Due to the high cost of purchasing, not everyone in this position can utilize it.

### **2. Low Speed and Range:**

An electric car will not be able to go vast distances. Electric vehicles cannot travel farther at a faster rate of speed than those powered by engines if speed is the issue. The driving range is also very limited in addition to this.

### **3. Low Price on Selling:**

Even though fuel-powered cars are expensive to maintain, they sell for a high price. When it comes to electric vehicles, you may acquire them for less than three times the price you paid. After operating an electric car, the relevance of its capacity reduces substantially, resulting in a low selling price.

### **4. The Inconvenience of Service Station:**

The utilization of electric vehicles is still in its infancy. As a result, the stations that serve it are similarly build in small numbers. Even after traveling great distances, service locations where cars may be refueled with electricity are few and far between.

## **5. Slow Charging:**

Electric vehicles require many hours to charge, unlike engine-powered vehicles, which can recharge quickly. The charging of these automobiles is quite sluggish. Why would anyone waste time refilling a vehicle in our fast-paced world?

## **6. Expensive Recharging Options:**

If there is any other choice than recharging the electric vehicles at a charging station, it is to charge them with the electrical power supply connected to their houses. If you do this, your electricity bill may surprise you considerably. To recharge these vehicles, a high-voltage electric current is required.

## **7. Fewer Users:**

Due to the high cost of electric vehicles, it is not accessible to everyone. It is not incorrect to suggest that electric vehicles are exclusively available to the wealthy. One of the main reasons for its high price is that the number of electric vehicles is also limited due to low product availability. The costs of low commodities and excess demand are high.

# **5. APPLICATIONS:**

## **1. Personal Transportation:**

Electric cars and electric bikes are becoming increasingly popular as a means of personal transportation. They can be used for commuting, running errands, or leisure activities.: Electric buses and trains are being used in many cities around the world to provide clean and efficient public transportation options.

## **2.Commercial Vehicles:**

Electric delivery trucks, vans, and other commercial vehicles are being developed and deployed by companies looking to reduce their carbon footprint and operating costs.

## **3.Agriculture and Mining:**

Electric tractors and mining vehicles are being developed to reduce emissions and increase efficiency in these industries.

#### **4. Emergency Services:**

Electric vehicles are being used by emergency services, such as police and fire departments, as they offer quiet and efficient transportation options.

#### **5. Military:**

The military is exploring the use of electric vehicles for a variety of applications, including transport, reconnaissance, and communication.

Overall, electric vehicles have the potential to be used in a wide range of applications, as they offer many advantages over traditional gasoline-powered vehicles.

#### **6. CONCLUSION:**

In conclusion, electric vehicles offer a promising solution to many of the environmental and economic challenges facing the transportation sector. By using electricity as a power source, they produce significantly fewer emissions and pollutants than traditional gasoline-powered vehicles, helping to mitigate the negative effects of climate change. Electric vehicles also offer the potential for cost savings over the long term, as they require less maintenance and can be charged for a fraction of the cost of gasoline. With advancements in battery technology and charging infrastructure, the range and performance of electric vehicles are improving rapidly, making them an increasingly viable alternative to traditional vehicles. While there are still some challenges to be addressed, such as the availability of charging infrastructure and the cost of batteries, the future looks bright for electric vehicles and the role they can play in creating a more sustainable transportation sector.

#### **7. FUTURE SCOPE:**

##### **Battery Technology:**

Improvements in battery technology will lead to longer driving ranges and faster charging times, making electric vehicles even more practical and convenient.

**Charging Infrastructure:**

The development of more widespread and accessible charging infrastructure, including fast-charging stations, will increase the convenience and accessibility of electric vehicles.

**Autonomous Driving:**

The integration of electric vehicles with autonomous driving technology will create new opportunities for transportation services and enhance safety and efficiency.

**Vehicle-to-Grid (V2G) Technology:**

V2G technology will enable electric vehicles to store and share energy with the grid, allowing for greater grid stability and potential cost savings for vehicle owners.

**Increased Adoption:**

As more people adopt electric vehicles, economies of scale will help to lower costs and make them more accessible to a wider range of consumers.

Overall, the future of electric vehicles looks bright, as advancements in technology and infrastructure continue to drive their growth and adoption. As we work towards a more sustainable and carbon-neutral future, electric vehicles will play a critical role in reducing emissions and creating a more sustainable transportation sector.

