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CHAPTER-1

INTRODUCTION

Peak oil prices and the environmental effects of petroleum-based transportation infrastructure have sparked a renewed interest in electric transportation infrastructure in recent decades. Because the electricity used by electric vehicles can originate from nuclear power, fossil fuels, renewable ener-gy sources including wind, solar, and tidal power, or any mix of these, they differ from fossil fuel-powered automobiles.

Electric drive vehicles (EVs) are vehicles that are propelled by one or more electric motors or transmission motors. Those that are powered directly by an external power source, those that are powered by a stationary electricity source that draws power from an external source, and those that are powered by an on-board electrical generator, like a hydrogen fuel cell or an internal combustion engine (a hybrid electric vehicle), are the three primary categories of electric vehicles. Motorcycles, scooters, lorries, cars, airplanes, and sports vehicles are all examples of electric vehicles. In contrast to diesel submarines that run on batteries, some of the lighter UAVs are powered by electricity for the duration of the battery run.

When electricity was one of the most widely used power sources for motor vehicle propulsion in the mid-1800s, electric vehicles made their debut. They offered a degree of convenience and comfort that was unmatched by cars that ran on gasoline. Although the internal combustion engine (I.C.E.) is the most widely used kind of propulsion for cars, electric propulsion is still used in other vehicle types, including trains and small vehicles of all kinds. A hybrid electric vehicle combines some form of electric propulsion with a traditional automobile, often driven by fossil fuels. The Toyota Auris and other hybrid electric vehicles are a few examples. The Chevrolet Volt is an example of an Extended Range Plug-In Electric Vehicle.

BROAD OVERVIEW OF THE INDIAN AUTOMOBILE INDUSTRY

As the largest tire, second-largest bus, and third-largest truck producer in the world, India holds a dominant position on the international scene. Between 2020 and 2027, the market for electric vehicles is expected to expand at a rate of 44%, reaching 6.34 million units sold year. By 2030, there should be five direct and indirect jobs in the electric car industry. According to estimates, financing EVs would account for more than 80% of the $60 billion yearly present size of the Indian car finance industry by 2030. In FY22, the Indian passenger automobile industry is expected to grow by 22 to 25 percent.

With a valuation of over $100 billion, India's car industry is expected to rank third globally by 2025, accounting for 2.3% of GDP and 8% of total sales. In India, two-wheeled vehicles account for 81.2 percent of the automobile market, while passenger automobiles make up 14.6%. Small and medium-sized cars are in great demand as passenger vehicles. By FY21, India's automobile exports reached 4.1 million units. Car exports from India increased from 436,500 units between April and June 2020 to 1,419,430 units between April and June 2021.

NEED FOR ELECTRIC MOBILITY

Electric automobiles are seen as long-term, economical investments because they just require renewable energy sources to replenish their batteries, not gasoline. According to the US Department of Energy, electric cars produce half as much CO2 as gas-powered vehicles. The vast majority of purchasers place a high value on getting good gas mileage. According to the same survey, 68 percent of Asian drivers anticipate higher mileage from their vehicles as a result of increased gas prices. As a result, 38% of Indian automobile buyers now purchase electric or hybrid vehicles.

According to Mashable, Suzuki has already tested more than 50 electric prototypes in India, and other businesses, such as Toyota, had plans to offer electric vehicles in India after this change in the sector. In 2019, Hyundai unveiled the Kona Electric, the country's first electric car.

One of the primary advantages of electricity flow is that it enhances people's quality of life by reducing dangerous gas emissions. Additionally, because electric cars' engines are non-combustible, they emit fewer greenhouse gases, which aids in the fight against climate change.

It's important to remember that these technologies are always developing, enhancing power flow efficiency and bringing in new uses: Electric boats, lorries, and airplanes can all indicate the beginning of electrical wiring during testing.

Promoting the development of electric vehicles not only raises the level of living in our cities but also increases the competitiveness of the automotive industry, a vital pillar of our economy. In certain industries, particularly those that affect small and medium-sized enterprises, concentrating on the flow of power could result in the preservation of up to a million jobs.

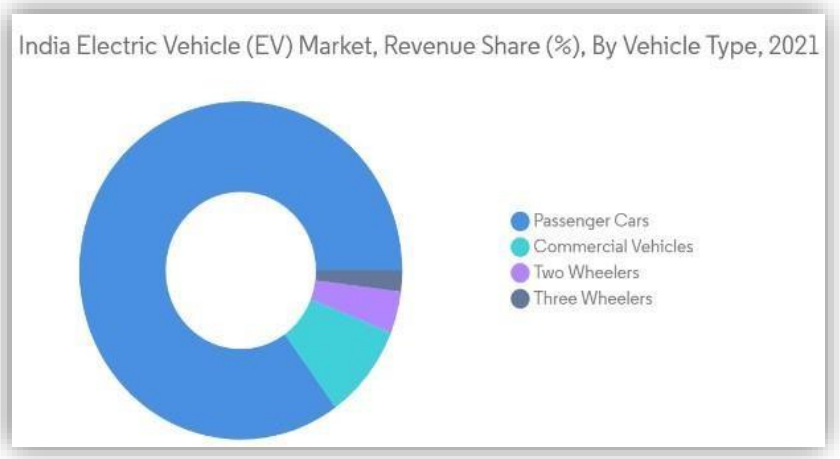


Fig 1: Indian Electric Vehicle Market Revenue and Share

PAST EFFORTS AND PRESENT STATUS OF ELECTRIC MOBILITY IN THE COUNTRY

The Indian government planned to release a roadmap for the development of domestic and hybrid electric vehicles (EVs) in April 2012. The government, business, and academic sectors were expected to participate in negotiations on February 23 and 24. The creation of the policy's last portions will come after this consultation procedure. Ministers from the energy, road transportation, finance, and petroleum ministries are working together to develop a comprehensive framework for the industry. Along with these services, representatives from the automobile industry took part in the endeavor, including Anand Mahindra, Deputy Chairman and Managing Director of Mahindra & Mahindra, and Vikram Kirloskar, Deputy Chairman of Toyota Kirloskar.

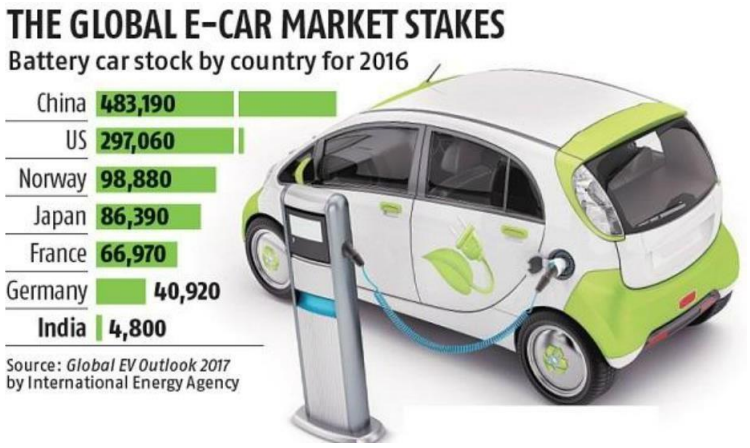


Fig 2: Global E-Car Market Stakes

GLOBAL SCENARIO

A significant milestone in the history of EV sales will be reached by the end of 2021, when 6.4 million EV and PHEV vehicles will have been sold globally. This is due to the fact that most major countries are now paying attention to the decarbonization issue.

This represents a 98% increase over the prior year.As more electric vehicles become available on the road, more public charging stations will be required, even though the majority of charging takes place at home or at work.

We estimated that there were 175 000 public EV chargers in 2019. By 2025, there will be 1.3 million public EV chargers, and by 2030, there will be 2.9 million.

The highest shares of new electric car registrations in 2021 were in China (1.149 million new registrations) and Europe (1.06 million new registrations), with the US coming in second with 297000 new registrations.

Due to stimulus plans implemented by a number of European governments, the number of electric car registrations in Europe has increased more quickly than in the rest of the globe since 2019.

Global passenger electric vehicle sales are expected to rise quickly from 3 million in 2020 to 66 million in 2040, according to Bloomberg NEF's Economic Transition Outlook. Almost two-thirds of all passenger cars sold globally will be electrified by 2040. Leading the change are Europe and China.

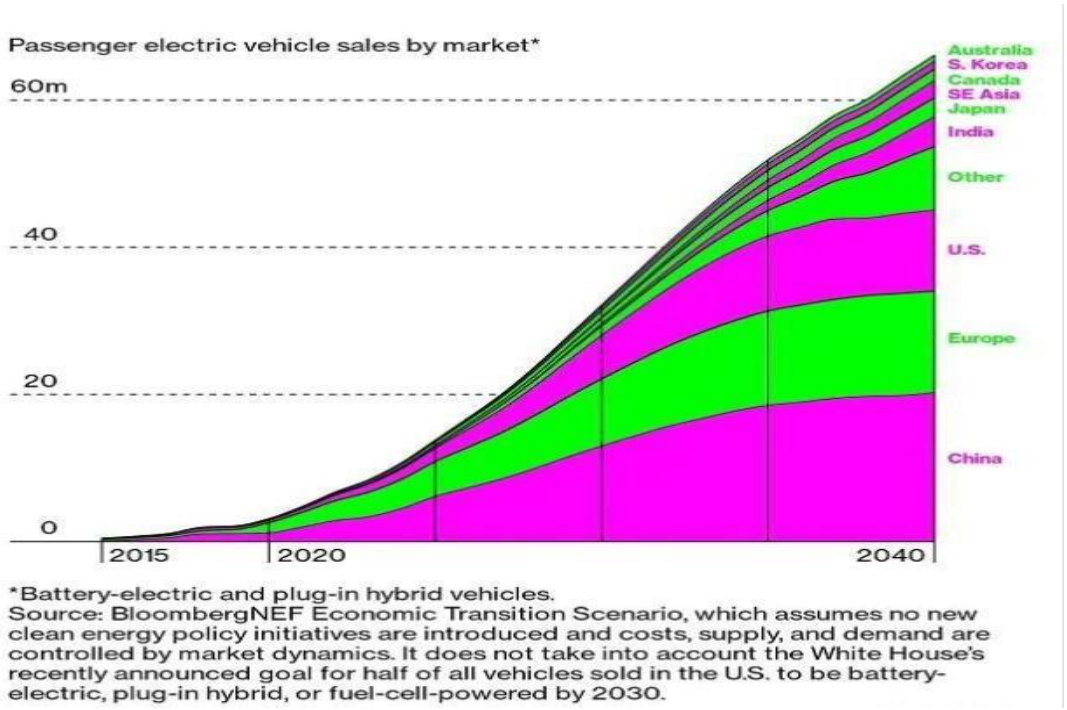


Fig 3: Passenger EV Sales

The increasing demand for battery packs for electric vehicles is helping China, which is the world's top producer of lithium-ion batteries. In an effort to catch up, the European Union plans to create enough batteries by 2025 to meet its own needs.

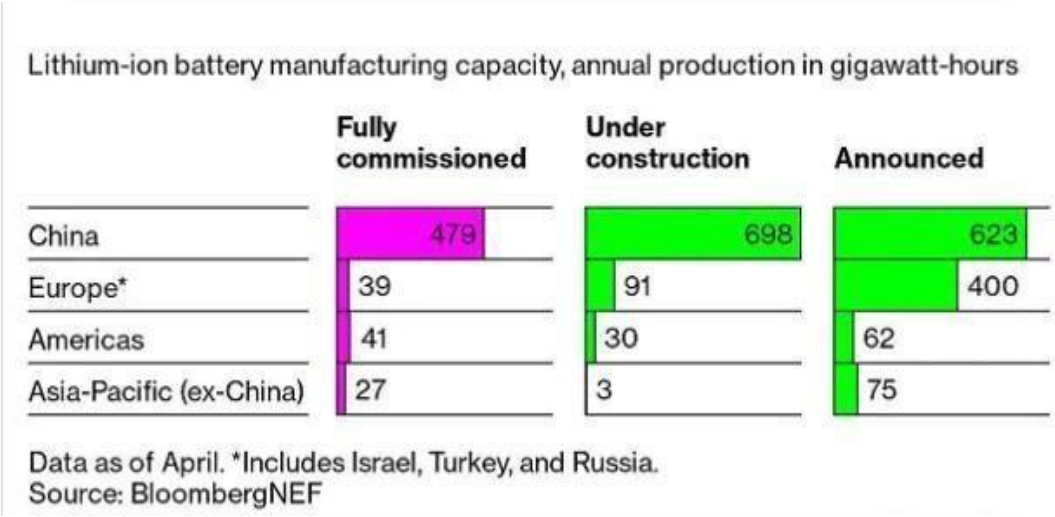


Fig 4: Lithium-ion Battery Manufacturing Capacity by Annual Production

MARKET OVERVIEW

Market Environment: Infrastructure for EV Charging

The creation of a database for the Indian public sector has been sought by the Ministry of Higher Education. However, there is currently no database in India that offers aggregated information on the operation of vital infrastructure.

The PEI estimates that Delhi has about 372 public crossing sites. A study institute claims that 1827 difficult states have been placed across the country.
The graphic below illustrates the range of services that were provided along the EV charging infrastructure value chain.

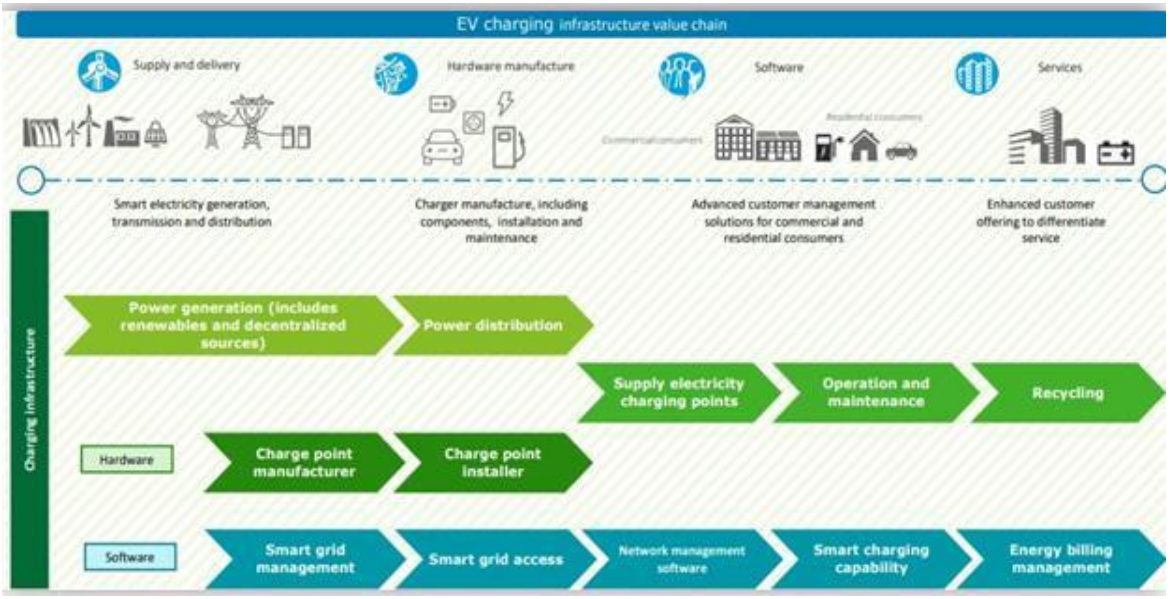


Fig 5: Value chain of EV charging infrastructure

Stakeholder Landscape: EV Charging Infrastructure

The ecology of electric vehicles is composed of multiple entities. Establishing a comprehensive ecosystem and offering policy and regulatory assistance are crucial tasks for governments at all levels as well as sector regulators. They promote adoption, facilitate investment, and guarantee equitable operation of the industry. The diagram below depicts a high-level view of the top participants in India's electric mobility market.

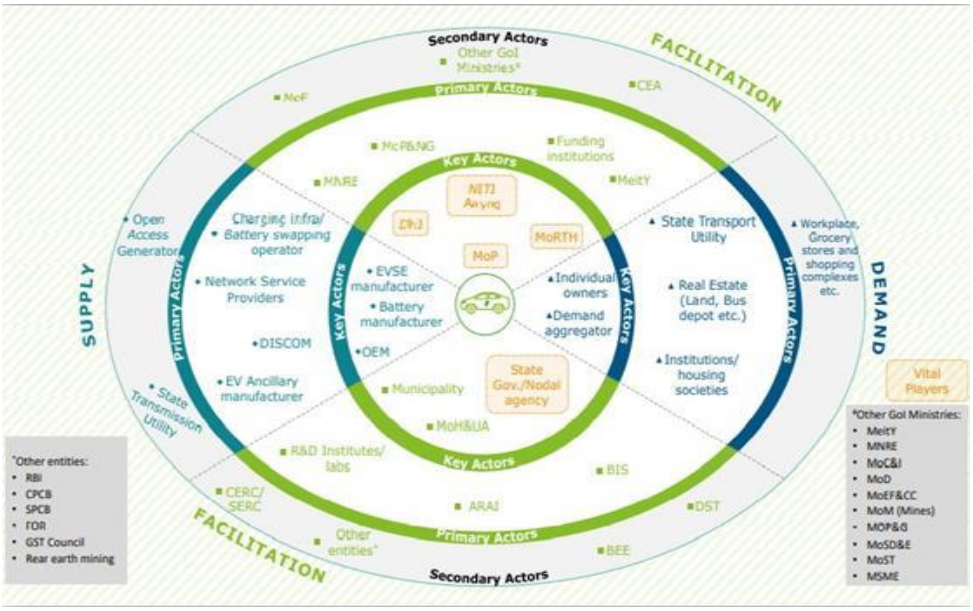


Fig 6: Ecosystem of Electric Mobility in India

India's EV Policy and Regulatory Framework

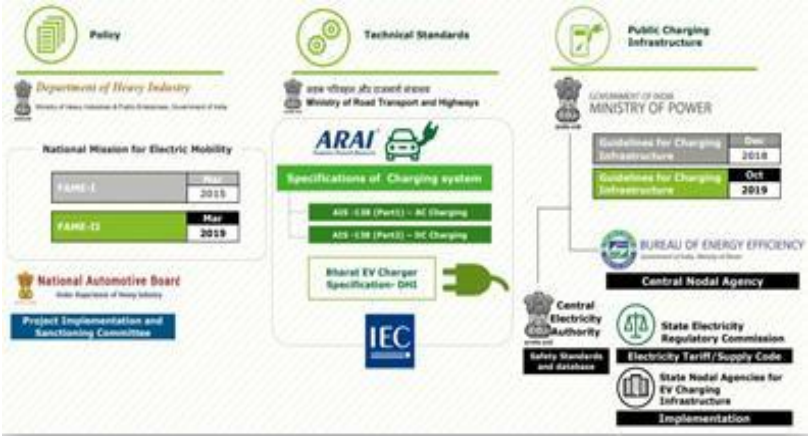


Fig 7: India's EV Policy

KEY PLAYERS (MAJOR PLAYERS IN EV INDUSTRY)

The Indian electric vehicle market is expected to reach $15,397.19 billion in 2027, up from an estimated USD 1,434.04 billion in 2021, at a compound annual growth rate (CAGR) of 47.09% from 2022 to 2027. The COVID-19 pandemic limited access to locally produced electric vehicles due to facility and production facility closures. However, when consumers switched to more reasonably priced, environmentally friendly forms of transportation supported by government subsidies, EV sales increased significantly as the restrictions were relaxed.

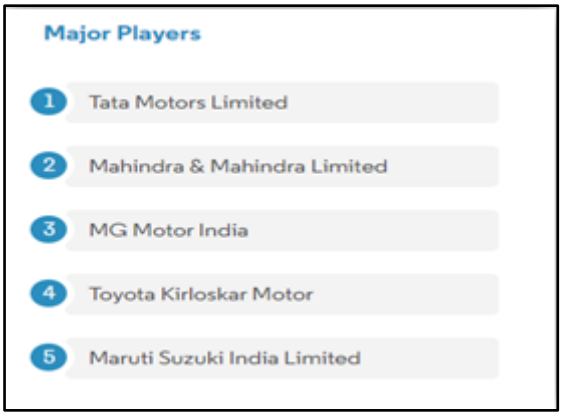


Fig 8: Major Players in EV Industry

Tata Motor Company announced intentions to produce electric vehicles in January 2022, with the goal of selling 50,000 vehicles annually by FY 2023. By the end of fiscal year 2023, the corporation has found suppliers that have committed to producing 50,000 electric vehicles, up from 125,000 to 150,000 per year in 2000.

Fig 9: TATA Nexon

MG Motor India formally announced in January 2022 that it would debut an electric vehicle before the end of fiscal year 2022–2023 with a planned launch date of March 2023. The car is expected to cost somewhere between INR 10 lakh and INR 15 lakh.

The development of this electric crossover will take place on a worldwide platform designed especially for the Indian market. With a driving range exceeding 300 kilometers, the vehicle is a sub-4-meter crossover. It is going to compete with the Tata Nexon EV, which is now the best-selling car in India. The corporation plans to alter several features of its next electric vehicle to comply with legal standards for product marketing techniques.

Hyundai Motor India said in December 2021 that it will invest INR 4,000 crore to launch its 12th electric car by 2028 through a number of focused product strategies aimed at increasing consumer interest in the nation for future transportation options. The company is also in talks with six Indian private and public companies to expand the infrastructure for charging electric vehicles and allay major worries among electric vehicle users.

Together with its sibling firm, Evey Trans Pvt. Ltd., Olectra Greentech announced in July 2021 that it had obtained a contract for 100 electric buses. A group comprising both businesses has been given a contract to supply 100 electric buses to the State Transport Corporation (STC) across the country, using a 12-year OPEX model, as part of the Indian government's FAME-II initiative. Both people and automobiles are supposed to be transported between cities by these buses.

Mahindra & Mahindra announced in April 2021 that it would launch 16 electric cars (EVs) by 2027 in all SUV and light vehicle categories in an effort to maintain its market-leading position in India. The corporation has set a lofty growth goal of 15–25% by 2025, leaving room for private investors or aspirations to make EVs a viable business.

CHAPTER 2

KEY MARKET DRIVERS & CHALLENGES

KEY MARKET DRIVERS

The upcoming key factors are expected to lead to substantial expansion in the electric vehicle charging infrastructure sector in India.

Strong Government Push

The following key factors are expected to drive substantial expansion in India's EV Charging Infrastructure sector. Over recent years, governmental actions at both state and national levels have continued to grow in intensity to facilitate the development of charging facilities.

The primary and most crucial move was the recognition of electric vehicle charging as a "ser-vice." Setting up and managing an EV charging station no longer necessitates a license.

States have introduced both financial and non-financial benefits, such as reduced tariffs on the production and operation of chargers.

Furthermore, the way that power regulators have classified "EV Charging Stations" as a separate category under the Tar-iff Order has helped to advance e-Mobility across the country. In the July 2019 Union Budget, the GST rate for electric car chargers and charging stations was reduced from 18% to 5%.

Industry Initiatives

Numerous automotive manufacturers and various businesses, such as independent developers of charging stations, have shown a keen interest in creating charging infrastructure.

Tie-Ups

With Petrol Pumps	Charging manufacturers and original equipment manufacturers are collaborating with fuel stations to enhance the availability of charging, especially with the battery swapping alternative. Indian Oil Corporation has formed alliances with OLA Electric Mobility and Sun Mobility for battery exchange facilities, whereas VoltUp has teamed up with Hindustan Petroleum Corporation Ltd to establish 50 batteries replacement stations.
With shop owners,	e-2W Businesses like Ather are opting to use decentralized charging solutions, working with Kirana stores to exchange batteries or with shopkeepers to set aside a portion of their area for charging stations.

Public Charging Stations:

A noticeable trend has emerged where hotels, enterprises, and resorts are establishing EV charging points, referred to as community charging stations, situated 40 to 70 kilometers away from urban areas. These stations are intended for conventional 15 Amp charging for electric vehicles and e-bikes.

Projects such as Plugin India, which is a network of electric vehicle users and advocates in India working to promote electric vehicles since 2013, have recognized and nurtured this movement.

India boasted over 257 community charging stations by January 2020, along major roads such as Chennai to Mahabalipuram, Bengaluru to Mangalore, Del-hi to Jaipur, Mumbai to Nashik, and Mumbai to Pune (extending to Mahabaleshwar).

Plazas for charging:

To improve the framework for electric mobility and guarantee that there are charging stations in public areas, charging hubs have been set up in India. EESL opened India's first public charging station on July 20, 2020, at the Chelmsford Club in New Delhi.

A total of 14 electric vehicles can be charged at once at this location.
In order to serve a variety of vehicle types, the plaza is furnished with multiple chargers with varying power levels.

EESL plans to develop approximately 10 electric vehicle charging stations during the fiscal year 2020-21.

Fig 11: EV Charging Statio

CHALLENGES

The best e-mobility practices from industrialized nations may not be appropriate or practical for addressing India's unique issues because of the country's unique infrastructure challenges. Therefore, the solution to these problems must be indigenous or tailored to India's urban areas.

End-User challenges

Range Anxiety: This is the fear of driving an electric car across a certain distance or how long its charge will survive. In India, the number of kilometers per liter, or fuel efficiency, is one of the most important factors to consider before buying a car with an internal combustion engine. Many owners of electric vehicles wish to go long distances between charges, something that is not possible with the batteries used in electric vehicles today. According to a recent poll conducted by Castrol, a well-known lubricant company, which involved 1,000 customers, fleet supervisors, and business experts around India, drivers expect to get 401 kilometers on a single charge.

Time Anxiety: Customers want quick charging that is on par with filling up a gas tank, but the current charging methods—particularly the slower charging options—cannot accomplish this. According to Castrol's research, drivers prefer charging times of 35 minutes or less on average.

Concern over the electric vehicle's capacity to locate a charging station is the main source of charge anxiety. This results in trust concerns. People in India, for example, frequently check the meter twice before filling up at a gas station; similarly, they face similar trust issues with electric charging stations, including doubts about whether the car is actually charging and whether the electric charging station is operational.

CPOs

The low usage rate stems from the insufficient number of electric vehicles currently on the roads. Given the present trends, particularly with the FAME II initiative and its advantages, it appears that the count of electric vehicles won't reach impressive levels, potentially not until 2024, making it impractical to treat charging infrastructure as an independent venture.

The construction of island banks, which includes parking spaces at key sites around cities, is a problem the government has not addressed. Despite being given free property under government regulations, even public sector businesses are having difficulty obtaining land. Furthermore, unclear pricing has resulted in exorbitant leasing fees. For example, it has been stated that in some instances, the cost of the land leasing alone accounts for over 40% of the charging station's operating expenses.

FAME II mandates that a minimum of two 100kW chargers must be installed at each public charging station, which works fine in regions like Delhi where this level of power is classified as low tension. However, in states such as Gujarat or Uttar Pradesh, where the low-tension threshold is limited to 50kW, the relevant Charge Point Operator will need to opt for a high-tension connection, requiring the addition of cables, transformers, and other infrastructure. This extra setup often costs two to three times greater than the subsidies received, rendering the entire initiative ineffective.

Private Fleet Operators

Securing a reliable power source for an EVSE set up at a fleet-managed electric vehicle charging location is an issue.

For rideshare operators and fleet managers functioning across multiple states, the variability in EV charging rates creates difficulties.

Numerous states have established a separate tariff classification specifically for electric vehicles.

DISCOMS

System components are being stressed due to the distribution network. The challenge of increased peak demand in service areas will necessitate more financial resources for network enhancements and energy procurement, which will ultimately harm DIS-COMs over time.

Variable energy usage arises because people plug in their vehicles at different times and places. This inconsistency will impact the reliability of electricity supply throughout the grid.

Increasingly incorporating electric vehicles would disrupt the power demand pattern, resulting in problems like sudden spikes in energy consumption, strain on transformers, decrease in voltage, voltage fluctuations, and the presence of harmonics.

Fig 12: DISCOMS

CHAPTER 3

FUTURE OF EV INDUSTRY

ELECTRIC VEHICLES @ 2030

The government of India seeks for electric automobiles to account for 30% of the market by 2030. However, policymakers in this sector need to introduce innovative and impactful strategies to facilitate the advancement required to reach this objective.

"Projections from NITI Aayog and RMI indicate that by 2030, electric vehicles could make up 80% of the market for two and three-wheelers, 50% for four-wheeled vehicles, and 40% for buses."

Fig 13: NITI Aayog predictions by 2030

Fig 14: Actual and Expected EV Sales by 2030

ANTICIPATED EV ADOPTION PATH IN INDIA

1.	The two-wheel electric vehicle market will likely see acceptance before the four-wheel electric vehicles.	2W EVs are a great match for India's transport landscape: They have a more affordable initial price and reduced ongoing expenses when contrasted with 4Ws. This method of transport excels in areas with heavy congestion. It is perfect for quick trips within urban or rural areas.
2.	Rise in adoption of 3W EVs	3W electric vehicles provide a solution for affordable transportation in the last mile. This is fundamentally a key factor contributing to its rising popularity. Since 3W vehicles offer a way to earn for numerous individuals in India, coupled with their economical operational expenses, the acceptance of 3W electric vehicles is expected to expand significantly.
3.	Greater adoption of EVs in the commercial/ public segment	Given the inclination of Indian consumers toward using public transport, it is anticipated that this mode of travel will significantly contribute to decreasing CO2 emissions. Business fleets are expected to transition to electric vehicles because of their low operating expenses.
4.	Introduction of EVs in shared mobility	Shoppers in India are mindful of expenses, and shared mobility provides an economical transport option. Using electric vehicles, the expenses associated with operation are considerably reduced, decreasing the total cost of vehicle sharing for users and leading to greater acceptance.

CHAPTER 4

RISK & CHALLENGES TO EV STAKEHOLDERS

4.1. In terms of EV Component OEMs + Battery OEMs

Policy Risk	Failure to execute policy measures after their announcement. Assistance through subsidies is being gradually reduced, and there are more rigorous requirements for obtaining incentives. The trade of automotive parts presents a policy-related risk. The introduction of new policies mandating investment in battery recycling.
Financial Risk	Failure to execute policy measures after their announcement. Assistance through subsidies is being gradually reduced, and there are more rigorous requirements for obtaining incentives. The trade of automotive parts presents a policy-related risk. The introduction of new policies mandating investment in battery recycling.
Supply Chain Risk	Limited availability of mineral resources for the local production of crucial parts. The standard of vehicle accessory parts manufactured in the United States. A shortage of domestic auto accessory components has arisen because of limited production capabilities. A volatile connection with China presents a geopolitical threat (reliance on Chinese imports).

Technological Risk	Technology is progressing swiftly, especially within the battery sector, creating a threat of becoming outdated. The cost of batteries might not decrease as anticipated, perhaps due to a discrepancy between supply and demand. Compatibility between different systems. Cost compared to efficiency: the risks associated with favoring certain technologies.
Other Risks	Uncertain customer preferences high skilled personnel wage rate/shortage of trained manpower Changing safety requirements and the risk of non-compliance. Battery scrap page or recycling concerns are environmental concerns.

4.2. In terms of Consumers

Policy Risk	The financial assistance is being gradually reduced, and the requirements for obtaining an incentive are becoming stricter. The NGT's directives regarding compulsory battery disposal after a specified duration could change the financial viability of electric vehicles.
Financial Risk	Significant financial assurances are provided for electric buses under the GCC framework. Compared to their internal combustion engine equivalents with comparable capabilities, electric vehicles come with a hefty upfront cost. Tariffs and other taxes related to the use of electric vehicles pose a risk to total operating costs.
Supply Chain Risk	Scarce options for electric vehicle types and charging stations. The performance of a newly manufactured part for an electric vehicle could pose a problem.
Technological Risk	Extended charging duration (the batteries currently employed in 2W and 3W do not facilitate rapid DC charging). Emerging technologies (like hydrogen) might ultimately replace EV technology, presenting a threat of becoming outdated.
Other Risks	A danger exists concerning the safety and quality of the batteries.



CHAPTER 5
LITERATURE REVIEW

To address regional load challenges, India may think about making small improvements rather than a major overhaul. Encouragement of home charging is necessary. It is crucial to do a comprehensive study of locations, populations, traffic patterns, and public safety before implementing large charging networks. Initiatives in the transportation and energy sectors should be coordinated. To assist market growth, electric car customers are given financial incentives such tax rebates, purchase grants, discounted tolls, free parking, and priority access to certain highway lanes.

The initial expansion of the electric vehicle market persists, yet several obstacles hinder their broad acceptance. These obstacles include the higher costs associated with the new technology, the relative inconvenience stemming from range limitations and charging durations, and consumer understanding regarding the technology's availability and practicality. The latter aspect, often termed “consumer awareness,” is vital.

Factors such as environmental issues, expenses, comfort, reliability, technological capability, social acceptance, and infrastructure access all affect vehicle selection.

Both conventional and electric vehicles have been used to assess these factors. These criteria are thought to have a significant impact on a person's choice of vehicle. According to research, governments and electric car manufacturers should concentrate more on boosting social acceptability by emphasizing technology and developing infrastructure in order to build confidence. The general public is well aware of the benefits of the environment, according to the findings. The government and automakers are responsible for funding the manufacturing of automobiles.

CHAPTER 6

RESEARCH METHODOLOGY

This part aims to understand the process of uncovering information that creates a framework for evaluating and re-evaluating both primary and secondary research. The techniques and strategies employed during the initial analysis to arrive at conclusions are clearly defined and lead to a rational approach that backs the research inquiry.

Objective of the Research

Primary Objective

To understand how consumers view and act regarding electric cars within the framework of India.

Secondary Objective

In order to illustrate the several factors that affect consumers when they choose a vehicle or convince them to purchase an electric car soon.

to research the various factors that prevent consumers from choosing electric cars.

Reasons for the Research

The worldwide automobile industry is experiencing a notable increase in creativity due to technological breakthroughs and changes in the modern environment. Electric vehicles (EVs) are the most important advancement in the automobile industry's current wave of innovation. In-dia businesses are concentrating on the development and expansion of electric vehicles. The market for electric vehicles in Indiana is still in its infancy. Furthermore, these businesses are under tremendous pressure to become more productive and efficient in this fiercely competitive climate. Therefore, we hope that our research will help businesses better understand consumer perceptions, which will help them as they develop their marketing strategy, advertising campaigns, and sales plans.

Research Process

A research approach consists of stages or cycles that guide the inquiry from its inception to the final report, recommendations, and concluding actions. The research process provides a clear and systematic pathway for the exploration and ensures that all individual components of the study are aligned with each other.

This section's objective is to provide an overview of the research process and methodologies used to accomplish the project's objectives. This study includes exploratory research that was made possible by the "Survey Method." For the analysis, both primary and secondary data were used.

Primary Data

3 The research employs a quantitative approach, collecting primary data from the target population, as outlined by Nana Adu-Pipim Boaduo in 2011. A systematic questionnaire was created for participants utilizing the Google Form platform. The survey was segmented into multiple sections, including Demographic Details, awareness regarding electric vehicles, various consumer vehicle purchasing criteria, and more. This primary data will be analyzed to explore the influencing factors and their significance to the respondents.

Data Collection Instrument

To gather primary information, the research tool utilized is a "Questionnaire." The questionnaire has evolved into a widely accepted, thorough, and economical way to gather information. It consists of a series of inquiries directed at participants to obtain their responses. Questionnaires include both types of questions: those that allow for open responses and those that require yes or no answers. This report has been created based on the primary information that was gathered through a Google form.

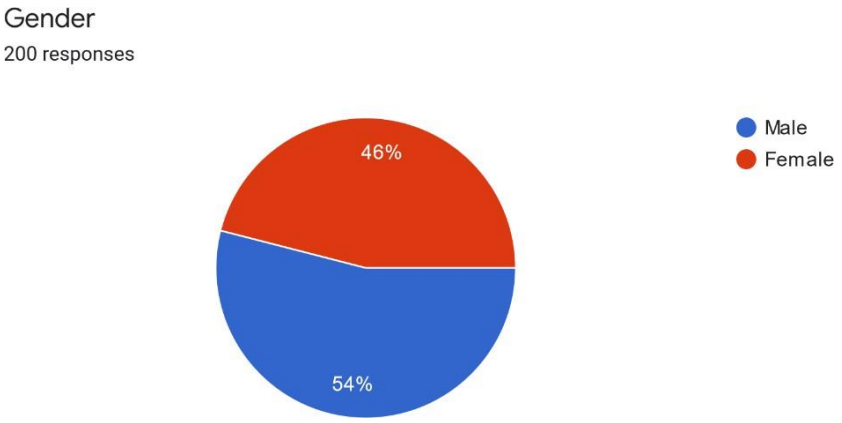
Secondary Data

This is the research data that has been previously generated. This information may include company specifics, like current sales figures and so forth. Such data is obtained from various sources, including literature, academic articles, online platforms, and more.

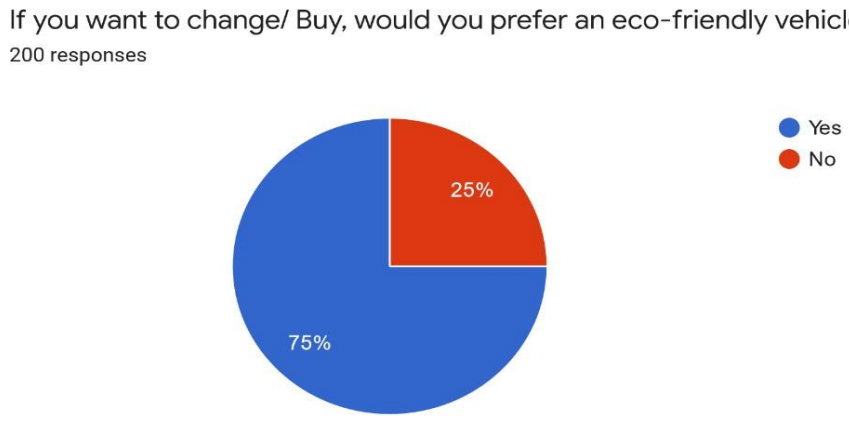
CHAPTER 7

DATA ANALYSIS AND INTERPRETATION

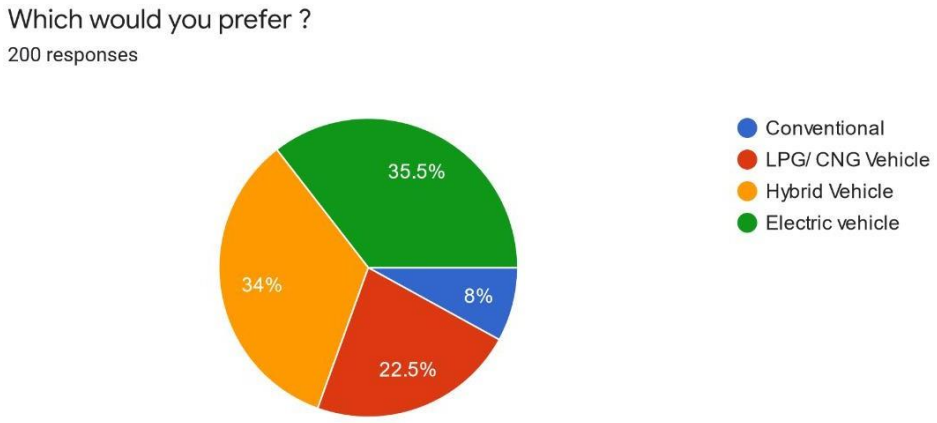
The total number of participants in the study is 200, with 54% identifying as male and 46% as female.



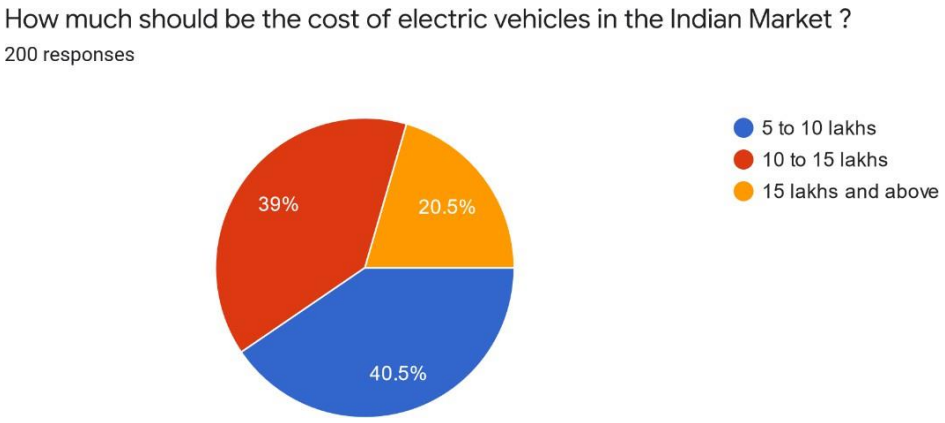
75% were in favour of eco-friendly vehicles and **25%** favoured conventional vehicle. Respondents are aware of climate conditions and ready to change their preference to eco-friendly cars.



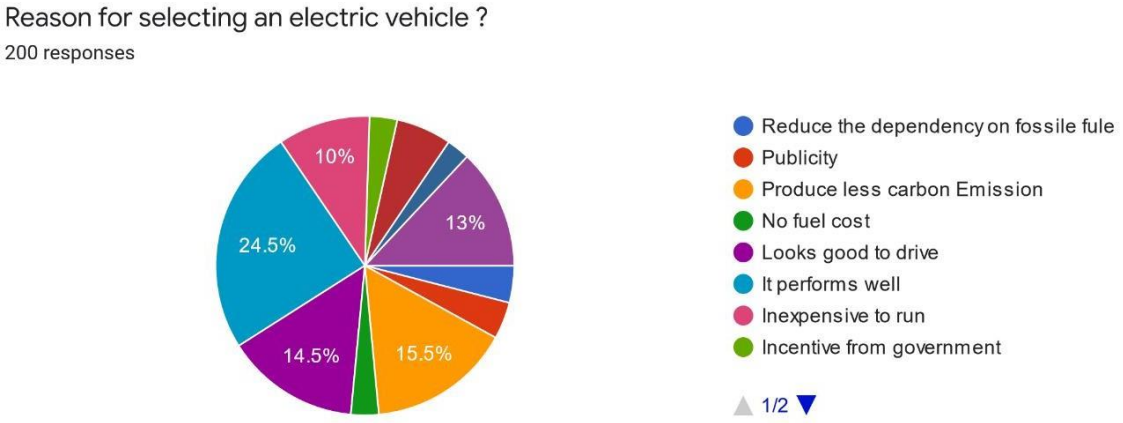
When asked regarding choice of vehicle, respondents majorly selected electric vehicles. There were 35.5% persons who chose electric vehicle.



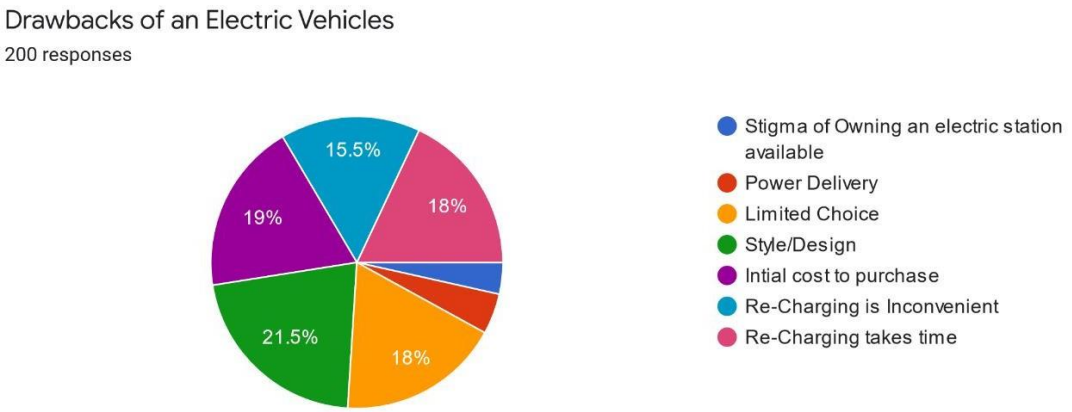
Considering that cost plays a crucial role, consumers anticipate electric vehicles to be priced between 5 to 10 lakhs.



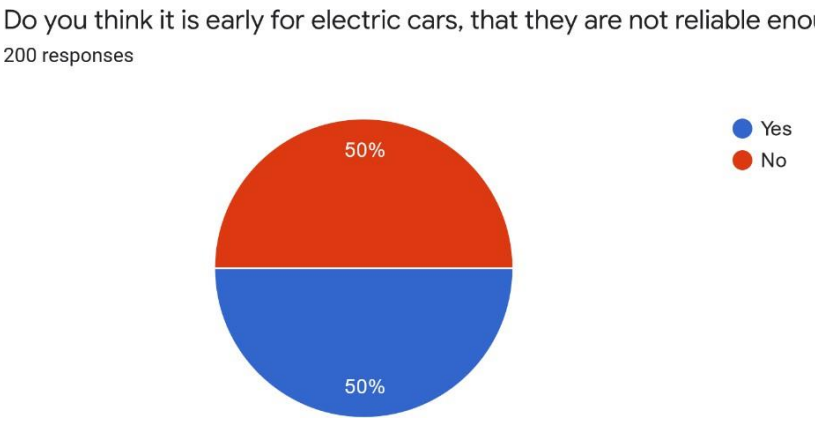
To find the consumer perception it's important to find out the factors for selecting EV. Respondents considers **it because it performs well, less carbon emissions, looks good to drive, inexpensive to run as important factors**.



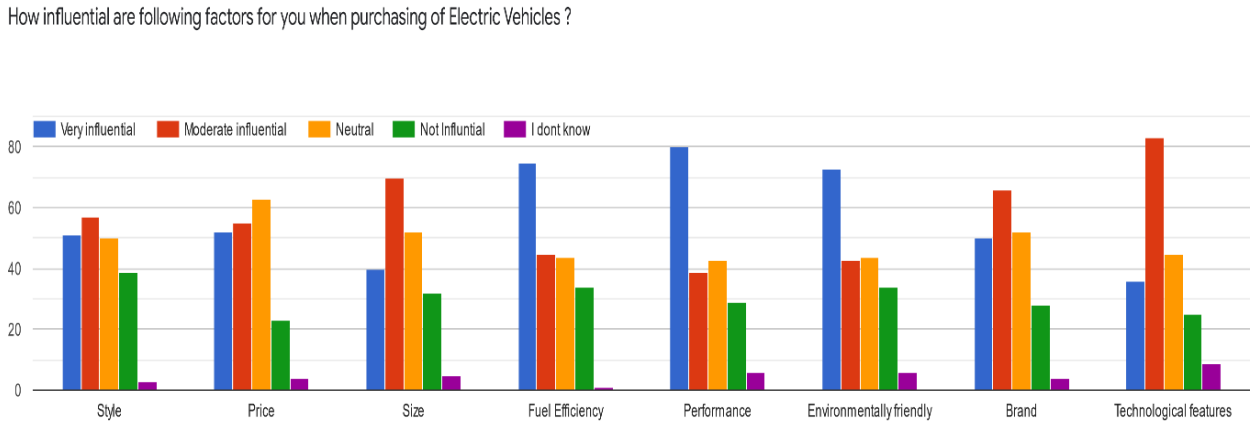
Respondents considers **Style/Design, Initial cost to purchase, Re-charging takes time, limited Choice, Re-Charging is inconvenient** as major drawback/limitation to consider EVs in current situation.



Considering the current infrastructure and development of electric vehicle in India, it is neutral according to responses collected from respondents that it is early for EVs to launch.



Respondents were being asked about the various factors which influences the purchase decision of a vehicle. Majority of respondents consider performance, fuel efficiency, price, technical features, and environment friendly as very influential, whereas they consider style, size, and brand as moderately influential factors.



7.1 Hypothesis testing

Test 1: Relationship between Choice of vehicle and Gender
H0: There is no significant difference of gender on the choice of vehicle.
H1: There is significant difference of gender on the choice of vehicle.

Actual(A)					
	Conventional	Electric Vehicle	Hybrid Vehicle	LPG/CNG Vehicle	Total
Male	11	33	35	27	106
Female	4	37	32	21	94
Total	15	70	67	48	**200**

Expected(E)				
	Conventional	Electric Vehicle	Hybrid Vehicle	LPG/CNG Vehicle
Male	7.95	37.1	35.51	25.44
Female	7.05	32.9	31.49	22.56

(A-E) ^2/E				
	Conventional	Electric Vehicle	Hybrid Vehicle	LPG/CNG Vehicle
Male	1.170125786	0.45309973	0.007324697	0.095660377
Female	1.319503546	0.510942249	0.008259765	0.10787234

x^2	3.672788492
df	3
p-value	**0.299033733**

P value is greater than 0.05 thus we accept H0 (null hypothesis) i.e., there is no significant difference of gender on the choice of vehicle. We can conclude that H0 is true or false, but our experiment and statistical test were not "strong" enough to lead to a p-value lower than 0.05.

Test 2: Relationship between choice of vehicle and Cost of Vehicle.

H0: There is no significant difference in cost of vehicle on the choice of vehicle.

H1: There is significant difference of cost of vehicle on the choice of vehicle.

Actual(A)				
	5-10 lakhs	10-15 lakhs	15 lakhs & above	Total
Male	31	51	24	106
Female	53	26	15	94
Total	84	77	39	**200**

Expected(E)			
	5-10 lakhs	10-15 lakhs	15 lakhs & above
Male	44.52	40.81	20.67
Female	39.48	36.19	18.33

(A-E)^2/E			
	5-10 lakhs	10-15 lakhs	15 lakhs & above
Male	4.105804133	2.544378829	0.536473149
Female	4.629949341	2.869193147	0.604959083

x^2	15.29075768
df	2
p-value	**0.000478249**

Since the P value is less than 0.05, we reject the null hypothesis (H0), which states that there is a substantial variation in the cost of vehicles depending on the decision made.

Test 3: Relationship between choice of vehicle and Income.

H0: There is no significant difference in income and their choice of vehicle.

H1: There is significant difference in income and their choice of vehicle.

Actual(A)					
	Conventional	**Electric Vehicle**	**Hybrid Vehicle**	**LPG/CNG Vehicle**	**Total**
upto 5 lakhs	8	30	27	14	79
5-10 lakhs	3	5	6	7	21
10-20 lakhs	3	30	25	21	79
20 lakhs & above	1	5	9	6	21
Total	15	70	67	48	**200**

Expected(E)				
	Conventional	**Electric Vehicle**	**Hybrid Vehicle**	**LPG/CNG Vehicle**
upto 5 lakhs	5.925	27.65	26.465	18.96
5-10 lakhs	1.575	7.35	7.035	5.04
10-20 lakhs	5.925	27.65	26.465	18.96
20 lakhs & above	1.575	7.35	7.035	5.04

(A-E) ^2/E				
	Conventional	**Electric Vehicle**	**Hybrid Vehicle**	**LPG/CNG Vehicle**
upto 5 lakhs	0.726687764	0.199728752	0.010815228	1.297552743
5-10 lakhs	1.289285714	0.751360544	0.152270789	0.762222222
10-20 lakhs	1.443987342	0.199728752	0.081096732	0.219493671
20 lakhs & above	0.209920635	0.751360544	0.548859275	0.182857143

x^2	8.827227849
df	
p-value	**0.453373179**

4 **Since the P value is higher than 0.05, we accept the null hypothesis, which states that there is no discernible difference between their choice of vehicle and income.**

Test 4: Relationship between choice of vehicle and age.
H0: There is no significant difference of age on the choice of vehicle.
H1: There is significant difference of age on the choice of vehicle.

Actual(A)					
	Conventional	Electric Vehicle	Hybrid Vehicle	LPG/CNG Vehicle	Total
18-25	7	32	34	26	99
25-45	6	23	25	13	67
45 & above	2	15	8	9	34
Total	15	70	67	48	**200**

Expected(E)				
	Conventional	Electric Vehicle	Hybrid Vehicle	LPG/CNG Vehicle
18-25	7.425	34.65	33.165	23.76
25-45	5.025	23.45	22.445	16.08
45 & above	2.55	11.9	11.39	8.16

(A-E)^2/E				
	Conventional	Electric Vehicle	Hybrid Vehicle	LPG/CNG Vehicle
18-25	0.024326599	0.202669553	0.021022916	0.211178451
25-45	0.189179104	0.008635394	0.2908454	0.589950249
45 & above	0.118627451	0.807563025	1.008964004	0.086470588

x^2	3.559432734
df	6
p-value	**0.736046375**

Since the P value is higher than 0.05, we accept the null hypothesis, which states that there is no discernible impact of age on vehicle preference.

Test 5: Relationship between choice of vehicle and cost of vehicle.

H0: There is no significant difference of cost of vehicle on the choice of vehicle.

H1: There is no significant difference of cost of vehicle on the choice of vehicle.

Actual(A)					
	Conventional	**Electric Vehicle**	**Hybrid Vehicle**	**LPG/CNG Vehicle**	**Total**
5 to 10 lakhs	2	47	18	17	84
10 to 15 lakhs	8	17	29	23	77
15 lakhs and above	5	6	20	8	39
Total	15	70	67	48	**200**

Expected(E)				
	Conventional	**Electric Vehicle**	**Hybrid Vehicle**	**LPG/CNG Vehicle**
5 to 10 lakhs	6.3	29.4	28.14	20.16
10 to 15 lakhs	5.775	26.95	25.795	18.48
15 lakhs and above	2.925	13.65	13.065	9.36

(A-E)^2/E				
	Conventional	**Electric Vehicle**	**Hybrid Vehicle**	**LPG/CNG Vehicle**
5 to 10 lakhs	2.934920635	10.53605442	3.653859275	0.49531746
10 to 15 lakhs	0.857251082	3.673562152	0.398217678	1.105541126
15 lakhs and above	1.472008547	4.287362637	3.681150019	0.197606838

x^2	33.29285187
df	6
p-value	**9.20927E-06**

We accept H0 (the null hypothesis), which states that there is no discernible difference in the cost of vehicles based on the choice of vehicle, because the P value is greater than 0.05.

Test 6: Relationship between Cost of Vehicle and age.
H0: There is no significant difference of cost of vehicle on age.
H1: There is significant difference of cost of vehicle on age.

Actual(A)				
	5-10 lakhs	10-15 lakhs	15 lakhs & above	Total
18-25	42	38	19	99
25-45	33	19	15	67
45 & above	9	20	5	34
Total	84	77	39	200

Expected(E)			
	5-10 lakhs	10-15 lakhs	15 lakhs & above
18-25	41.58	38.115	19.305
25-45	28.14	25.795	13.065
45 & above	14.28	13.09	6.63

(A-E)^2/E			
	5-10 lakhs	10-15 lakhs	15 lakhs & above
18-25	0.004242	0.000347	0.0048187
25-45	0.83936	1.7899603	0.286584386
45 & above	1.952269	3.6476776	0.400739065

x^2	8.9259987
df	4
p-value	0.062976

Since the P value is higher than 0.05, we accept the null hypothesis, which states that there is no discernible difference in the cost of a car based on age.

RESULTS AND SUGGESTIONS

Results

The purpose of this paper was to determine the factors that influence consumers' opinions on electric vehicles and their decision to purchase one. The following conclusions are drawn from the survey that was completed, the data that was analyzed, and the knowledge that was gained.

A significant number of participants fall into the Generation Y or Millennial category, encompassing both students and working individuals. This younger demographic is shifting its perspective from traditional vehicles to electric options, embracing sustainability.

It is clear that 75% of consumers are aware of electric vehicles, and many of them say they would like to learn more or maybe buy a battery-operated model in the future.

Most buyers have a budget of less than ₹10,000,000. In order to reach this market, up-and-coming automakers ought to think about launching their electric cars in this price range.

Most customers do not currently own an electric vehicle. There is a strong possibility that if carmakers offer excellent features along with engaging demonstrations and appealing promotions, they could draw in a larger clientele.

A sizable portion of the populace is certain that contemporary technology can provide affordable electric vehicles that meet their needs, including family size and budget.

People think that buying an electric car could improve their personal image, save money for their owners, and help fight global warming.

When choosing an electric car, users consider a number of important factors, such as cost, energy efficiency, maintenance needs, safety, the availability of charging stations, and the range that can be achieved on a single charge.

Recommendations Right time:

Over the next five to seven years, imports will be essential for Indian makers of electric vehicles (EVs). International businesses now have a great chance to join India, evaluate the basic component needs for electric vehicles (EVs), and develop a strategic plan based on their results.

Scope for Few Sectors:

The sectors expected to experience increasing requirements are: Aluminum sector – primarily, aluminum is utilized in electric vehicles more than in traditional vehicles (25% – 27%).

Electronics sector - The demand for power electronics in Electric Vehicles (EVs) is projected to show a growth of 17.2% compound annual growth rate (CAGR) from 2018 to 2023 (IIMB, 2018)

Early birds – Electric Vehicle (EV) components:

The majority of manufacturers producing automotive parts have either begun investigating components for Electric Vehicles (EVs) or are involved in the production of parts related to Electric Vehicles (EVs), especially for electric two-wheelers and three-wheelers.

BS-VI will celebrate the trend toward electric vehicles (EVs):

The Indian Supreme Court has directed the government to start implementing BS-VI standards in April 2020. Original Equipment Manufacturers (OEMs) will be drawn to electric vehicles (EVs) as a result of the shift to BS-VI, which would necessitate large investments in infrastructure improvements.

Clever decisions by the government:

GST, the removal of high denomination currency, and other changes have boosted the tax participation of citizens. This rise in taxation will fortify the economic framework. Upon achieving economic stability, comprehensive promotion of Electric Vehicles (EVs) will commence. The Economic Survey of 2017-18 indicates that the number of indirect taxpayers has noticeably improved by over 50% following the GST implementation. For the fiscal year 2017-18, tax revenue is 17.1 percent higher than the total collections recorded for the fiscal year 2016-17 (economic times).

CONCLUSION

Consumer behavior encompasses all actions taken by individuals during the stages of making decisions before and after purchasing. A company can thrive within a competitive landscape only by understanding the complexities of consumer behavior. Insights into what buyers want empower marketers to devise strategies that align with consumer demands.

The structure has been developed to identify the preferences of consumers when considering the purchase of an electric vehicle in India. Based on a review of relevant literature, we have identified elements that influence how consumers perceive electric cars. Feedback from participants was collected, and various factors were examined.

The kind and color, ride comfort and safety, financial and promotional offers, features and size, spending habits, and aesthetic appeal are some of the factors that influence a customer's decision to buy an electric car.

FUTURE STUDY SCOPE

The analysis states that the Indian automobile industry has a large amount of room for electric automobiles. Thus, it may be worthwhile to look at how customer brand impression affects the adoption of electric vehicles.

Another research opportunity lies in examining how advertising and promotional strategies of brands contribute to the marketing of electric vehicles.

A potential constraint might be that this market analysis could be influenced by various factors that may alter consumer perspectives on battery-powered vehicles. Future research could expand on this by exploring other aspects of consumer buying behavior related to automobiles in order to identify the underlying reasons.

A more extensive study could involve a larger sample of participants across a broader geographic region to yield more universal results and new analytical insights. With numerous international companies entering the market, a study assessing their effect on consumer behavior could be worthwhile. Recent issues have shaped consumer preferences for electric vehicles, largely due to insufficient infrastructure. Our research focused on consumer perspectives, but it could also widen its scope by incorporating insights from retailers.

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ANNEXURES

Gender *

- ◯ Male
- ◯ Female

If you want to change/ Buy, would you prefer an eco-friendly vehicle ? *

- ◯ Yes
- ◯ No

How much you earn annually? *

- ◯ Upto 5 lakhs
- ◯ 5 to 10 lakhs
- ◯ 10 to 20 lakhs
- ◯ 20 lakhs & above

Which would you prefer ? *

- ◯ Conventional
- ◯ LPG/ CNG Vehicle
- ◯ Hybrid Vehicle
- ◯ Electric vehicle

How much should be the cost of electric vehicles in the Indian Market ? *

- ○ 5 to 10 lakhs
- ○ 10 to 15 lakhs
- ○ 15 lakhs and above

Reason for selecting an electric vehicle ? *

- ○ Reduce the dependency on fossile fule
- ○ Publicity
- ○ Produce less carbon Emission
- ○ No fuel cost
- ○ Looks good to drive
- ○ It performs well
- ○ Inexpensive to run
- ○ Incentive from government
- ○ Easy to drive
- ○ Cost of Ownership

Drawbacks of an Electric Vehicles *

- ◯ Stigma of Owning an electric station available
- ◯ Power Delivery
- ◯ Limited Choice
- ◯ Style/Design
- ◯ Intial cost to purchase
- ◯ Re-Charging is Inconvenient
- ◯ Re-Charging takes time

Do you think it is early for electric cars, that they are not reliable enough? *

- ◯ Yes
- ◯ No

How influential are following factors for you when purchasing of Electric Vehicles ? *

	Very influential	Moderate influential	Neutral	Not Influntial	I dont know
Style	○	○	○	○	○
Price	○	○	○	○	○
Size	○	○	○	○	○
Fuel Efficiency	○	○	○	○	○
Performance	○	○	○	○	○
Environmentally friendly	○	○	○	○	○
Brand	○	○	○	○	○
Technological features	○	○	○	○	○