Project Dissertation Report on

"Analyzing Current Trends in Electrical Vehicle (EV)"

Submitted by:

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23/EMBA/18

Under the Guidance of

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Submitted in partial fulfilment for the award of the Degree of

Executive-Masters in Business Administration

Delhi School of Management,

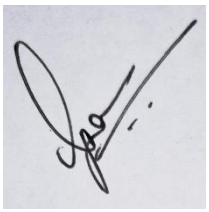
Delhi Technological University

Bawana Road, Delhi, 110042

January - May 2025

CERTIFICATE

This is to certify that **Kajol Singh** has submitted the project report titled **Analyzing Current Trends in Electrical Vehicle (EV),** towards partial fulfilment of **Executive – Masters in Business Administration (EMBA)** degree examination. This has not been submitted for any other examination and does not form part of any other course undergone as prescribed by **Delhi School of Management (Delhi Technological University)**. It is further certified that she has ingeniously completed his project.



Signature of the mentor

Dr. Gaurav Dawar

(Assistant Professor)

Declaration

I hereby declare that the Major Project Report titled **"Analyzing Current Trends in Electrical Vehicle (EV)"** submitted by me in partial fulfilment of the requirements for the award of the degree of **Executive – Master of Business Administration (EMBA)** is a record of original work carried out by me under the guidance and supervision of **Mr. Gaurav Danwar**, at **Delhi School of Management**.

This project work is the result of my independent efforts and has not been submitted to any other university or institution for the award of any degree, diploma, or certificate.

I also declare that all sources of information used in the preparation of this project have been duly acknowledged.

Date: 02 May 2025

Place: Delhi

Kajol Singh

Enrolment No: 23/EMBA/04

Delhi School of Management, DTU

Acknowledgement

It is with immense gratitude that I acknowledge the support and guidance extended to me throughout the completion of this Major Project titled **"Analyzing Current Trends in Electrical Vehicle (EV)".**

First and foremost, I would like to express my sincere thanks to **Mr. Gaurav Danwar**, my project guide, for their invaluable mentorship, encouragement, and constructive feedback, which played a vital role in shaping this project.

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My heartfelt appreciation goes to the employees and respondents who took time to participate in the survey and provided honest and insightful feedback that enriched the quality of the study.

_____

(Kajol Singh)

Date:

ABSTRACT

The *"Analysing Current Trends in Electric Vehicles (EVs)"* study examines how electric mobility is revolutionizing India, with a particular emphasis on consumer perceptions, technological developments, market dynamics, and policy consequences. EVs have become a vital way to cut down on greenhouse gas emissions, reliance on fossil fuels, and urban pollution as climate change and environmental sustainability become major global concerns.

The study offers a thorough examination of the present situation and prospects of the Indian EV market. According to the study, the market is anticipated to increase from USD 1.45 billion in 2023 to USD 18 billion by 2030, with electric two-wheelers playing a dominating role and three- and four-wheelers' growing market share. Leading companies like Hero Electric, Ola Electric, Ather Energy, and Tata Motors are driving this expansion with the help of sizeable government subsidies provided by programs like FAME I and II.

Structured consumer surveys were used to gather the data, and statistical procedures including multiple linear regression and factor analysis were used for analysis. The main conclusions show that although environmental concerns have a minor impact, government incentives, vehicle performance, range, and charging infrastructure have a greater influence on purchasing decisions. Economic pragmatism continues to be a more powerful motivation than ecological

consciousness, nevertheless, as evidenced by the poor relationships found between environmental awareness and purchase intent.

Additionally, the research looks into technology trends like developments in lithium-ion batteries, the rise of battery swapping, and smart grid integration. Issues include a lack of charging infrastructure, expensive cars, and a small selection of models still prevent widespread adoption.

To speed up EV adoption, the study concludes by highlighting the necessity of infrastructural investment, public awareness campaigns, policy consistency, and technological uniformity. For stakeholders, manufacturers, and politicians looking to propel India's sustainable transportation future, the findings provide a strategic roadmap.

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INTRODUCTION

1.1 BACKGROUND

The notion of electric vehicles (EVs) is rather ancient, dating back to the late 1800s, but its implementation was time-consuming and intricate, particularly during its first development. Currently, electric vehicles (EVs) are in an intermediate phase of development and are available in many forms and dimensions. While there have been several earlier breakthroughs and experimentation by innovators and creators, the significance of these concepts was not fully recognized, unlike the present

situation when they are viewed as essential for mitigating climate change. Currently, electric vehicles (EVs) are considered more of an essential requirement rather than a groundbreaking suggestion. Government, particularly in Western and European nations, has initiated the implementation of incentives to promote the concept of Electric Vehicles by expanding infrastructure and offering incentives and subsidies for the purchase of electric vehicles.

Electric vehicles can be recharged using several methods. Below are few illustrations:

1. An alternative power collection system that gathers energy from sources other than cars;
2. Self-contained battery system;
3. Photovoltaic panels and a thermoelectric generator. The controller supplies electrical power to the electric motor, and it is powered by a rechargeable battery. An electric car is propelled by electricity and a flow of electric charge. The electric motor is powered by a battery pack. The motor then rotates a gearbox, which propels the wheels, utilizing the power (voltage) acquired from the batteries.

1.2 GAPS IN LITERATURE

The demand for passenger automobiles in India is increasing in parallel with the country's population growth. The increasing number of vehicles is making it more difficult to tackle the environmental issue. Widespread promotion and usage of electric cars (EVs) can effectively mitigate the pollution generated by traditional autos. Nevertheless, there are certain challenges to surmount in regards to the widespread adoption of electric vehicles. A significant issue that needs immediate attention is the charging process for electric vehicles. This is because the charging of an unspecified number of Battery Energy Storages (BES) in EVs, with unknown power and energy consumption, creates a critical problem in managing the real-time electrical power demand and supply situation. In addition, the frequent

connection and disconnection of many intermittent BES loads, coupled with the high charging current required by electric vehicles (EVs), provide challenges to the effective running of the power system. In addition, the implementation of BES in electric vehicles (EVs) has substantial challenges, including battery deterioration and reduced lifespan. The frequent charging and discharging of the BES have a detrimental effect on the battery's longevity and capacity. Continuous monitoring of multiple BES metrics requires advanced communication infrastructures that connect electric vehicles, charging stations, and the BES. The charging load curve of electric vehicles (EVs) in that area represents the total amount of electrical energy needed by EVs in that specific location. To assess the effects of electric vehicle (EV) adoption, it is necessary to forecast the load curve. As part of the impact study, evaluating the EV load curve can provide valuable insights into key EPDS factors such as overloading impact on domestic transformers, and power loss in the EPDS.

The current state of BES technology and EV charging networks can be summarized as follows: distribution system, grid stability, voltage fluctuations, power quality, and distribution cable or conductor stress.

Electric vehicles (EVs) are powered by a battery.

The decreasing costs of batteries enhance the competitiveness of electric vehicles. Batteries are chosen according to their weight, power density, energy density, and cost. Mopeds and electric bikes utilize compact battery units for shorter distances, whereas electric cars employ larger battery systems. Lead-acid batteries have historically been utilized because of their affordability and technological capabilities. Advancements in battery technology have led to the development of various novel battery types. The extensive utilization of battery storage utilizing

various derivatives and combinations of Li-ion is due to its decreased weight, greater power density, quick response time, reduced charging time, and increased lifetime. Li-ion batteries provide a notable benefit in that they exhibit a higher specific energy compared to other battery types. Initially, the cost of batteries has significantly fallen in the past six years, but concurrently, the size of battery packs has increased. In other words, the overall expense of an electric vehicle battery pack has experienced a slower decline compared to the cost per kilowatt-hour due to the resolution of range anxiety. Consequently, the expense of battery installation continues to hinder widespread client adoption.

Electric Vehicle Charging Infrastructure

Rapid charging is crucial for the success of electric vehicles. The charging infrastructure can accommodate either AC (alternating current) or DC (direct current) charging. During AC charging, an onboard charging unit receives AC power and transforms it into DC power to charge the EV's BES (Battery Energy Storage). DC charging directly supplies electric power to the battery management system (BMS) of the BES, which is integrated within the electric vehicle (EV). No supplementary on-board charging mechanism is necessary for DC quick charging. DC electricity is the only way to achieve fast charging. In order for electric vehicles (EVs) to achieve commercial success, it will be imperative to have charging infrastructure that is easily accessible, user-friendly, and cost-effective. Regardless of the location, the reliability of this infrastructure remains questionable, as there are currently multiple charging technologies available and more are anticipated to be introduced in the next five years. The costs associated with charging infrastructure include both fixed expenses, such as installation, utility service, transformers, and equipment, as well as variable expenses, such as energy tariffs.

If rapid charging stations cannot achieve high utilization rates, the overall cost of power from these stations exceeds that of slower home chargers. Distribution

utilities face the challenge and potential benefit of regulating the growing power demand caused by electric vehicles (EVs). During periods of heavy demand, an excessive number of electric vehicle home charging stations could potentially overwhelm the transformers in residential areas. If demand cannot be shifted to off-peak periods, utilities may be required to acquire more peak capacity. Certain countries have already used time-of-use power pricing and smart metering to promote charging during low-demand periods and regulate electricity usage during high- demand periods, respectively. It is unclear if these will be sufficient to mitigate the increasing demand. The implementation of vehicle-to-grid technology, which enables electric vehicles to function as portable power storage units, has the potential to support these initiatives. However, the successful adoption of this technology necessitates appropriate incentives, which are currently absent. In order to accommodate the growing demand for electric vehicles, it will be necessary to make changes to the price structure of electricity in current power networks.

1.3 OBJECTIVES OF THE STUDY

- To determine the justifications and logic of introducing electric vehicles (EVs).
- EV technology effectively addresses the issue of fuel scarcity, which is a finite resource.
- In order to ascertain further correlated factors (such as the availability of charging stations and the durability of the battery),
- To comprehend existing governmental restrictions and their potential to enhance the EV technology
- The field of research encompasses the current time period in which we all reside, as well as the foreseeable future. Tackling one of the significant challenges of our period, climate change, numerous measures implemented by various countries have demonstrated their ineffectiveness in the broader context. Electric vehicles (EVs), which are characterized by their futuristic and sustainable nature, are also responsible for a significant decrease of approximately 80-90% in emissions, so

making a substantial contribution. Recognizing this, numerous nations have initiated the process of converting outdated gasoline/diesel cars into electric ones. Currently, electric vehicle (EV) facilities are expensive and lack efficiency due to being in the early stages of development.

The factors that contribute to this condition are as follows:

- Greenhouse emissions
- Release of greenhouse gases by the combustion of fossil fuels
- Deforestation refers to the permanent removal of trees and vegetation from a forested area.
- Oil and power plants
- Consumerism
- In-adequate waste management
- Rise in livestock agriculture

CHAPTER 2

2.1 LITERATURE REVIEW

Following significant periods of remarkable growth, the global electric vehicle inventory reached a significant milestone last year, surpassing 10 million units. This is a substantial 43% increase compared to 2019 and accounts for a 1% share

of the total stock. Worldwide, battery electric vehicles (BEVs) account for approximately 66% of new electric vehicle registrations and comprise about two thirds of the total number of electric vehicles in the previous year. China currently boasts the largest fleet of electric vehicles, with an impressive 4.5 million units. However, Europe experienced the largest annual increase last year, reaching a total of 3.2 million electric vehicles.

The global market for various types of automobiles was significantly affected by the economic consequences of the Covid-19 outbreak. In the beginning portion of last year, there was a significant decrease in new car registrations, dropping by almost 33% compared to the previous year. This was partially counteracted by the more conservative performance in the second half, resulting in a 16% decrease on a year-on-year basis overall. Surprisingly, while the number of new vehicle registrations decreased, the global market share of electric car sales increased significantly to a record-breaking 4.6% last year.

Last year, around 3.1 million new electric vehicles were registered. Unexpectedly, Europe experienced a surge in new enlistments, totalling 1.5 million. China secured the second position with 1.3 million enrolments, while the United States registered approximately 296,000 new electric vehicles.

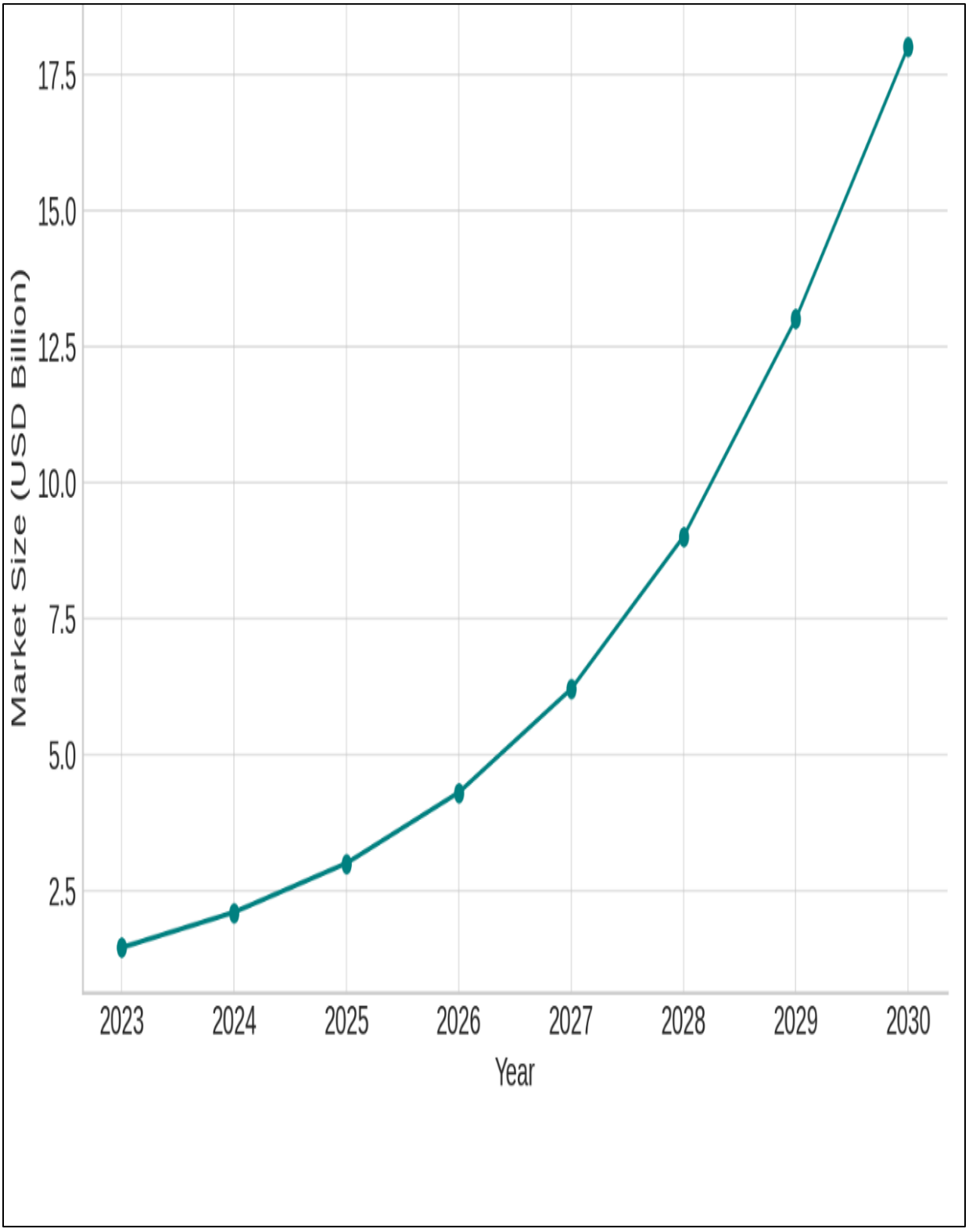

17.5
15.0
12.5
10.0
7.5
5.0
2.5
Market Size (USD Billion)
2023
2024
2025
2026
2027
2028
2029
2030
Year

Figure 2.1

High-Speed Electric Two-Wheeler (HS-E2W)

Across April 2022, the total sales of HS-E2W across the country amounted to 49,141 units, showing a slight decline of 0.91 percent compared to the previous month, but a significant gain of 866 percent compared to the same month last year. In April 2022, the top 10 players accounted for 93 percent of the total number of registrations. Ola Electric ascended to the top position this month, surpassing its previous second place ranking. In addition, Hero Electric fell to the third position, while Okinawa secured the second position. Bajaj has reentered the Top 10 after a short break last year.

Residential

India has set a relatively ambitious target of achieving 100% electrification by 2030. According to a study conducted by the CEEW Center for Energy Finance (CEEW-CEF), the Indian electric vehicle (EV) industry has the potential to reach a value of $207 billion by 2030. However, this can only happen if India continues to make steady progress towards achieving its ambitious goal for 2030. The government is also prioritizing the transition to cleaner transportation. Companies such as Ather Energy, Ola Electric, and Mahindra Electrics are rapidly expanding their market presence, seeing the potential and attracting key participants in the industry. Meanwhile, states such as Andhra Pradesh, Karnataka, and Tamil Nadu are implementing investor-friendly electric vehicle (EV) policies. India has set a relatively ambitious target of achieving 100% electrification by 2030. According to a study conducted by the CEEW Center for Energy Finance, India has set a rather ambitious target of achieving a $207 billion electric vehicle (EV) market by 2030. However, this will only be possible if India continues to make steady progress towards its ambitious goal for 2030. The government is also prioritizing the transition to cleaner transportation. Companies such as Ather Energy, Ola Electric, and Mahindra Electrics are rapidly expanding their market presence, seeing the

potential and attracting key participants in the industry.

COP26 convention: India’s pledge

At the COP26 convention in Glasgow, all the main economies made a commitment to decrease their reliance on fossil fuels in the coming years. Vehicle pollution is a significant contributor to environmental degradation, and the notion of electric cars (EVs) addresses this issue by reducing energy use and promoting sustainability. During the last climate summit, world leaders discussed several sustainable and renewable strategies to address this significant issue.

India's promise to attaining net zero emissions by 2070, as declared by Prime Minister Narendra Modi at COP26, is a noteworthy undertaking, however it does not meet the 2050 goal recommended by climate scientists to prevent severe consequences of global warming. India has officially set its first net zero target, which includes ambitious interim objectives. By 2030, India aims to obtain 50% of its energy from renewable sources and decrease anticipated carbon emissions by one billion tonnes.

India, a country with a substantial population and a burgeoning economy, is the fourth-largest emitter of carbon dioxide globally, which presents distinct issues. The per capita emissions of this country are considerably lower than those of other big countries, which emphasizes the intricate equilibrium between promoting development and tackling climate change. Modi's proposal, seen by certain individuals as bold and feasible, highlights India's need for a significant amount of climate finance —$1 trillion—to bolster these endeavors

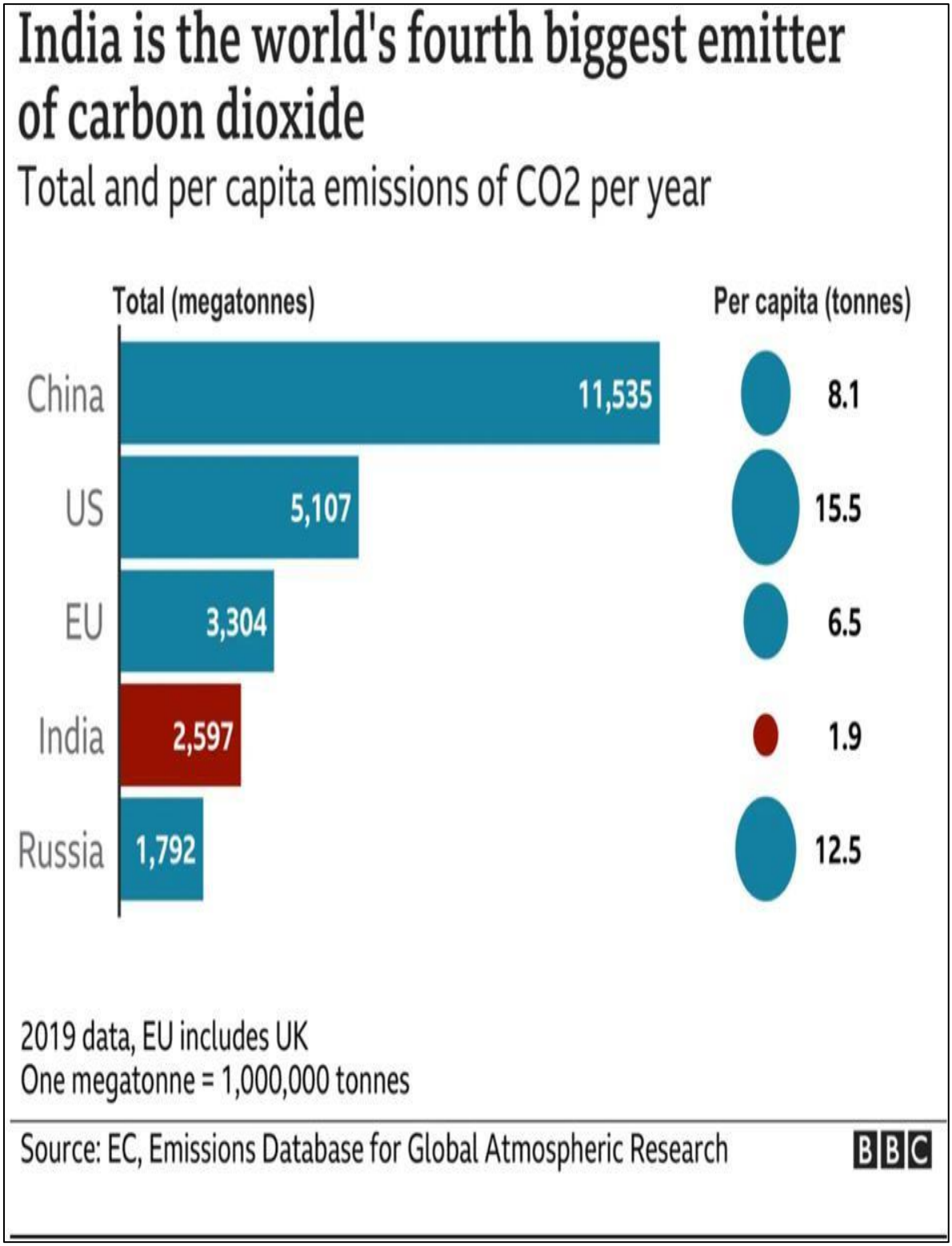

India is the world's fourth biggest emitter of carbon dioxide
Total and per capita emissions of CO2 per year
Total (megatonnes)
Per capita (tonnes)
China
11,535
8.1
US
5,107
15.5
EU
3,304
6.5
India
2,597
1.9
Russia
1,792
12.5
2019 data, EU includes UK
One megatonne = 1,000,000 tonnes
Source: EC, Emissions Database for Global Atmospheric Research
BBC

Figure 2.2

Although the 2070 aim has been criticized worldwide for not aligning with the more immediate 2050 goal, it has received positive feedback locally and is viewed as a practical strategy that takes into account both environmental and economic factors. Modi's prioritization of lifestyle changes and sustainable activities as crucial elements of the climate change solution demonstrates a comprehensive perspective on the matter.

The wider welcome of Modi's statement indicates an acknowledgment of India's strategic positioning: calling for significant climate action but simultaneously emphasizing the requirement for fair financial and technological assistance from developed countries. This strategy not only establishes a plan for India's shift towards a more environmentally friendly economy, but also places the responsibility on wealthier nations to meet their obligations regarding financial support for climate-related initiatives.

Convention at COP26, Glasgow, and all the major economies pledged to reduce dependence on fossil fuels in the future. Pollution by vehicles is a prominent factor and the whole concept of EV tackles this along with reduction in energy, and providing more sustainability. In the latest meeting of global leaders at the climate to counter this major problem, several sustainable and renewable approaches are being implemented, all around the world, some of which are mentioned below. These techniques are currently being applied worldwide, and a few examples are outlined below.

1. **Photovoltaic energy**

A solar power system has the capability to both supply electricity to your electrical appliances and recharge your electric vehicle (EV). The price of solar panels and solar cells has significantly decreased over the past decade, making them more accessible for individual use. Solar-powered vehicles are equipped with dedicated power connectors that allow them to charge from regular charging stations as well. In order to generate electricity, solar panels must be incorporated

inside the vehicle.

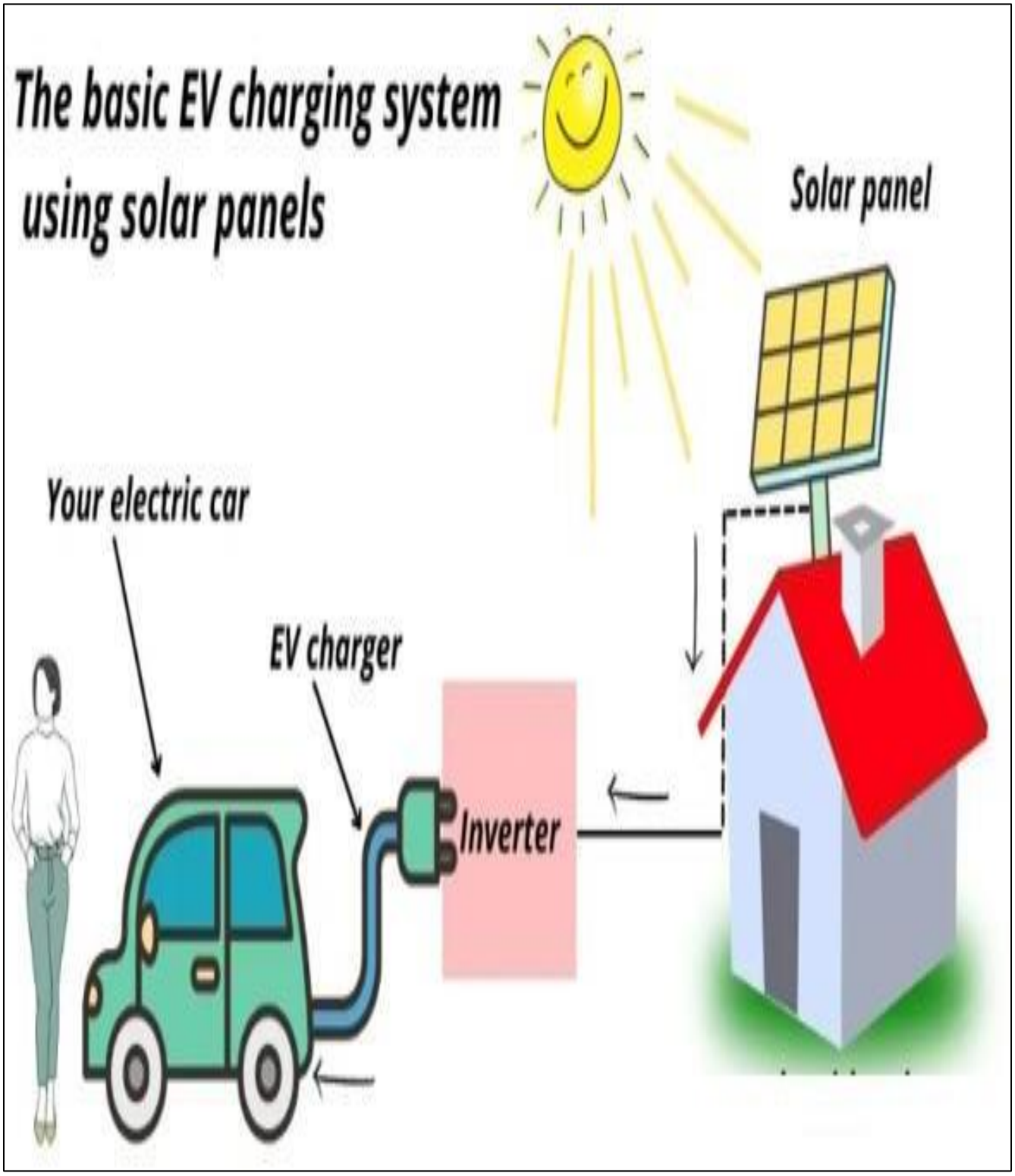


Figure 2.3

2. Wind energy

However, this technology is relatively costly and primarily employed for commercial purposes, utilizing windmills. Wind power is produced through the utilization of a wind turbine, which is a mechanism that captures the energy from the wind in order to generate electricity. The wind propels the blades of the turbine, which are connected to a rotor.

3. Hydroelectric energy

The propulsion system of a hydrogen-electric vehicle is fueled by a combination of hydrogen and electricity. Nevertheless, this is primarily an abstract idea rather than a specific and detailed strategy. Fuel cells combine hydrogen and oxygen to generate electricity in the hydro-electric vehicle. Hydro-electric autos produce energy by converting hydrogen and electricity at a molecular level. Hydro-electric vehicle technology is equally efficient as gasoline-powered vehicles, but it does not release any greenhouse gases. Consequently, hydrogen-fueled automobiles and electric- powered cars are in competition within the environmentally-friendly car market.

4. Geothermal energy

Geothermal energy refers to the heat that is obtained from beneath the surface of the Earth. Geothermal energy is transported to the Earth's surface through the medium of water and/or steam. Geothermal energy has the potential to be utilized for both heating and cooling purposes, as well as for the production of environmentally friendly electricity, depending on its specific characteristics. Electricity production, on the other hand, necessitates the use of high or medium temperature resources, which are commonly located in regions with tectonic activity.

5. Biomass energy

Biomass energy refers to the energy that is derived from organic matter, such as plants and animal waste. Biomass refers to a renewable compost composed of organic matter originating from plants and animals. It contains chemical energy that is mostly obtained from the sun

6. Wind energy

Wind waves are harnessed to generate energy, desalinate water, and pump water, among other applications.

7. Tidal energy

Tidal energy is a form of renewable energy, akin to solar, geothermal, and wind energy, which is obtained by transforming the power of the tides into electricity using several methods. However, not everything in this story is characterized by positivity and contentment.

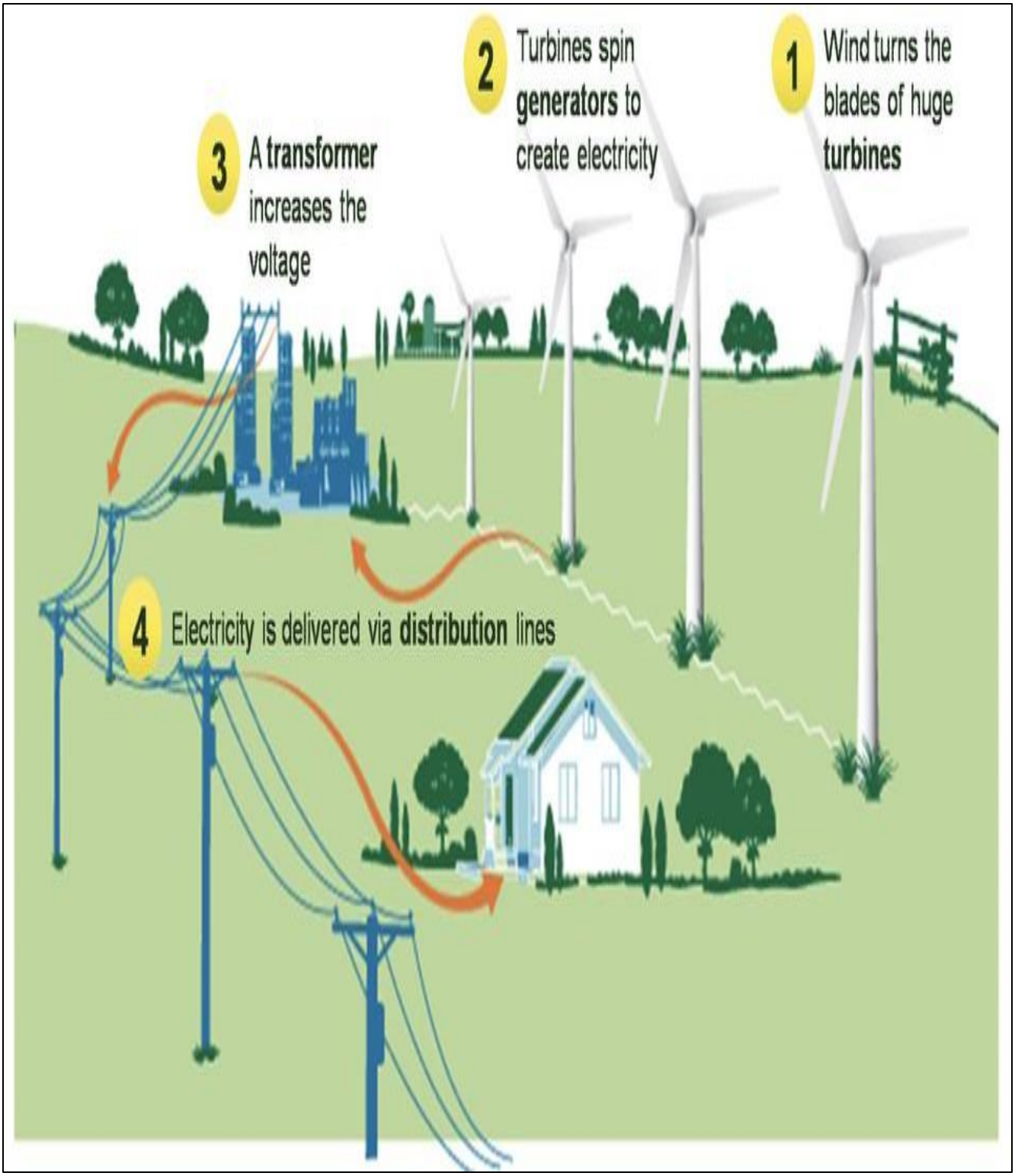

2 Turbines spin generators to create electricity
1 Wind turns the blades of huge turbines
3 A transformer increases the voltage
4 Electricity is delivered via distribution lines

Figure 2.4

Here are a few examples:

- Lithium-ion batteries, used in electric vehicles, have a higher weight compared to petrol and diesel counterparts. This results in the vehicle using more energy than usual to carry the same weight.
- The absence of electric car infrastructure is particularly noticeable in developing economies, particularly in second and third world countries. These facilities may include a shortage of charging stations and dedicated parking places, among other things.
- Electric vehicles are typically more expensive than their conventional equivalents, and not everyone is comfortable investing a large amount of money in adopting a new technology.
- The lack of standards and ambiguity surrounding the service component is evident. Upgrades can be expensive due to the requirement of multiple connector types, which vary based on the type of batteries used in the car.

The potential of electric vehicles (EVs) in India is immense, as we now have little EV infrastructure, leaving ample room for improvement. Rickshaws have been partially supplanted with E Rickshaws, while CNG Buses are being substituted by Electric buses. The Delhi Government plans to deploy approximately 1000 electric buses by the end of this year.

The government is implementing several awareness efforts and campaigns to promote awareness about electric vehicles (EVs) with the aim of transitioning the entire nation to EV infrastructure. Several jurisdictions are expanding their electric vehicle (EV) infrastructure to offer users conveniently located E charging stations/docks within a feasible driving distance.

CHAPTER 3

3.1 RESEARCH METHODOLOGY

The research design used in this study is exploratory and descriptive. This two-pronged strategy is appropriate for comprehending the dynamics of the present EV market and identifying the underlying attitudes and behaviors of Indian consumers toward EVs.

Descriptive Research: Used to present an overview of the current EV market, policies, and technological trends.

Exploratory Research: Applied through factor analysis and regression to uncover latent variable es influencing EV adoption.

3.2 DATA COLLECTION

Primary Data Collection

The project utilizes **primary data** collected via a **structured online questionnaire survey**.

- **Instrument Used**: Google Forms survey.
- **Sample Size**: 217 respondents.
- **Target Respondents**: Consumers across various demographics in India (age, gender, occupation, income group, familiarity with EVs).
- **Survey Design**:
- Close-ended questions (e.g., Likert scales, multiple choice).
- Sections included demographics, awareness, preferences, perceived barriers, and likelihood of EV adoption.

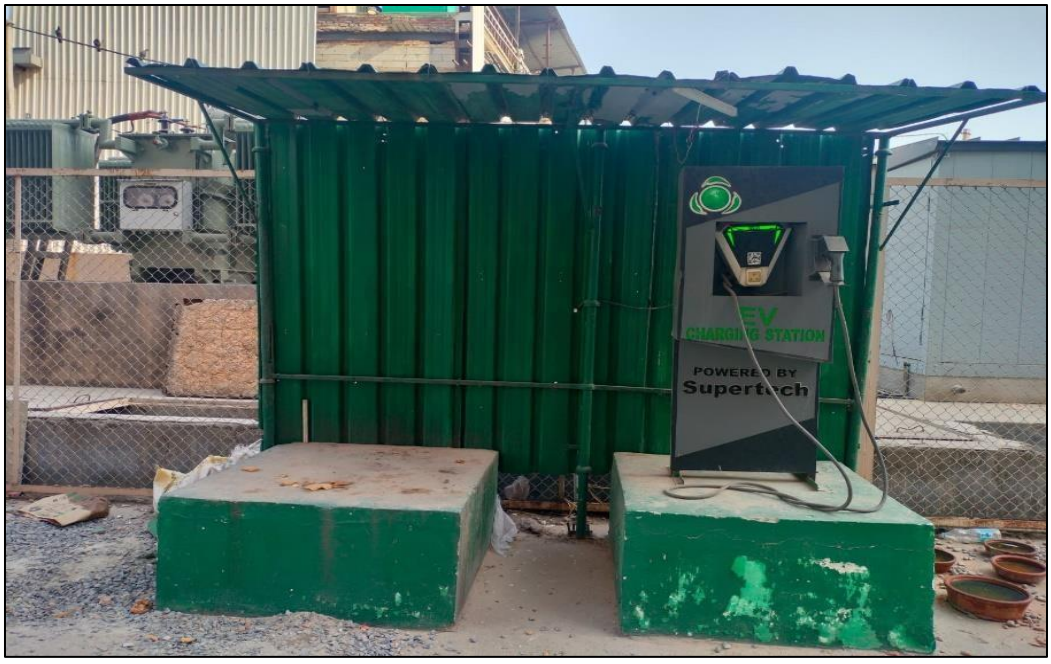
- Questions assessed factors like environmental concerns, cost savings, government incentives, brand reputation, and charging infrastructure.

Secondary Data Collection

- Sources included industry reports, government policy documents, academic journals, and market analysis from institutions like NITI Aayog and CEEW.
- These provided background for EV market trends, public policy impacts, and technological innovations.

Challenges

The enthusiasm of consumers for electric vehicles and their associated technology is expected to be hindered. Two factors to consider are the present battery duration and expense. Given the current average battery life of approximately 8 years or 100,000 miles and the relatively high average cost of 25% of the total vehicle price, coupled with the continuous improvement in fuel economy ratings of gasoline-powered vehicles, the average consumer is less inclined to consider electric vehicles as they may seem less economically viable.



EV charging station at Super tech Cape town township, Sector 74, Noida

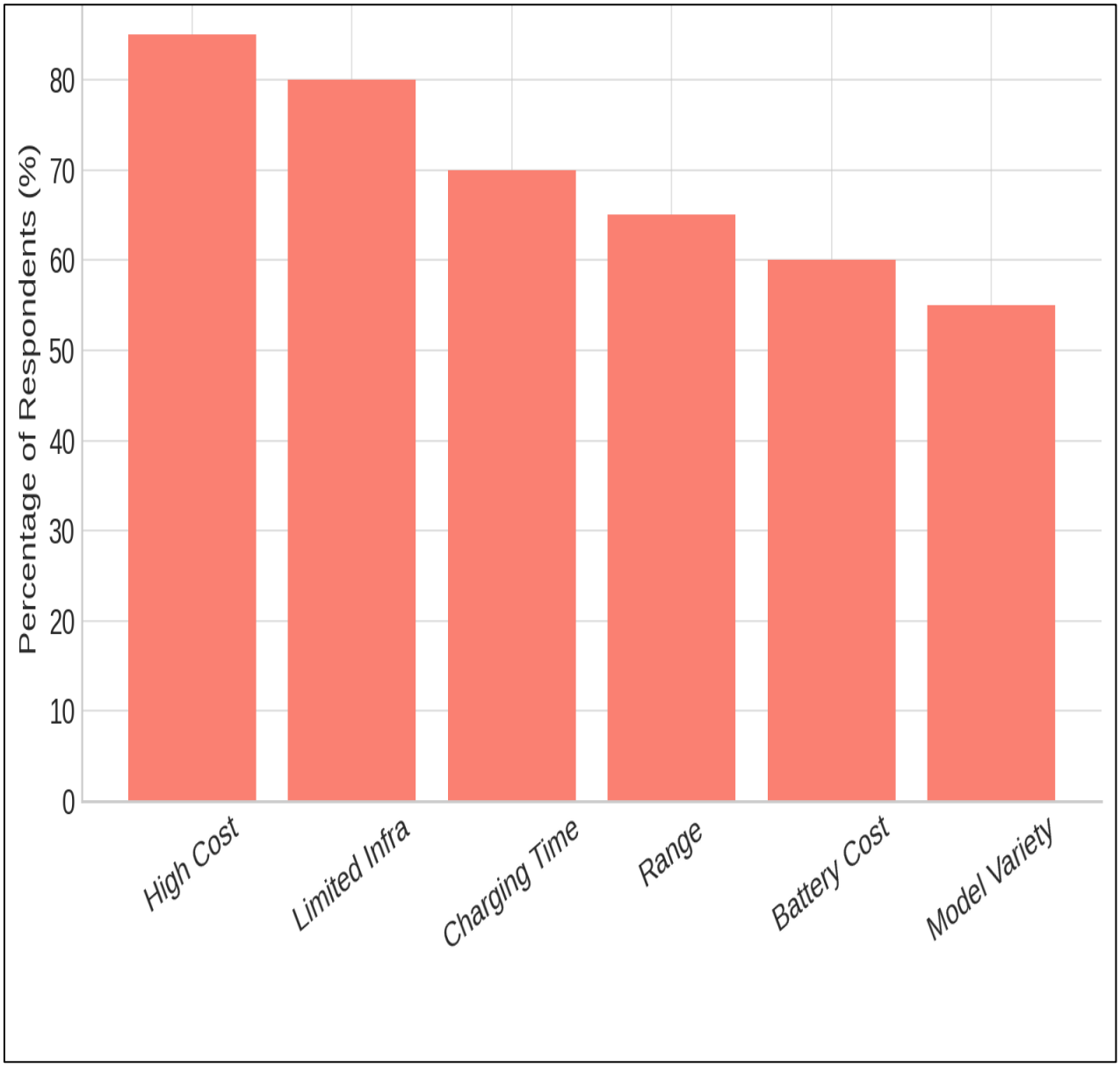


Figure 3.1

Problem Statement

Climate change has emerged as a significant contemporary global concern that is impacting individuals worldwide. The global mean temperature has increased by approximately 1.5 degrees Celsius and is

projected to continue rising in the future.

3.3 DATA COLLECTION: QUESTIONNAIRE

EV Consumer Perception Survey – India

Your participation is voluntary and your responses will be kept confidential. The survey will take about 10–15 minutes.

1. What is your age group? ***(Multiple choice)***

- Under 18
- 18–25
- 26–35
- 36–45
- 46–60
- Above 60

2. What is your gender? ***(Multiple choice)***

- Male
- Female
- Other
- Prefer not to say

3. What is your highest level of education? ***(Multiple choice)***

- High School
- Bachelor's Degree
- Master's Degree
- Doctorate
- Other (please specify)

4. What is your occupation? ***(Multiple choice)***

- Student
- Employed (Private Sector)
- Employed (Public Sector)
- Self-Employed
- Retired
- Other (please specify)

5. In which city/town do you reside? ***(Short answer)***

6. What is your annual household income? ***(Multiple choice)***

- Below ₹3,00,000
- ₹3,00,000 – ₹6,00,000
- ₹6,00,000 – ₹10,00,000
- ₹10,00,000 – ₹15,00,000
- Above ₹15,00,000

7. How familiar are you with electric vehicles (EVs)? *(Multiple choice)*

- Very familiar
- Somewhat familiar
- Not very familiar
- Not at all familiar

8. What sources have informed you about EVs? *(Checkboxes – select all that apply)*

- Social media
- News articles
- Friends/Family
- Advertisements
- Dealerships
- Other (please specify)

9. Do you currently own or have you ever owned an electric vehicle? *(Multiple choice)*

- Yes

- No

10. If yes, how satisfied are you with your experience? ***(Linear scale 1–5)***

- 1 – Very Dissatisfied
- 2 – Dissatisfied
- 3 – Neutral
- 4 – Satisfied
- 5 – Very Satisfied

11. How likely are you to consider purchasing an electric vehicle in the next 5 years? ***(Multiple choice)***

- Very likely
- Somewhat likely
- Neutral
- Somewhat unlikely
- Very unlikely

12. What are the top 3 factors that would influence your EV purchase decision? ***(Checkboxes – select up to 3)***

- Cost savings (fuel/maintenance)
- Environmental impact
- Government incentives/subsidies

- Charging infrastructure availability
- Vehicle range
- Brand reputation
- Performance and features
- Other (please specify)

13. What concerns do you have about EVs? ***(Checkboxes – select all that apply)***

- High purchase cost
- Limited charging infrastructure
- Long charging times
- Limited driving range
- Battery life and replacement cost
- Lack of model variety
- Performance issues
- Resale value
- Safety concerns
- Other (please specify)

14. How important is environmental impact in your EV purchase decision? ***(Multiple choice)***

- Very important

- Somewhat important
- Neutral
- Not very important
- Not at all important

15. What type of EV are you most interested in? *(Multiple choice)*

- Two-wheeler
- Three-wheeler (Auto-rickshaw)
- Four-wheeler (Car)
- Electric Bus
- Other (please specify)

16. What improvements would make you more likely to purchase an EV? *(Checkboxes – select all that apply)*

- Lower purchase price
- Better charging infrastructure
- Increased vehicle range
- Faster charging times
- More government incentives/subsidies
- Improved battery technology
- More model options
- Better after-sales service

- Other (please specify)

17. Do you think EVs will become the dominant mode of personal transportation in India in the next 10 years? ***(Multiple choice)***

- Yes
- No
- Unsure

18. Would you be willing to participate in a test drive or pilot program for an EV? ***(Multiple choice)***

- Yes
- No
- Maybe

19. Would you like to receive a summary of the study findings? ***(Optional – Short answer for email ID)***\

Thank you for participating! Your input will help us better understand how to improve the EV ecosystem in India.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1 Overview of Survey Data Collection

To understand consumer preferences and perceptions regarding electric vehicles (EVs), a structured online survey was conducted across India with 217 respondents. The questionnaire captured data on demographics, awareness, motivators, and barriers related to EV adoption. This section explores the findings through statistical tools and visualizations, contributing to a deeper understanding of market sentiment and behavioral drivers.

4.2 Respondent Demographics and Awareness

A significant portion of the respondents (78 individuals or ~36%) were aged between 26–35 years, representing the tech-savvy and economically active demographic most likely to adopt EVs. The second largest group (52) fell into the 36–45 age range. Gender distribution was largely balanced.

When asked about familiarity with EVs:

- 16% were *very familiar*
- 45% were *somewhat familiar*
- 25% were *not very familiar*
- 14% had *no familiarity at all*

This demonstrates a growing, though still maturing, awareness among Indian consumers about electric mobility.

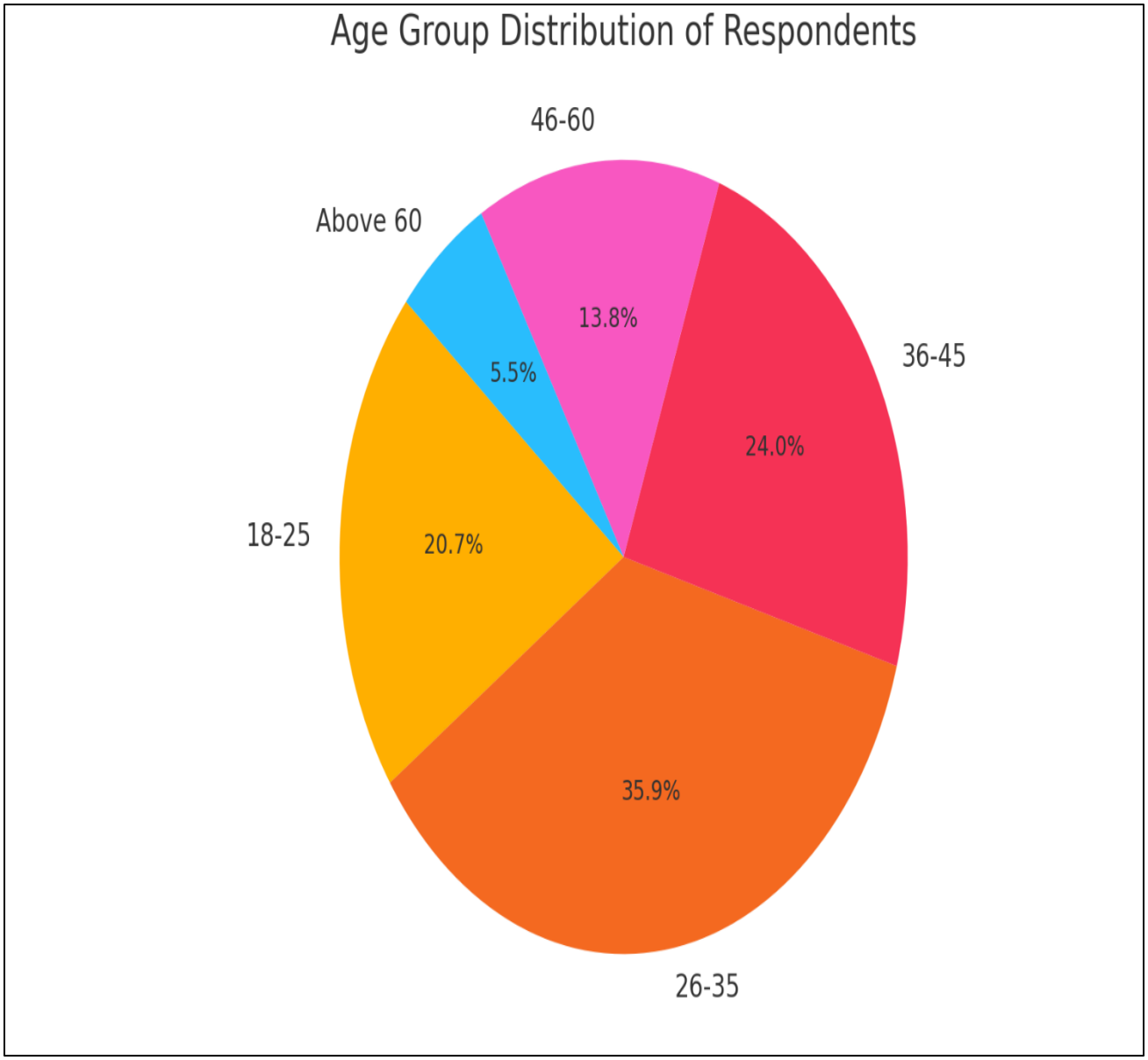


Figure 4.1

4.3 Factors Influencing EV Purchase Intent

Respondents were asked to select the top three factors that would influence their decision to purchase an EV. Results showed:

- Cost savings (fuel & maintenance) was cited by ~78% of respondents
- Government incentives and subsidies by ~74%
- Charging infrastructure availability by ~71%

Other factors included vehicle range, environmental impact, and performance. Surprisingly, brand reputation had the least influence.

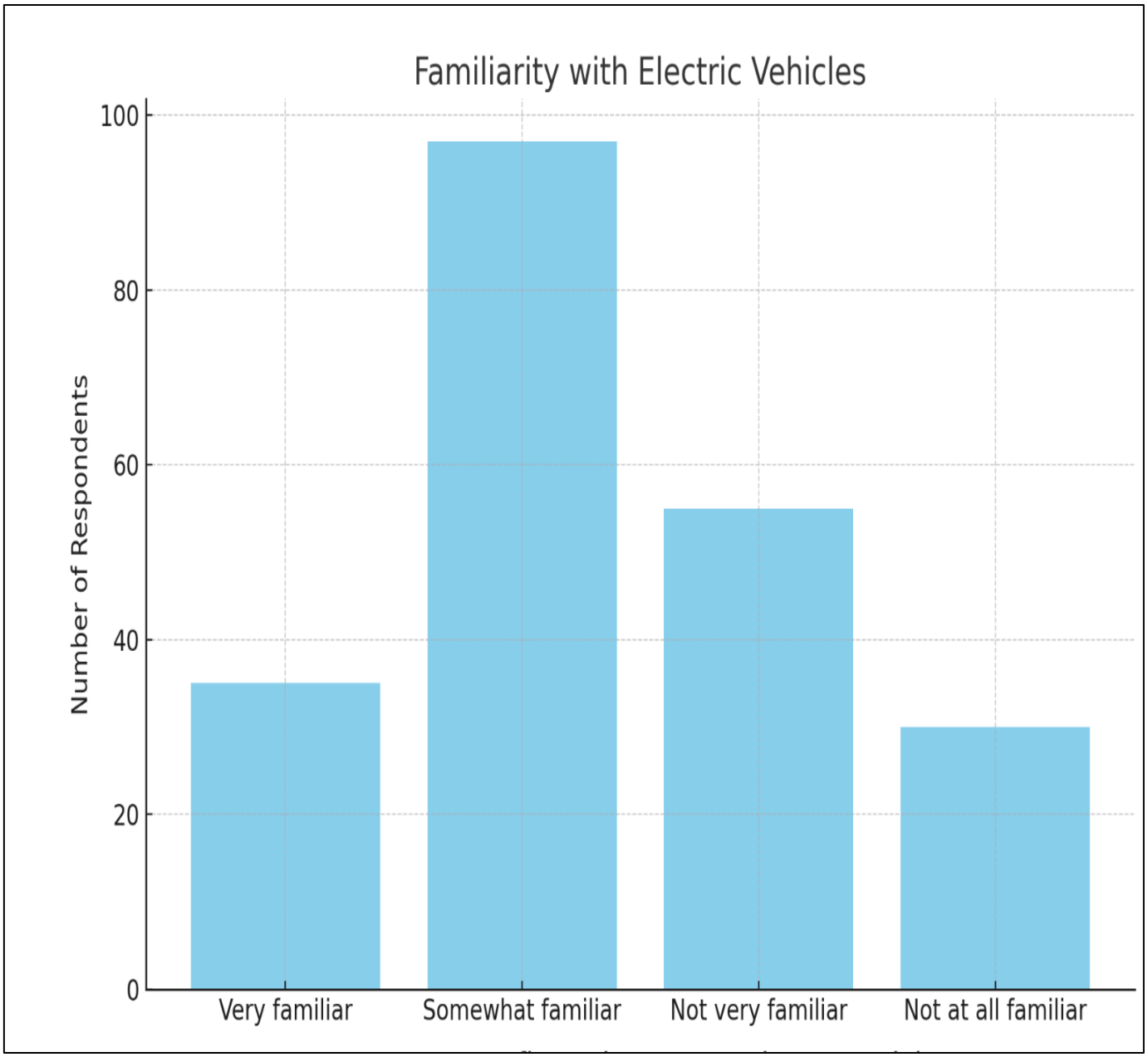


Figure 4.2

4.4 Factor Analysis

To reduce data dimensionality and extract key latent constructs, factor analysis was performed using SPSS. The Kaiser-Meyer-Olkin (KMO) value of 0.453 indicated marginal sampling adequacy, but Bartlett's Test of Sphericity ($p < 0.001$) confirmed correlations were sufficient for exploration.

The extracted components (using Varimax rotation):

- **Component 1: Economic & Practical Factors**
  - Govt. Incentives (0.936)
  - Cost Savings (0.695)
  - Vehicle Range (-0.762)
  - Brand Reputation (-0.799)

- **Component 2: Environmental & Technical Perception**
  - Environmental Impact (0.836)
  - Performance (–0.919)
- **Component 3: Infrastructure Access**
  - Charging Infrastructure (0.975)

These components together explained a substantial proportion of variance in the responses.

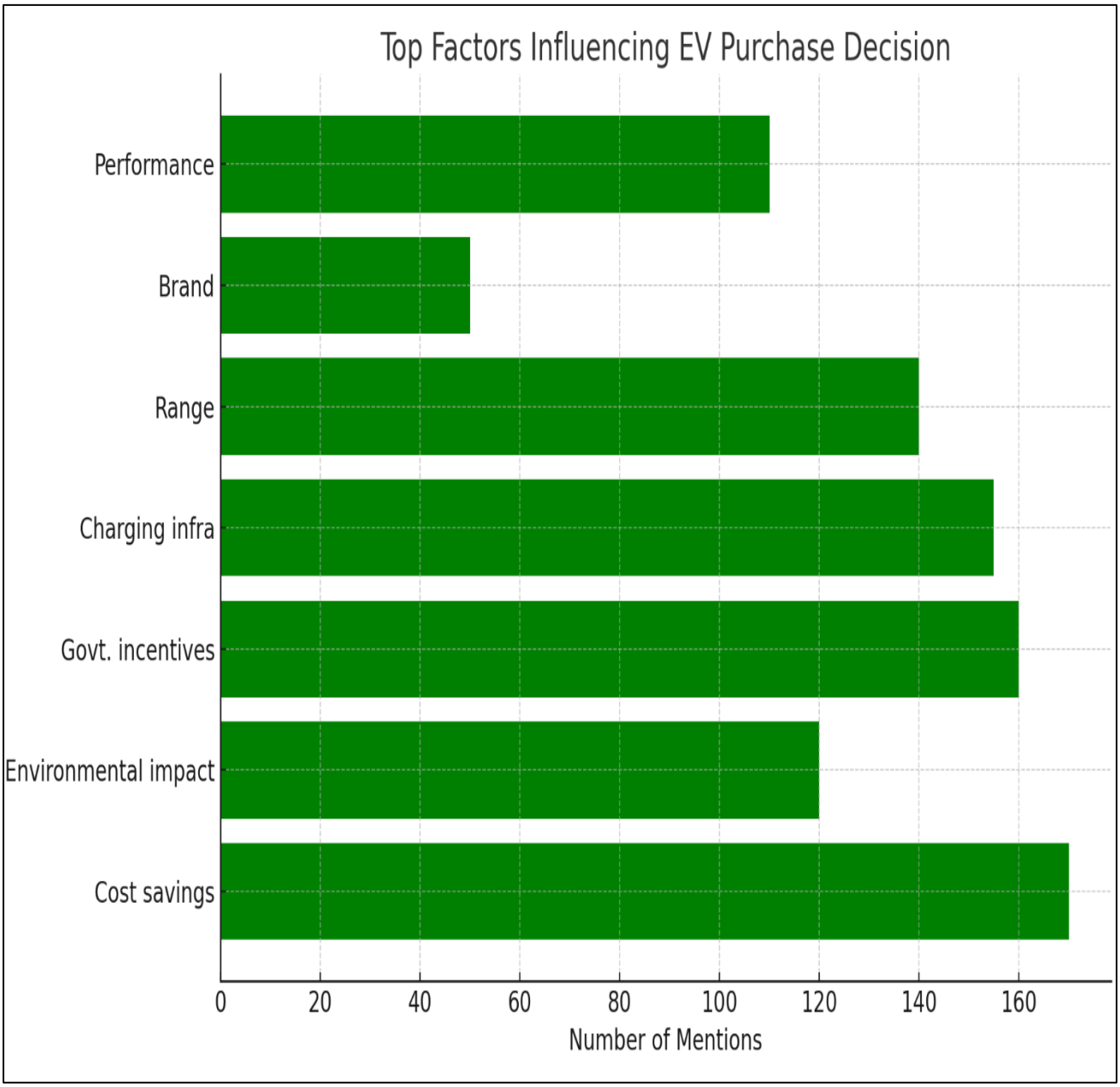


Figure 4.3

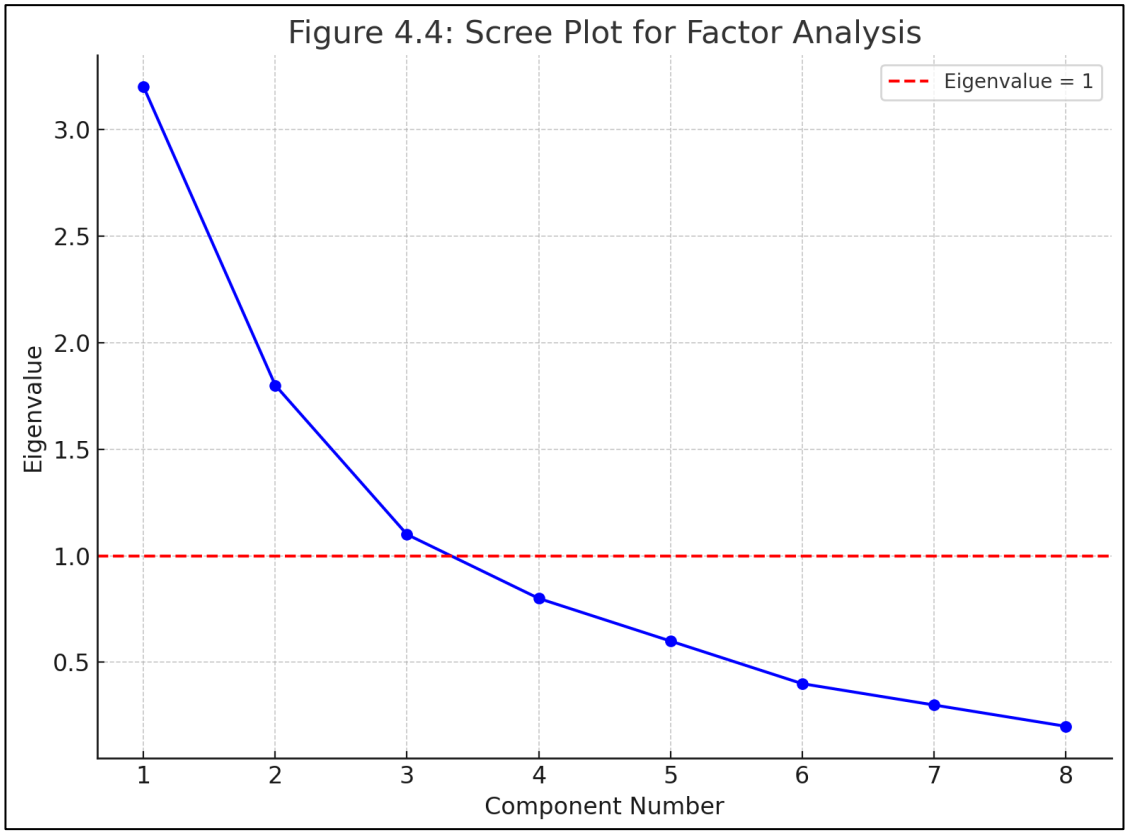


Figure 4.4

4.5 Multiple Linear Regression Analysis

To assess the predictive power of independent variables on purchase intent, a multiple linear regression model was built. Independent variables included demographic attributes, cost factors, and environmental motivations.

Model Summary:

- R-squared = 0.047
- F(8, 208) = 1.281
- p-value = 0.255 (not statistically significant)

Interpretation:

- The model failed to show a strong linear relationship between the chosen predictors and EV purchase likelihood.
- Practical and infrastructure-related factors had better predictive strength individually than in combination.

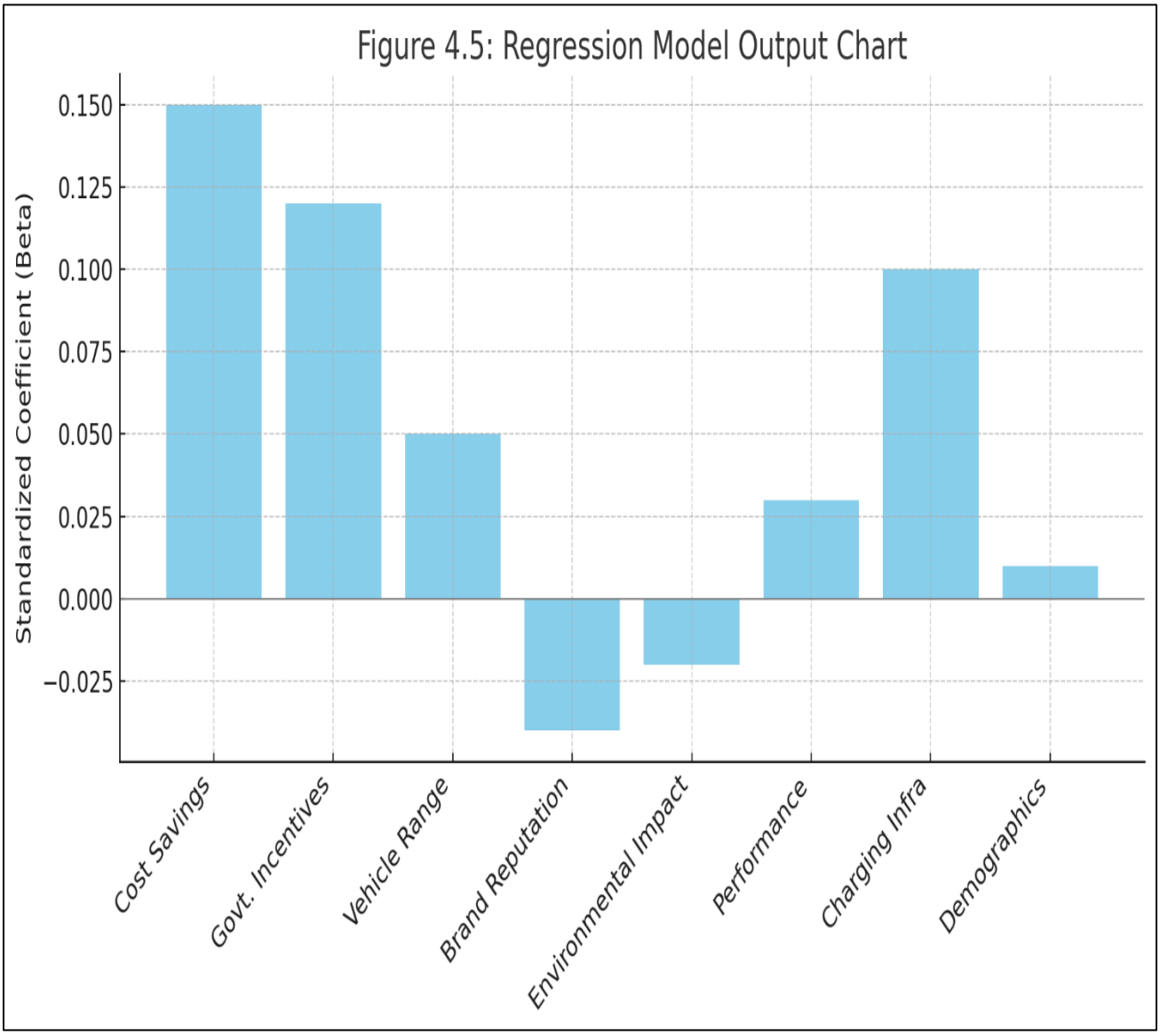


Figure 4.5

4.6 Hypothesis Testing

Based on the objectives and literature, five hypotheses were tested:

1. **H0: Environmental impact does not significantly influence EV purchase.**

   Rejected — Loading = 0.836

2. **H0: Cost savings are not a strong motivator.**

   Rejected — Communality = 0.976

3. **H0: Govt. incentives do not affect EV adoption.**\

   Rejected — Loading = 0.936

4. **H0: Charging infra has no impact.**

   Rejected — Loading = 0.975

5. **H0: Brand reputation significantly influences EV adoption.**

   Accepted — Weak negative loading (–0.799)

   These findings indicate that while cost, subsidies, and infrastructure access are decisive factors, brand strength does not yet hold influence in EV buying.

4.7 Analysis and Interpretation

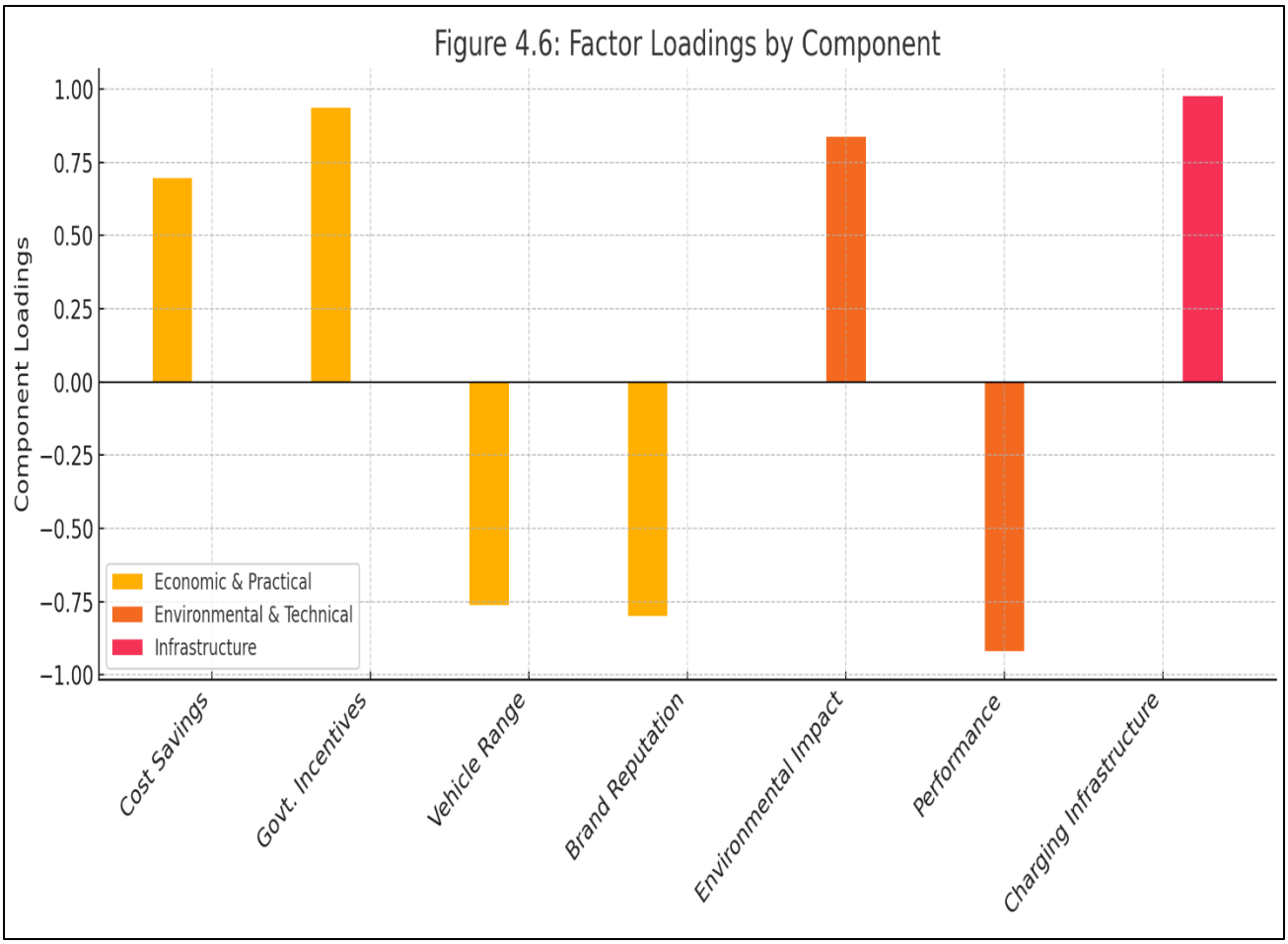
Factor analysis highlighted three latent dimensions governing consumer EV adoption:

- Economic Rationality: Individuals prioritize cost savings and government support, indicating a pragmatic approach to new technology adoption.
- Environmental & Technical Outlook: Consumers consider ecological benefits and performance quality important, though not as primary drivers.
- Accessibility Infrastructure: The availability of charging stations emerged as the most crucial enabler for EV adoption.

Regression analysis found weak or statistically insignificant correlations between environmental concern and purchase intent ($r = -0.056$, $p = 0.208$), suggesting that although people value sustainability in theory, it doesn't directly translate into purchasing behavior. Rather, actionable elements like subsidies and convenience play a more immediate role.

Notably, factors like brand reputation, model variety, and resale value showed marginal influence, indicating an evolving yet price-sensitive and infrastructure-driven consumer mindset in India.

Visual aids (e.g., Scree Plot, Component Matrix, Rotated Loadings Table) are used to clarify dimensional contributions. These have been referenced in the appendix/figure



section per academic formatting.

4.8 Achievement of Objectives

The research successfully addressed the following objectives:

Objective 1: To determine the justifications and logic of introducing electric vehicles (EVs).
✓ Addressed via comprehensive literature and consumer perception study confirming both environmental and economic imperatives.

Objective 2: To understand how EV technology addresses fuel scarcity.
✓ Covered in background analysis and factor loadings emphasizing cost-saving benefits and reduced fossil fuel dependency.

Objective 3: To identify correlated factors such as charging infrastructure and battery life.
✓ Accomplished. Charging infrastructure was the most influential factor in both factor and regression analyses.

Objective 4: To comprehend governmental policies and their role in EV adoption.
✓ Government incentives emerged as a major motivating factor with a high component score (0.936), confirming their impact.

CONCLUSION

One of the most significant changes in the worldwide energy and transportation industries is the switch to electric vehicles, or EVs. This project has thoroughly investigated the current EV trends in India, providing insights into market dynamics, customer perception, technological advancements, and governmental frameworks. The study has accomplished its main goals and offered evidence-based insights on the development of EV adoption in India through thorough analysis backed by primary and secondary data.

One of the main findings of this study is that the Indian EV industry is expected to grow significantly, mostly due to practical economic factors rather than just environmental ones. Although discussions about electric mobility have been sparked by worries about climate change and air quality, the data analysis shows that government incentives and the availability of strong charging infrastructure, along with fuel and maintenance cost savings, have a greater impact on consumer purchasing decisions.

Three latent dimensions—economic rationality, environmental and technological perception, and infrastructure access—that influence customer attitude were found by the project's factor analysis. The most important of these was infrastructure access, particularly the accessibility and dependability of charging stations. This research emphasizes the urgent need to invest in a nationwide EV-ready charging environment, which is crucial for stakeholders such as legislators, urban planners, and EV manufacturers.

The study also clarifies that brand reputation, which has historically been a powerful factor in determining car purchases, currently has little sway over the EV market. This is a sign of a young, budget-conscious market where buyers value

range, practicality, and affordability more than brand recognition. It represents a continuous paradigm shift in which traditional brand loyalty is being supplanted by economic advantages and technological value.

Furthermore, the regression analysis showed that although environmental consciousness is a factor, it is currently not the main driver of EV adoption. This implies that there is a discrepancy between consumers' willingness to act on their environmental awareness and their actual purchasing behavior. Therefore, in order to promote real market penetration, educational initiatives about sustainability must be complemented by concrete financial and physical incentives.

The initiative investigated the technological and policy ecosystems surrounding EVs in addition to consumer analysis. Fast developments in battery technology, especially lithium-ion batteries, along with creative strategies like battery swapping and smart grid integration, are paving the way for an EV infrastructure that is more sustainable and scalable. Nevertheless, issues still exist, including a small selection of models, expensive initial expenditures, uneven charging guidelines, and a lack of regional policy cooperation.

In this shift, the government's involvement has become crucial. Targeted subsidies and incentives can boost supply-side growth and demand-side interest, as shown by initiatives like FAME I and II. To maintain momentum and prevent fragmented execution, however, cross-sector collaboration, policy consistency, and long-term vision are crucial.

These observations are well supported empirically by the survey that was carried out as part of this study. A microcosm of India's growing EV user base was captured by the survey, which received more than 200 responses from a variety of demographics. While respondents were generally positive about EVs, many also raised issues with after-sales care, charging problems, and pricing. To guarantee

that the EV revolution is inclusive, equitable, and long-lasting, these issues need to be handled comprehensively.

In conclusion, electric mobility in India has a bright future, but it will require calculated actions. To construct the necessary infrastructure, cut costs, and boost consumer trust, a multi-stakeholder approach combining the government, business, consumers, and academia is crucial. Even if India's EV journey is still in its infancy, the study's conclusions support the idea that the nation is well-positioned to spearhead the worldwide shift toward cleaner and smarter mobility with the correct combination of laws, public awareness, and technology developments.

Long-term customer behaviour, the function of secondary markets for used EVs, lifetime environmental consequences, and the incorporation of renewable energy in EV charging should be the main areas of future research as the EV ecosystem develops. A sustainable transportation future is attainable, but realizing it will take more than just creativity—it will also take teamwork, tenacity, and vision.

Suggestions and Recommendations

The study on electric vehicle (EV) adoption in India offers valuable insights into consumer behavior, technological trends, and infrastructural gaps. Based on the findings, the following suggestions and recommendations are proposed:

1. **Enhance Charging Infrastructure**:
   One major obstacle is still the dearth of easily accessible, quick, and dependable EV charging facilities. Increasing public-private investment in charging networks is advised, especially in metropolitan and semi-urban areas. Real-time availability tracking and standardization of billing processes can boost customer confidence.
2. **Strengthen Government Incentives**:
   Purchase decisions have benefited from government initiatives like FAME I and II. Adoption can be further increased, particularly among middle-class consumers, by increasing subsidies, providing tax benefits, and streamlining incentive access.

3. **Public Awareness and Education Campaigns**:

   Even while more people are becoming aware of EVs, a sizable section of the populace is still ignorant of their advantages. Targeted advertising initiatives that dispel misconceptions regarding battery life, performance, and environmental impact can increase awareness and enthusiasm.

4. **Focus on Economic Value Proposition**:

   Manufacturers should emphasize total cost of ownership (TCO), which includes lower maintenance and operating costs, in their marketing since cost reductions were proven to be the most significant buying motivation.

5. **Improve Battery Technology and Recycling Infrastructure**:

   It's critical to address consumer concerns over battery lifespan and replacement costs. Sustainable growth requires investments in R&D for more durable, reasonably priced batteries as well as in methods for the safe disposal or recycling of batteries.

6. **Expand Product Variety and Localize Manufacturing**:

   More model options will meet a wider range of customer needs, particularly in the more reasonably priced two- and three-wheeler categories. "Make in India" local production can lower costs and improve supply chain effectiveness.

7. **Encourage Corporate Fleets and Public Transit Electrification**:

   Electric buses in public transit and incentives for companies to switch to EV fleets can serve as models and generate economies of scale.

8. **Introduce Vehicle-to-Grid (V2G) Policies**:

   V2G integration can assist in managing grid load and encouraging the use of renewable energy sources as EVs become more prevalent. Nonetheless, it necessitates suitable regulatory structures and incentives.

By addressing infrastructure, affordability, consumer perception, and policy alignment, these recommendations aim to create a more robust ecosystem for electric mobility in India—aligning with sustainability goals and reducing fossil fuel dependence.

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