



## From Crude Oil to Electricity: Examining the Shift in Indian Consumer Preferences and Behaviour Towards Electric Vehicles

Aryan Gupta<sup>1\*</sup>

<sup>1</sup>UG - Business Administration, St. Xavier's College of Management & Technology, Patna, India.

**Email id:** [aryan5smhs@gmail.com](mailto:aryan5smhs@gmail.com)<sup>1</sup>

**\*Orcid id:** 0009-0009-9278-9929

### Abstract

*The Industrial Revolution spurred mass production, making petrol vehicles affordable and accessible. The government invested in infrastructure to accommodate their widespread use, but environmental concerns arose. Efforts to address these led to the promotion of alternatives like CNG vehicles, with incentives driving their adoption. Despite emitting fewer greenhouse gases than gasoline vehicles, CNG still poses environmental challenges. Electric vehicles, emitting zero tailpipe emissions, offer superior ecological benefits. Electric vehicles (EVs) are one of the near-term practical solutions to vehicle technology providing solutions to growing concerns over environmental sustainability. The acceptance of a new product is always difficult in a market having people who are so traditionally driven and laggards. This paper aims to analyze the preferences through questionnaires learning various factors driving consumers' purchase decisions. The paper also discusses the importance of charging infrastructure in influencing customer's product choices. To what extent has India inculcated 'Aatmanirbhar Bharat' in the brains of Indians that could drive consumers to delve into Indian-manufactured or foreign-manufactured EVs? Through the survey of 80+ vehicle consumers, the paper scrutinizes the customer's ideal price point for both EV 2-wheelers and 4-wheelers to help manufacturers make pricing decisions. Lastly, we enquire about consumers' optimism towards EV adoption in the future. The paper concludes that 71.6% of people desire to switch to EVs because of environmental concerns, 58% because of cost savings on fuel, and less emission of greenhouse gases. The data results show that customers' non-purchase decision is influenced by a lack of undeveloped charging infrastructure, lack of awareness of government incentives, high maintenance costs, uncertainty about the reliability of the technology, and higher prices of EVs as compared to petrol and diesel vehicles. Also, 81.5% of people expressed their view to have automobiles manufactured in India from the opposing belief that foreign manufactured goods have a superior quality. More than 60% of the market is optimistic towards electric vehicles (EVs) dominating the automotive sector in India within the next five years.*

**Keywords:** Electric Vehicles, Crude Oil, Manufacturing, Automotive

### 1. Introduction

The well-established negative consequences of air pollution on human health and the economy are widely recognized. The increasing level of air pollution in Indian cities has raised concerns among policymakers, especially with six of the world's ten most polluted cities located in the country. Due to rapid urbanization and growth in automobiles, most of the urban Indian cities are not only experiencing increased traffic congestion but are also confronted with severe air pollution. Transportation contributes to more than 10 percent

of India's carbon emissions and is the most challenging factor in curbing air pollution in several urban cities. In India, transportation currently accounts for 14% of greenhouse gas emissions. With over 300 million vehicles currently on the road and 200 more million to be added in the next two decades, India faces a massive challenge to electrify its road vehicles and reach its goal of net zero by 2070. However, this challenge also provides India with a tremendous opportunity. As the 4th largest producer of



automobiles, the transition to EVs provides a huge economic opportunity if India localizes EV and battery manufacturing. Charging-related issues are another reason behind people's scepticism towards EVs and they are driving away customers. Lead acid batteries take eight hours and lithium-ion batteries take one to five hours to charge, which is much longer than the time needed to refuel a vehicle. India is also battling with issues of infrequent and insufficient power supply. The government is encouraging to set up of additional power generation infrastructure to make EVs more attractive. The Indian government has defined public charging stations and EV charging businesses as de-licensed activities. It has been specified that each 3-by-3-kilometer (1.9 by 1.9 mi) area in cities must have at least one charging station, and one station every 25 kilometres (16 mi) on both sides of highways. Reiterating its commitment to the Paris Agreement, the government of India plans to make a major shift to electric vehicles by 2030. It outlined a two-pronged strategy for buyers and manufacturers, offering \$1.4 billion in subsidies to buyers and increasing import tariffs to encourage the manufacture of electric vehicles by domestic companies. The government is focusing on electrifying public transportation with subsidies, primarily for two-wheelers, three-wheelers, and buses [6]. It also earmarks \$140 million for the development of charging infrastructure. Road Transport and Highways Minister Nitin Gadkari launched the campaign, saying that Go Electric is a future for India that will promote low-cost, environmentally friendly, indigenous electrical products. Gadkari expressed concern about the cost of importing fossil fuels and called CO<sub>2</sub> emissions from vehicles a major challenge. The government waived registration fees for EVs and urged the states to give tax breaks. In India, electric 3-wheelers (e-rickshaws) have been somewhat fruitful, anyway very little dissemination of electric vehicles has occurred inside 2-wheelers, 4-wheelers, and city transport armadas [5]. Although previous studies have made significant contributions to the

understanding of consumer behavior on electric vehicles, a noticeable gap remains in comparing the conventional petrol and diesel vehicles with the EVs' market landscape, what are the factors preventing people from switching to EVs? The sale of automobiles in 2023 was 21.2 million of which only 6.5% was EVs out of the total vehicle sales, increasing from 4.8% in 2022. So, this paper aims to fill those gaps that are crucial for advancing our knowledge and addressing how the sales volume of EVs can increase as a percentage of total vehicle sales, what infrastructural developments could compel people to switch to EVs from traditional petrol and diesel vehicles and how familiar are people with the government's incentives towards promoting the use of EVs.

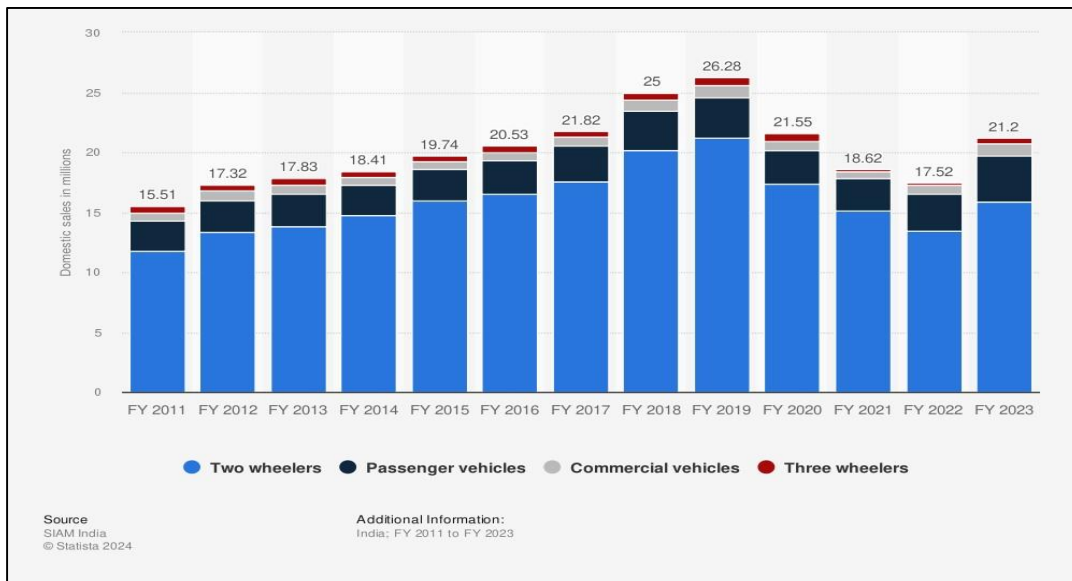
From Figure 1&2, in 2023, out of 21.2 million vehicle sales in India, only 6.5% were electric vehicles (EVs), up from 4.8% in 2022. Despite the growth, EVs still represent a small fraction of total sales. This highlights the significant gap between traditional vehicle sales and EV adoption, signaling room for expansion and market penetration.

## **2. Methodology**

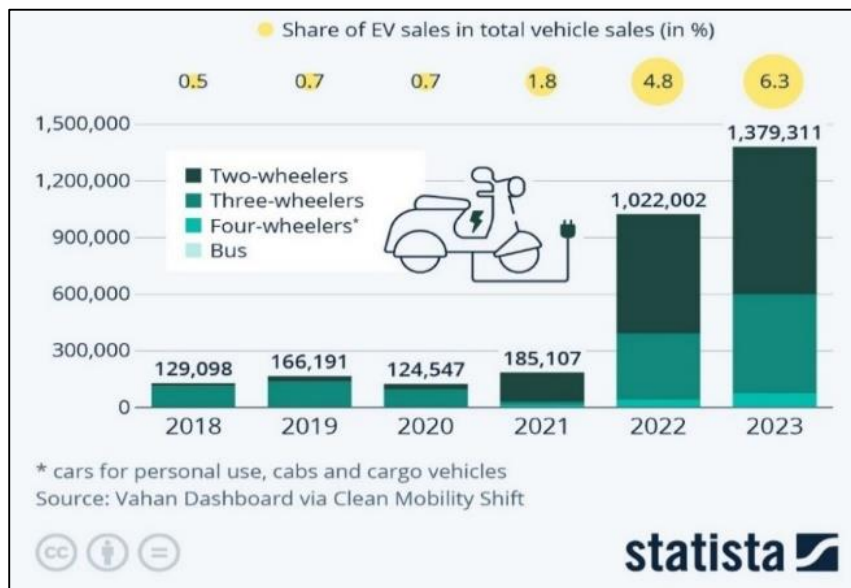
This paper adopts a mixed-methods approach to understanding consumer behavior on EVs. The methodology involves a combination of qualitative interviews with key stakeholders, collecting quantitative survey data from a diverse sample of over 80 participants, and analyzing secondary statistical data from reputable sources. By leveraging multiple data sources and research techniques, the study seeks to provide a nuanced and comprehensive examination of Consumer Attitudes and Preferences Towards Electric Vehicles (EVs). The survey was administered using Google Forms and distributed to a diverse range of participants spanning various demographics, including working professionals, students, and homemakers. The questionnaire encompassed various inquiries aimed at gauging participant preferences, employing a multifaceted approach to gather comprehensive insights. Participants were prompted to rank their

preferences on a scale of 1 to 5, offering nuanced gradations for expressing their choices. Additionally, the survey incorporated questions with multiple response options, allowing participants the flexibility to select more than one choice to reflect their preferences accurately. Furthermore, inquiries requiring a simple binary response, such as 'yes' or 'no,' were included to capture specific sentiments or opinions succinctly.

Towards the survey's conclusion, participants were provided with an open-ended section where they could freely contribute suggestions or feedback, fostering an environment conducive to constructive input and ideation. The secondary data utilized in this study was sourced from reputable academic journals, industry reports, and government publications [4].



**Figure 1 Sales of Automobiles in India from Financial Year 2011 to 2023, by Type (in millions)**



**Figure 2 Electric Vehicles Sales in India by Year and Type**

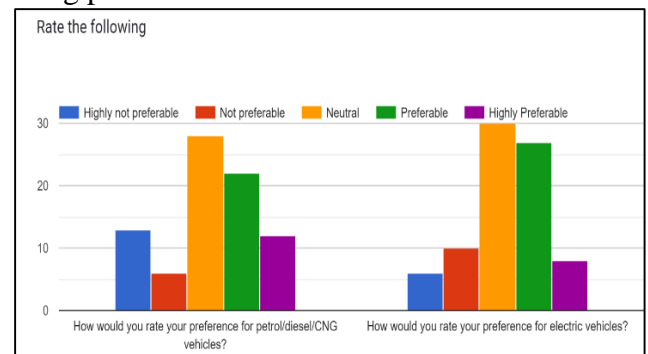
Criteria such as the methodology used in data collection, sample size, research design, and critical findings were evaluated to determine the reliability and validity of the data. Additionally, the reputation and expertise of the authors, as well as the publication venue, were considered indicators of data credibility. A systematic literature review was conducted to identify relevant studies and reports published between 2010 and 2023 [1-3]. Keywords such as "automobile sales," "EV adoption," and "environmental impact" were used to search databases, including Jstor, Statista, and Google Scholar. An interview with Mr. Omkar Gupta, Founder and CEO of Machines Tools & Solutions, was conducted to gain valuable insights into consumer preferences regarding sustainable products and the role of youth in driving this shift. The interview was a qualitative research tool to complement existing data and literature on the subject. Mr. Gupta was selected as the interviewee based on his expertise and leadership role in manufacturing, particularly in producing innovative machinery. His firsthand experience and insights into consumer behavior and market trends were deemed valuable for the research objectives.

### 3. Results & Discussion

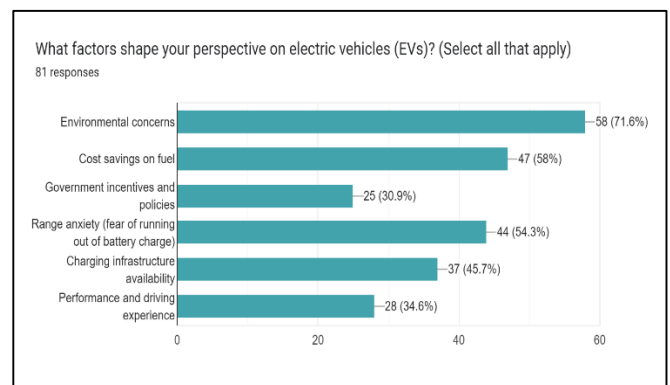
In this section, we present the outcomes of the data analysis pertaining to the survey questions posed in our research. Our analysis primarily involves examining the responses obtained from the survey participants, aimed at gaining insights into their perceptions, attitudes, and behaviors regarding consumer behavior on EVs. Through a combination of qualitative and quantitative techniques, we delve into the survey data to uncover key themes, trends, and variations among the respondents. By rigorously scrutinizing the survey responses, we aim to provide a comprehensive understanding of the perspectives expressed by the participants, thus fulfilling the objectives of this study.

Based on the Figure 3, it can be deduced that 13 participants hold a strong aversion towards petrol/diesel/CNG vehicles, while 6 participants express some level of preference against them. Conversely, 28 respondents remain neutral on the matter. Furthermore, 22 participants exhibit a

preference for these vehicles, with 12 individuals indicating a strong preference for them. Based on the data provided, 6 participants express a lack of preference for electric vehicles, while 10 participants find them somewhat unpreferable. A total of 30 respondents remain neutral on the matter. Furthermore, 27 participants exhibit a preference for electric vehicles, with 8 individuals expressing a strong preference for them.



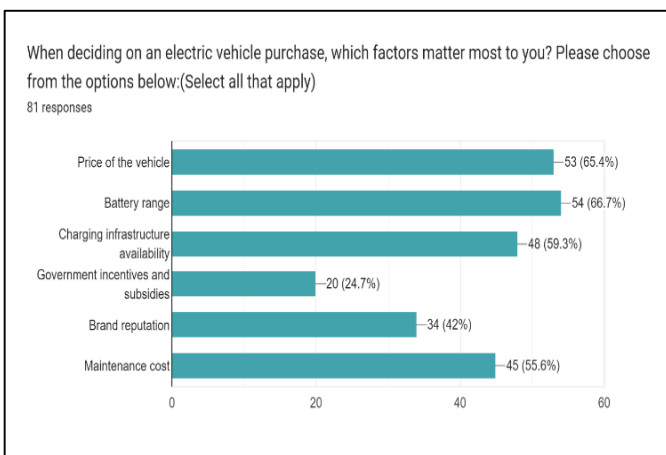
**Figure 3 Rating Preference for Traditional and Electric Vehicles**



**Figure 4 Factors that Shape Consumer's Perspective on Electric Vehicles**

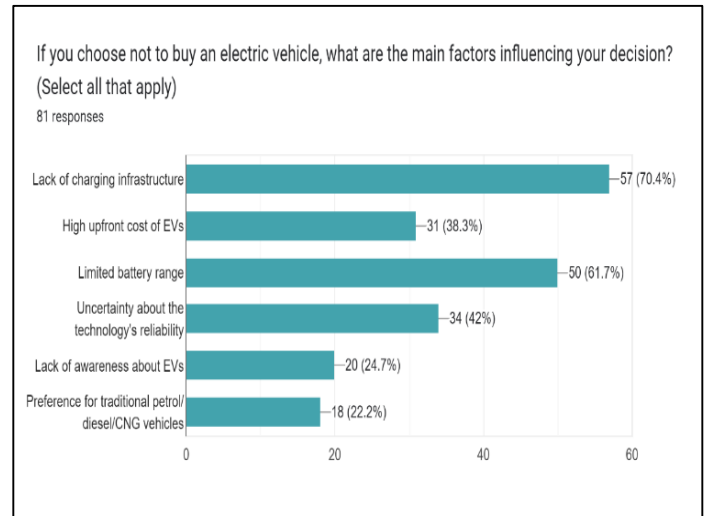
Analysis of Figure 4: A significant majority of respondents, comprising a staggering 71.6%, express concern for environmental preservation. Additionally, 58% of participants express a desire to economize on fuel expenditures, while 54.3% harbor apprehensions regarding the possibility of battery depletion. Moreover, 45.7% of respondents prioritize the presence of charging infrastructure. Notably, a mere 30.9% of participant's exhibit concerns regarding government incentives, suggesting a potential deficit in awareness.

Analysis of Figure 5: Most respondents consider various factors when purchasing an electric vehicle. Specifically, 65% prioritize the price of the vehicle, 67% emphasize battery range, and 59% highlight the importance of charging infrastructure availability. Additionally, 24.7% of participants consider government incentives and subsidies, while 42% prioritize brand reputation. Moreover, 57% of respondents find maintenance cost to be a significant factor.

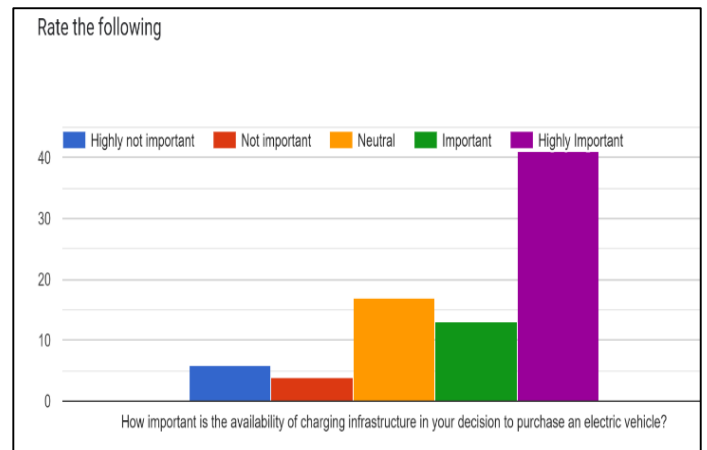


**Figure 5 The Most Significant Factors for Consumers when Deciding to Purchase an Electric Vehicle**

Analysis of Figure 6: Most Respondents, accounting for 70.4%, believe that the lack of charging infrastructure is the primary factor influencing consumer buying decisions regarding electric vehicles. Additionally, 38.3% of participants cite the high upfront cost of EVs as a significant consideration. Moreover, 61.7% express concerns about the limited battery range, while 42% are apprehensive about the uncertainty surrounding the technology's reliability. Furthermore, 24.7% of respondent's attribute consumer buying decisions to a lack of awareness about EVs, while 22.2% indicate a preference for traditional petrol/diesel/CNG vehicles.

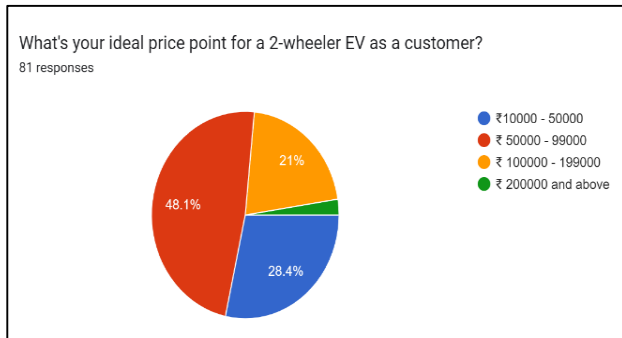


**Figure 6 The Primary Factors Influencing Consumers' Decision of not Purchasing an Electric Vehicle**



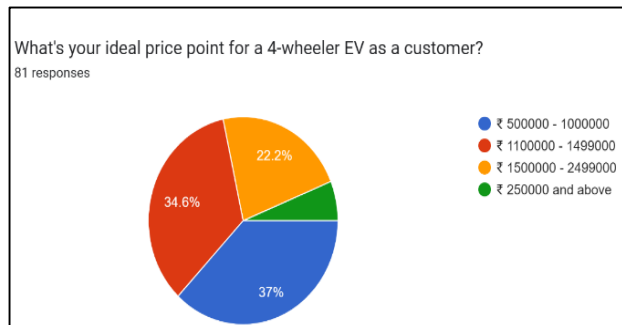
**Figure 7 Importance of Charging Infrastructure**

Analysis of Figure 7: According to the data provided, 6 respondents deem the availability of charging infrastructure as highly unimportant in their decision to purchase an electric vehicle, while 4 respondents consider it not important. Additionally, 17 respondents remain neutral on the matter. On the other hand, 13 respondents perceive the availability of charging infrastructure as important, and a significant majority of 41 respondents believe it to be highly important in their decision-making process regarding electric vehicle purchases.



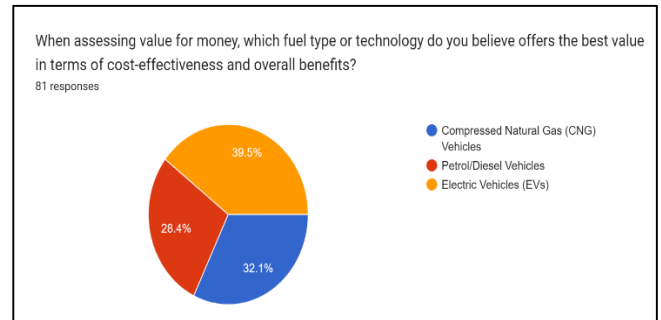
**Figure 8 Ideal Price for 2-Wheeler EV according to the Respondents**

Analysis of Figure 8: According to the data above, 28.4% of respondents believe that the ideal price range for an electric vehicle falls between ₹10,000 and ₹50,000. A significant majority, comprising 48.1% of respondents, perceive the ideal price to be within the range of ₹50,000 to ₹99,000. Conversely, a smaller proportion of respondents, approximately 23.5%, consider the ideal price to exceed ₹1,00,000.



**Figure 9 Ideal Price for 4-Wheeler EV according to the Respondents**

Based on the above Figure 9 data, 37% of participants consider the ideal price point for a 4-wheeler EV to be in the range of ₹500,000 to ₹1,000,000. Additionally, 34.6% of respondents believe the ideal price falls within the range of ₹1,100,000 to ₹1,499,000. Furthermore, 22.2% of participants perceive the ideal price to be between ₹1,500,000 and ₹2,499,000. Lastly, 6.2% of respondents suggest that the ideal price for a 4-wheeler EV is ₹2,500,000 and above.



**Figure 10 Cost-effectiveness of Traditional and Electric Vehicles as perceived by Consumers**

Analysis of Figure 10: As per the data presented, most respondents, accounting for 39.5%, perceive Electric Vehicles (EVs) as offering the optimal value in terms of cost-effectiveness and overall benefits. In comparison, 32.1% of participant's favour Compressed Natural Gas (CNG) Vehicles, while 28.4% find Petrol/Diesel Vehicles to offer the best value.

### 3.1 Hypotheses Testing

- **Hypotheses Testing 1** - Behaviour of consumers based on the price of the electronic vehicles.
- **Null Hypotheses** - More people prefer to buy 2-wheeler EVs when the price is less.
- **Alternate Hypotheses** - More people prefer to buy 2-wheeler EVs when the price is higher. In this case, we took the X-variable to be the price and the Y-variable to be the probability of the customer buying the 2-wheeler electric vehicle at that price point.

Results of Table 1: Here, the p-value is 0.07 which is more than 0.05 which means that we do not reject the null hypothesis. This means that we do not have enough statistical evidence to conclude that there is a significant preference for buying 2-wheeler EVs when the price is higher. Therefore, we fail to reject the null hypothesis, meaning that we do not have sufficient evidence to support the claim that more people prefer to buy 2-wheeler EVs when the price is higher. From this, it can be inferred that price is one of the main drivers in the case of choosing to opt for e-vehicles or traditional vehicles.

- Hypotheses Testing 2** - Behaviour of consumers based on the price of the electronic vehicles. Null hypotheses- More people prefer to buy 4-wheeler EVs when the price is less. Alternate hypotheses- More people prefer to buy 4-wheeler EVs when the price is higher. In this case, we took the X-variable to be the price and the Y-variable to be the probability of the customer buying the 4-wheeler electric vehicle at that price point.

Results of Table 2 - Here, the p-value is 0.01 which is less than 0.05 which means that we reject the

null hypothesis. This means that we have enough statistical evidence to conclude that there is a significant preference for buying 4-wheeler EVs when the price is higher. Therefore, we reject the null hypothesis in favor of the alternative hypothesis, indicating that more people prefer to buy 4-wheeler EVs when the price is higher. From this, it can be inferred that factors other than price, such as availability of charging infrastructure, cost saving on fuels, etc. play a major role.

**Table 1 Results of Hypotheses Test 1**

Price	Number of People	Probability
50000	23	0.28395062
99000	39	0.48148148
199000	17	0.20987654
300000	2	0.02469136

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.473582299	0.132909277	3.5632	0.070531238	-0.09828016	1.045444762	-0.09828016	1.045444762
X Variable 1	-1.38014E-06	7.05653E-07	-1.9558	0.189649081	-4.4163E-06	1.65604E-06	-4.4163E-06	1.65604E-06

**Table 2 Results of Hypotheses Test 2**

Price	No. of people	Probability
1000000	30	0.37037037
1499000	28	0.34567901
2499000	18	0.22222222
3000000	5	0.0617284

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.546276411	0.067798706	8.05733	0.015056445	0.254562124	0.837990698	0.254562124	0.837990698
X Variable 1	-1.48175E-07	3.15326E-08	-4.69912	0.042425263	-2.83849E-07	-1.25015E-08	-2.83849E-07	-1.25015E-08

**Conclusion**

Our research endeavors to dissect the evolving landscape of consumer behavior regarding electric vehicles (EVs) within the Indian automotive market. By employing a multifaceted methodology incorporating qualitative interviews, quantitative surveys, and secondary data analysis, we have delved deep into the intricate nuances shaping individuals' attitudes and preferences toward EV

adoption. In a nation grappling with the dire consequences of air pollution, exacerbated by the burgeoning number of vehicles on its roads, our study uncovers a palpable sense of urgency among consumers to embrace cleaner and more sustainable modes of transportation. The Industrial Revolution, which catalyzed mass production and the proliferation of petrol vehicles, laid the foundation for the current environmental predicament.



However, this era also birthed the imperative for change, prompting governments worldwide to invest in infrastructure and promote alternatives like compressed natural gas (CNG) vehicles. Despite their reduced greenhouse gas emissions compared to traditional gasoline counterparts, CNG vehicles still present environmental challenges, paving the way for the emergence of electric vehicles as a superior ecological solution. EVs stand as a beacon of hope on the horizon, offering zero tailpipe emissions and promising significant strides toward environmental sustainability. Yet, their journey to widespread acceptance is fraught with obstacles, as entrenched consumer habits and perceptions pose formidable barriers to adoption. Our research underscores the pivotal role of consumer preferences in driving market dynamics, shedding light on the factors influencing individuals' decisions to transition to EVs. Amidst the cacophony of voices clamoring for change, our study provides a nuanced understanding of the underlying motivations propelling consumers toward EV adoption. Environmental consciousness emerges as a primary driver, with a substantial majority expressing a fervent desire to mitigate their carbon footprint and contribute to the preservation of our planet. Additionally, economic considerations loom large, with many individuals drawn to the prospect of substantial cost savings on fuel expenditure offered by EVs. However, the path to widespread EV adoption is riddled with obstacles, chief among them being the dearth of charging infrastructure. Our research elucidates the pivotal role of charging infrastructure in shaping consumers' purchasing decisions, underscoring the urgent need for investment and expansion in this critical domain. Moreover, concerns surrounding the high upfront costs of EVs, limited battery range, and reliability of technology loom large in the minds of prospective buyers, highlighting the imperative for manufacturers and policymakers to address these barriers head-on. As India charts its course towards a greener and more sustainable future, our findings serve as a clarion call for concerted action. The government's ambitious initiatives, including subsidies for buyers and incentives for domestic manufacturing, signal a paradigm shift towards

electric mobility. Yet, realizing this vision necessitates a collaborative effort encompassing policymakers, manufacturers, and consumers alike. By leveraging insights gleaned from our research, stakeholders can chart a course toward a future where electric vehicles reign supreme, paving the way for a cleaner, greener, and more prosperous India. Lastly, concerted efforts are needed to accelerate the transition to electric vehicles (EVs) in India. Collaboration among policymakers, manufacturers, and consumers is essential to address infrastructure challenges, overcome economic barriers, and raise awareness. Promoting domestic manufacturing, fostering innovation, and implementing supportive policies are crucial steps towards achieving a cleaner, greener automotive sector. Continuous monitoring and evaluation will be key to tracking progress and refining strategies to realize the vision of a sustainable future powered by EVs.

### **Appendix**

#### **Questionnaire**

Q 1) Full Name

Q 2) Age

Option 1) 18 - 25

Option 2) 26 - 30

Option 3) 31 - 40

Option 4) 41 and above

Q 3) Gender

Option 1) Male

Option 2) Female

Option 3) Others

Q 4) Occupation

Option 1) College Student

Option 2) Working Professional

Option 3) Retired

Q 5) How would you rate your preference for petrol/diesel/CNG vehicles?

Option 1) Highly not preferable

Option 2) Not preferable

Option 3) Neutral

Option 4) Preferable

Option 5) Highly Preferable

Q 6) How would you rate your preference for electric vehicles?

Option 1) Highly not preferable



Option 2) Not preferable

Option 3) Neutral

Option 4) Preferable

Option 5) Highly Preferable

Q 7) What factors shape your perspective on electric vehicles (EVs)? (Select all that apply)

Option 1) Environmental concerns

Option 2) Cost savings on fuel

Option 3) Government incentives and policies

Option 4) Range anxiety (fear of running out of battery charge)

Option 5) Charging infrastructure availability.

Option 6) Performance and driving experience.

Q 8) When deciding on an electric vehicle purchase, which factors matter most to you? Please choose from the options below:(Select all that apply)

Option 1) Price of the vehicle

Option 2) Battery Range

Option 3) Charging infrastructure availability.

Option 4) Government incentives and subsidies

Option 5) Brand Reputation

Option 6) Maintenance cost

Q 9) Can Electric Vehicles (EVs) be Seen as Status Symbols, Signifying a Wealthier Lifestyle?

Option 1) Yes

Option 2) No

Q 10) If you choose not to buy an electric vehicle, what are the main factors influencing your decision? (Select all that apply)

Option 1) Lack of charging infrastructure

Option 2) High upfront cost of EVs

Option 3) Limited battery range

Option 4) Uncertainty about the technology's reliability

Option 5) Lack of awareness about EVs

Option 6) Preference for traditional petrol/diesel/CNG vehicles

Q 11) How important is the availability of charging infrastructure in your decision to purchase an electric vehicle?

Option 1) Highly not important

Option 2) Not important

Option 3) Neutral

Option 4) Important

Option 5) Highly Important

Q 12) What's your ideal price point for a 2-wheeler EV as a customer?

Option 1) ₹10000 - 50000

Option 2) ₹50000 - 99000

Option 3) ₹100000 - 199000

Option 4) ₹200000 and above

Q 13) What's your ideal price point for a 4-wheeler EV as a customer?

Option 1) ₹500000 - 1000000

Option 2) ₹1100000 - 1499000

Option 3) ₹1500000 – 2499000

Option 4) ₹250000 and above

Q 14) What influences your preference when considering electric vehicles: Indian-manufactured or foreign-manufactured options?

Option 1) Strong preference for Indian-manufactured EVs

Option 2) Slight preference for Indian-manufactured EVs

Option 3) No preference; open to both Indian and foreign-manufactured EVs

Option 4) Slight preference for foreign-manufactured EVs

Option 5) Strong preference for foreign-manufactured EVs

Q 15) When assessing value for money, which fuel type or technology do you believe offers the best value in terms of cost-effectiveness and overall benefits?

Option 1) Compressed Natural Gas (CNG) Vehicles

Option 2) Petrol/Diesel Vehicles

Option 3) Electric Vehicles (EVs)

Q 16) Do you believe electric vehicles will dominate the automotive market in India in the 5 years?

Option 1) Yes

Option 2) No

### References

- [1]. Zandt, F. (January 3, 2024). How Many EVs Are Sold in India? [Digital image]. Retrieved February 21, 2024, from <https://www.statista.com/chart/31486/electric-vehicle-sales-in-india-by-year-and-type/>.
- [2]. SIAM India. (July 6, 2023). Sales of automobiles in India from financial year 2011 to 2023, by type (in millions) [Graph]. In Statista. Retrieved February 21, 2024, from



<https://www.statista.com/statistics/608392/automobile-industry-domestic-sales-trends-india/>

- [3]. Plug-in electric vehicles in India. (2024, February 17). In Wikipedia. [https://en.wikipedia.org/wiki/Plug\\_in\\_electric\\_vehicles\\_in\\_India](https://en.wikipedia.org/wiki/Plug_in_electric_vehicles_in_India)
- [4]. Navalagund, N., Mahantshetti, S., & Nulkar, G. (2020). Factors influencing purchase intention towards E-vehicles among the Potential Indian consumers-A study on Karnataka region. *Journal of the Social Sciences*, 48(3), 1598-1616.
- [5]. Shetty D, et al. (2020) Barriers to widespread adoption of plug-in electric vehicles in emerging Asian markets: An analysis of consumer behavioral attitudes and perceptions, *Cogent Engineering*, 7:1, DOI: 10.1080/23311916.2020.1796198
- [6]. India dominates the list of the world's most polluted cities. World Economic Forum. (n.d.). <https://www.weforum.org/agenda/2020/03/6-of-the-world-s-10-most-polluted-cities-are-in-india/>