

## **AN ANALYSIS TO UNDERSTAND THE IMPACT OF ELECTRIC VEHICLES TREND TO INDIAN ECONOMY TILL 2025**

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### **ABSTRACT**

**Introduction** - With the contemporary accelerating price of petrol vehicles and adverse impact on air pollution, the government of India has taken initiative measures to mitigate or control the growth of internal combustion engine related vehicles and promote alternative technology based on advanced approach light electric vehicles.

**Objective** - The motive of the paper is to analyse the impact of the electronic vehicle and its trend on the Indian economy till 2025. Moreover, the paper also identifies the comparison of the total cost of the electric vehicle with the conventional transportation system.

**Methodology** - The paper uses the qualitative approach where it uses for collecting secondary data, that exclusively explores through the existing studies. In this study, the selection of the paper for exploring the knowledge covers from two decades 2000 to 2022.

**Results** - The finding evaluated that an electronic vehicle has ample potential capability to uplift the Indian economy by numerous affecting factors like it exclusively reducing the dependency on crude oil, environmental flourishment, convenient and cost-effective mode of transportation, employment opportunities, startup initiatives, India can become the EV hub and among others.

**Keywords** : Electric Vehicle, Impact of Electronic Vehicles in India, Challenges and opportunities of electric vehicles, Trend of EV in Indian Economy till 2025.

### **1. Introduction**

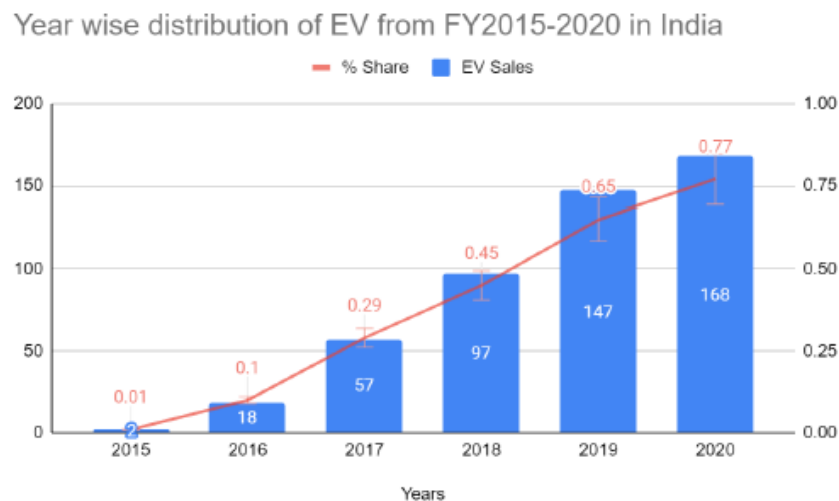
The transportation sector of India forms the 3rd largest greenhouse emission sectors with a leading ratio held by road transportation. India has more than 300 million vehicles functioning in

the country, in addition to 30 million vehicles annually added every year (Singh, S., 2019).

With the contemporary accelerating price of petrol vehicles and adverse impact on air pollution, the government of India has taken initiative measures to mitigate or control the growth of internal combustion engine related vehicles and promote alternative technology based on advanced approach light electric vehicles (Moerenhout, T., 2021). The Indian Government pleads to replace all conventional vehicles (operational personalised by using diesel or petrol based for fossil fuels) with electric vehicles by the year 2030 (PTI, 2017). The market of electric vehicles in India, which was estimated at approximately \$1027 thousand in the year 2019, will reach \$13,833 thousand with a growing CAGR of around 54.2% between the five financial years from 2019 to 2025<sup>1</sup>.

The graph (Figure 1) demonstrates the emerging electric vehicle sector that is one of the most promising alternative modes of transportation that also has immense capability to mitigate the adverse impact of conventional vehicles on the environment and human purse. The graph shows electric vehicles covering the year 2015 to 2020 as well as the percentage share of electric vehicles in total vehicles is also illustrated in percentage. This indicates that in the year 2020, around 0.77% of vehicle sales will belong to electric vehicles. The CAGR was achieved with an elevation of 133% compared to 2015 (GIZ & NITI Aayog., 2021).

**Figure 1: Year wise distribution of Electric Vehicles from FY 2015-2020 in India (GIZ & NITI Aayog, 2021).**



<sup>1</sup> <https://www.psmarketresearch.com/market-analysis/india-evse-market>

## 1.1 Background

Government of India, took appropriate measures in the past decade and effectively tried to promote the alternative transportation approach by fiscal incentive and subsidies for electric vehicle consumers providing electric vehicle charging infrastructure and other efforts are being pursued by the GOI. It was reflected in the timeline (Figure 2) as it covered 2011 to 2020 and the key initiative for adopting electric vehicles.

**Figure 2: Key initiative for adopting electric vehicles (GIZ & NITI Aayog, 2021).**



The major initiative taken by the government was the FAME-I (faster adoption and manufacturing of hybrid and electric vehicles) program which was launched in the year 2015. It was a three-year ambitious initiative to support the market with \$1.36 billion to promote alternative technology by inducing financial push in a competitive business (Moerenhout, T., 2021). Subsequently, the government introduced the second phase of the ambitious scheme named FAME-II, launched in 2019. The project was further amended and expected the sale of a two-wheeled electric vehicle of approximately six million units by 2025 (GIZ & NITI Aayog., 2021).

## 1.2. Literature Reviews

### *Economic Feasibility of EV In Indian Grounds*

E-mobility was recognised as a revolutionary shift in the automobile sector. Electric vehicles act as alternative resources for transportation, having twin benefits: First is its eco-friendly approach

that has amenable properties to reduce carbon emission, and another is economically feasible to appropriately sustain an economical household during rising and accelerating fuel prices (Bhardwaj, A., & Bhardwaj, T., 2019). Characteristics of electric vehicles made rapid production over the years mean that India was also preparing the foundation for the emerging vehicle and adoption of technology. The paper's intention (Kumar, A. et al., 2018) is to analyse the commercial viability of electric vehicles by exploring four charging stations and evaluating the challenges associated with them. Another study (Kumar, R. et al., 2020) explores the challenges of adopting electronic vehicles in India till 2030 and utilises a secondary approach for determining. The outcome highlights the challenges like the high cost of electric vehicles, lack of infrastructure, and unwillingness or poor purchasing power of the Indian masses. The paper (Kumar, P., & Chakrabarty, S., 2020) supports the sharing economy model with ample opportunity for the government to manage the resources appropriately.

### ***Electric Vehicle: Associated Challenges & Opportunities In India***

Indian conventional transportation confronts enormous challenges related to environmental degradation, health hazards, rising oil prices, insufficient fossil fuel reserves, massive expenditure on importing oil energy insecurity and so on (Garg, S., & Pachar, S., 2020). Electric vehicles are one of the hopes of light as it demonstrates the immense potential to resolve the challenges associated with conventional transportation (Das, P. K., & Bhat, M. Y., 2022). The paper comprehensively explores the measures taken by the Indian government and related policies like FAME I, FAME II, and NEMMP 2020, with the intention to encourage electric vehicle transportation (Kumar, R., & Padmanaban, S., 2019). The paper also overviews the circumstances the automobile sector faces during the adaptation of advanced technology like EV and exhibits the comparison of the China case study and the impact of electric vehicle transformation (Mehta, D). Another paper demonstrates the ecosystem of transportation in India needs to be improved on the parameters of accessible, reliable, available, convenient and safe (Ramji, A., & Venugopal, S., 2019).

### **1.3 Research Gap**

Research activities are abundant on Electric Vehicles as it is one of the most attractive and emerging topics from a research perspective. Nevertheless, maximum research concentrated on the challenges and opportunities, impact on the environment, and so on (Kumar, R., & Padmanaban, S., 2019; Ramji, A., & Venugopal, S., 2019). Minimal research focuses on the impact on the Indian economy. In the last two decades, none of the studies have explored the electric vehicle trend in the Indian economy until 2025. Henceforth the study has vital

significance for future and further study outlooks as it can become an excellent source of evidence.

#### **1.4 Research Question**

- Identifying the impact of electric vehicles in the Indian Economy till 2025?
- Determine the challenges while adopting Electric Vehicle in Indian grounds from an economic perspective?
- Comparison the total costing of the electric vehicle in comparison with the conventional transportation system?

#### **1.5 Importance of the Study**

The analysis of the study is significant because of the economic perspective. The electric vehicle has ample characteristics because it acts as vital components in sustaining the environment by reducing the carbon emission generated by burning of fossil fuel and providing a thriving pricing of fossil fuel as these vehicles depend on electric charging for running the vehicle. Thus the paper tries to explore the key driven components that reveals the total costing of the electric vehicle in comparison with the conventional transportation system. For analysis of the economic importance of electric vehicles from an Indian perspective.

#### **1.6 Research Objectives**

The motive of the paper is to analyse the impact of the electronic vehicle and its trend on the Indian economy till 2025. Moreover, the paper also identifies the comparison of the total cost of the electric vehicle with the conventional transportation system.

#### **1.7 Scope and Limitation**

The importance of the analysis is that it furnishes a comprehensive and sharp analysis of the electric vehicles with precise engagement to the Indian perspective with the government initiative and economic phasing to enforce the advanced vehicle technology. As India is the 4th leading carbon-emission country globally, it is prominent to deal with fossil fuel burning with a sustainable methodology that can overcome devastating environmental conditions. It distinguishes it from other research in various ways as it only concentrates on the economic perspective of e-vehicle. The study's limitation is that it did not explore diverse drives of e-vehicle as it did not investigate the social, environmental and other features and focus on the economic perspective of Indian soil.

## **2. Research Methodology**

### **2.1 Research Method & Design**

The paper uses the qualitative approach where it uses for collecting secondary data, that exclusively explores through the existing studies. This research effectively utilised to determine and identify the sources relevant with the electric vehicle and its economic trend in India, after identifying the collection of data take place then after compare and synthesis it appropriately and determine the hypothesis and obtain outcome.

### **2.2 Research Approach**

The *Secondary approach* is based on existing resources to comprehensively explore the research topic to enhance the knowledge and try to illustrate all the key and prominent points effectively. For secondary data, collection studies obtain information from governmental resources like NITI Aayog reports, journal literature, books, news and online articles. The secondary approach performs a vital and meaningful impact in determining the research question and the hypothesis effectively and assists to formulate the smooth outcome. In this study, the selection of the paper for exploring the knowledge covers from two decades 2000 to 2022. For collecting and extracting information from existing resources, the keywords and titles employed for researching include the related terms encompassing Electric Vehicle, Impact of Electronic Vehicles, Trend of EV in Indian Economy till 2025 and among others.

## **3. Analysis of Study**

### ***Question 1. Identifying the impact of electric vehicles in the Indian Economy till 2025?***

The advancement of technology with the transforming century involved the functionalization of Internal Combustion Engine (ICE), which took the electric vehicle market promptly because of the features like its swiftness and lower cost compared with electrical vehicles (Basu, A et al., 2019). Because of environmental vulnerability, enormous economic revenue is lost in human and ecological well-being. The advanced technology, which is based on non-conventional or renewable energy sources, attains effective popularity and population showing willingness to utilise advanced vehicle systems by switching conventional vehicles.

**Table 1: The comparison of conventional vehicle and their prices with the electric vehicle (GIZ & NITI Aayog, 2021):**

Company	Conventional Vehicle		Electric Vehicle	
Hero	Two Wheeler	47k-111k	Two Wheeler	35k-79k
TVS		44k-240k		115k
Bajaj		43k-194k		100k-115k
Mahendra		43k-211k		80k

The hike in electric vehicles' prices compared to conventional vehicles is instant, being a challenge for the Indian masses to adopt, as illustrated in the Table-1. However, both types of vehicles perform similarly for the same range. Besides that, the electric vehicle shows a high rate because of its technology and unavailability of skill to make the equipment adequately on Indian ground. Another challenge for a battery replacement that also increased the cost of the bike restricted the buyer to buy alternative transportation methods.

Indian transport is prominently dependent on fossil fuel, and about one-third of the total crude oil imported was utilised in transportation, explicitly on-road transportation, as around 85% of Indian gas oil is demanded from the road sector. The study mentioned the dependency and the fluctuation of crude oil in the below table. With the accelerating global oil prices, the Indian import oil bill rose 138% in 2022 (five months), 83.8 million tonnes of crude at a value of \$42 billion<sup>2</sup>. This effectively demonstrates the inflated share of imported fuel that drastically impacted the Indian economy. Crude oil import has a devastating twin impact on the Indian economy as the substantial cost affects the GDP and the vulnerable impact on the environment (Rahiman, H. U., & Kodikal, R., 2019).

<sup>2</sup> <https://www.livemint.com/market/commodities/indias-crude-import-bill-rose-over-190-at-24-7-bn-in-q1-11628190965940.html>

The impact of hiking crude oil in Indian economy (Sarkar, B., & Mathew, J. 2018):

- With the rise of crude oil prices, the Current Account Deficit (CAD) rose, and INR was devaluating and corresponded to other foreign currencies. To handle this situation, the GOI intended to control the elevating CAD, and it perished on the expense hike in crude to the customers.
- Interest rates are also reached on the higher side when inflation is elevated. When the interest rates drive culminates, the profitability of organisations declines. Consequently, it will have an unfavourable effect on corporate profitability.
- When the government's earnings are restricted in comparison to the expenditure budgets, it leads to a Fiscal Deficit situation. When the fiscal deficit rises, it leads to adverse impacts on the rating of the Indian economy that may go down.

Opportunities created by electric vehicle & Trend of EV in Indian Economy till 2025 (GIZ & NITI Aayog., 2021; Bhattacharya, K et al., 2020; )-

- Transportation companies like Ashok Leyland Mahindra and Mahindra Omega Seiki mobility, and Tata motors announced an investment of around \$6.5 billion in the market related to electric vehicle battery manufacturing and its components.
- The sector also promotes several startup companies like hero electric magenta and ola electric which also invest in the Indian economy around \$446 million in manufacturing, battery, supply equipment, and so on.
- The penetration of two-wheeler electric vehicles is assumed to reach 15% by 2025.
- Although, the penetration of four-wheelers was also accelerated gently with 5% till 2025, which was about 0.12% in the present scenario.
- The market demonstrates electric vehicle components' opportunity with promises to introduce \$2 billion by 2025.
- Indian Energy Storage Alliance assumed that the EV battery market would boost by more than 32% in the upcoming financial years (2020-2027) at a CAGR of 32%<sup>3</sup>.

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<sup>3</sup><https://timesofindia.indiatimes.com/business/india-business/electric-vehicle-annual-sales-likely-to-reach-6-34-million-units-in-india-by-2027-study-says/articleshow/79867373.cms>



- By the financial year 2025, the market of Li-ion-based batteries for e-auto was assumed to reach 40%. And the expectation of the market reached ₹40 billion for three-wheelers.<sup>4</sup>
- The Government of India foresees making India as an EV hub by 2025<sup>5</sup>.
- India can become a leading market for the export of electric vehicle technology as it currently holds more than 50% of conventional three-wheeler manufacturing exporters in developing countries across Middle Asia, Latin America, and Africa. The foundational export market of conventional vehicles can be effectively replaced by electric vehicles<sup>6</sup>.

Consequently, it is evaluated that an electronic vehicle has ample potential capability to uplift the Indian economy by numerous affecting factors like it exclusively reducing the dependency on crude oil, environmental flourishment, convenient and cost-effective mode of transportation, employment opportunities, startup initiatives, India can become the hub of EV and among others.

***Question 2. Determine the challenges while adopting Electric Vehicle in Indian grounds from an economic perspective?***

Challenges associated with adopting electric vehicles in the masses have been declining because of advancement in technology and the battery upliftment, making the technology more attractive to the buyer due to its characteristics like affordability, accessibility, convenience, and getting rid of expensive fluid cost (Preetha, P. K., & Poornachandran, P., 2019). This alternative mobility service has already penetrated several markets of Indian cities. With the emerging EV sector, India seeks to harness the opportunity by creating a domestic industry and flourishing the global market by leading the competitive edge. However, the market confronts several issues explicitly focusing on the economic challenges of adopting EV technology for the local masses (Kumar, R et al., 2020).

- E4W (Electric 4-Wheeler) provides immense range compared to conventional vehicles, though the cost and the time consuming for charging is relatively high, making it

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<sup>4</sup><https://auto.economictimes.indiatimes.com/news/industry/indian-ev-industry-to-represent-rs-500-billion-opportunity-by-2025-covid-notwithstanding-report/77127688>

<sup>5</sup><https://www.thehindubusinessline.com/economy/make-india-an-ev-hub-by-2025-gadkari/article33041078.ece>

<sup>6</sup> <https://www.autopunditz.com/three-wheeler-salesstatistics-india-fy2020/>

unreliable and unattractive from consumer insights.

- The cost of the battery is one of the major concerns because of the economic perspective, which restricts the buyer from adopting the technology—for instance, the cost of the Li-ion batteries.
- Raw materials, infrastructure, technology assistants, and smart grids are other challenges.
- The private sector who are willing to seek opportunities in the EV market confronts the challenges of the high up-front cost of electric vehicles to reach price parity with conventional alternatives.
- Relative to TCO, EV demonstrates parity in comparison with conventional vehicles from a multi disciplinary manner. As the technology was unfit for unattracted for high speed 2 wheeler as the technology was suitable and has a potential to achieve TCO parity at less than 10 km for daily usage but show challenges to accomplish 40 + km daily operation.
- The upfront cost of the conventional vehicle was extremely low in comparison with the electronic vehicle. As it is 50-75% higher compared with ICE.
- The financial assistance provided by the banking institute was very partial as it offers High Interest Rates Interest rates of 20% or more which is approximately 2times higher than the usual petrol diesel vehicles.

***Question 3. Comparison the total costing of the electric vehicle in comparison with the conventional transportation system?***

The comparison of the ICE, Hybrid and EV two wheeler prices is demonstrated in (Table 3). This appropriately shows the diverse drive and economic feasibility of operating EV technology as the best suitable alternative transportation medium for middle and low income groups.

**Table 2: Comparison of various types of vehicles with Electric Vehicle (Kumar, A., et al., 2018)**

<b>Parameters</b>	<b>Conventional Vehicle</b>	<b>Hybrid vehicle</b>	<b>Electric vehicle</b>

Efficiency	Converts 20% of energy to generate power.	Convert 40% of energy to generate power.	Converts 75% of chemical energy to generate power.
Speed	199.5 km/hour	177 km/hour	153 km/hour
Acceleration	96.5 km/hr	96.5 km/hr	96.5 km/hr
Maintenance	High maintenance	Similar to Conventional Vehicle	Minimal maintenance
Mileage (Average)	Accomplishing 10-12 kilometres per litre.	Accomplishing 20-25 kilometres per litre.	Can travel 120-200 kilometres without recharging
Cost	70 Thousands – 10 Lakh	12 Lakh - 20 Lakh	90 Thousand- 6 Lakh

However, there are certain challenges also in adopting the technology like the choice of a two-wheeled electric vehicle because the average household income in India is low, and the majority of people belong to the middle-income group. The traffic density of the country encourages people to buy or use two-wheelers adequately compared to 4 wheelers.

#### **4. Results**

Electric vehicles' development can be illustrated as a revolutionary change because of its impact on the human purse. It can be visualised as a one-time investment over the human purse because of high initial purchase due to expensive battery equipment. Nevertheless, after utilising the efficient electric motor, inexpensive electricity and zero-cost fuel consumption make it affordable or economically feasible. However, the number of electric vehicle utilities is rising in

uneven form as the adoption of vehicles fluctuates with the category. Consequently, it is evaluated that an electronic vehicle has ample potential capability to uplift the Indian economy by numerous affecting factors like it exclusively reducing the dependency on crude oil, environmental flourishment, convenient and cost-effective mode of transportation, employment opportunities, startup initiatives, India can become the hub of EV and among others.

In future, charging infrastructure will act as a vital factor for effectively utilising electric vehicles in urban locations.

Way forward for Affordable Pricing of Electric vehicle-

- The study exhibits that with the reduction in the lithium battery prices the price of the electric vehicle shall also be dropped in the near future as the battery price is expected to subdue with 10% CAGR between 2018 to 2024.
- This intensifies and accelerates the buying and adoption of new technology as an alternative choice of two wheeler transportation medium. It was expected that sales would also penetrate to nearly 24% in 2024.
- The prominent approach like the battery swapping model which is familiar in two wheeler can effectively intensify the high speed market of E3W and market expected to accelerate its growth without affecting the costing of the e-auto.
- Accelerate EV adoption by institutional regulatory features that aid EVs and promote effortless access to more finance in alternate transportation systems.
- Improves investor reliability by offering a substantial market resilience that effectively cooperates and collaborates central and state governments' existing schemes and programmes.

## **5. Conclusion**

Electric Vehicles are one of the most attention attaining technologies in the present scenario worldwide because of the devastating and degrading environment. It is requisite to leverage cutting-edge technology to effectively operationalize the alternative resources that assure ecology-friendly techniques for a comfortable and easily accessible vehicle for transportation. Electric vehicles are the transport median that relies on electric motors for propulsion. It was a revolutionising transformation in the road transportation network. It grew with an accelerating rate of 43% annually over the last five years in the worldwide market, around 2.6% in 2019.

Electric vehicle market, which is currently holding less than 1% of total vehicle sales, is expected to capture a market of ₹ 475 billion by 2025. Capturing the market two-wheeler electric vehicle approximately 62%, followed by three-wheeler with around 37%.

Eventually, encountering the transportation sector approach that relies on a balancing framework over employment generation, availability and affordability of technology, economic feasibility, and the intention to improve the competitiveness of the domestic manufacturing sector by eliminating the obstacles facing it.

### **5.1 Future Scope**

The paper in the future can go profoundly with the economic impact of electronic vehicles on the buyers by analysing consumers' perceptions by doing the primary research that relies on sampling collection and significant questionnaires to know the perception and their likelihood or non-likability toward adopting the technology.

### **5.2 Suggestions**

With the assistance of local government EV through diverse intervention that encompasses private investment in infrastructure, developing local markets to meet the need of electric vehicle components, supply chain integration with IT framework. All these things can effectively be accomplished by encouraging public private partnership. Additionally, by leveraging the cutting edge technology cost effective EV mechanism will conveniently promote consumers toward electric vehicles.

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