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Electric Mobility and the Green Transition: Assessing the Impact of EV Adoption on Climate Change

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Abstract

Electric vehicles (EVs) are increasingly becoming an important part of India's journey towards sustainable development. As the transport sector is a major contributor to greenhouse gas emissions, air pollution, and high energy consumption, the shift to electric mobility offers a promising solution to both environmental and economic challenges. While interest in EVs has grown among researchers and policymakers, only a limited number of studies have examined their overall contribution to achieving the Sustainable Development Goals (SDGs) in India. Using secondary data and an integrative review approach, this study explores how EV expansion supports the country's SDG agenda. It reviews existing policies, assesses market trends, and examines the sustainability initiatives undertaken by the Indian Government. The findings suggest that wider adoption of EVs can contribute to several SDGs by improving energy efficiency, encouraging innovation, lowering emissions, and creating new opportunities for green jobs and sustainable economic growth.

Keywords: SDGs, Electric Vehicles, CO2 Emission, Market Trends, Market Penetration.

Introduction

The words climate and weather are not similar, but both are interconnected. The world climate represents a phenomenon related to a longer period of time, whereas weather represents a shorter duration phenomenon. Climate plays a vital role in shaping our daily weather. It affects temperatures, seasonal changes, rainfall patterns, and the occurrence of events such as storms. As the climate continues to change, we are experiencing higher temperatures along with more frequent and intense extreme weather events and natural disasters, highlighting the strong link between climate and the weather around us. Climate change is the biggest threat to human civilization, and we are mainly responsible for that. In the name of

development and industrialization, we are making the climate worse year by year. The main reason for climate change is the burning of fossil fuels like coal, oil, and gas.

In September 2015, the United Nations announced 17 universal goals to end poverty and protect the environment. Based on those goals, an international treaty on climate change was signed on 12th December 2015. This treaty was adopted by 195 Parties at the UN Climate Change Conference (COP21) in Paris, France. The treaty was enforced on 4th November 2016. Currently, as of January 2026, there are 194 Parties to the Paris Agreement. The main goal of this treaty is to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels” and pursue efforts “to limit the temperature increase to 1.5°C above pre-industrial levels.”

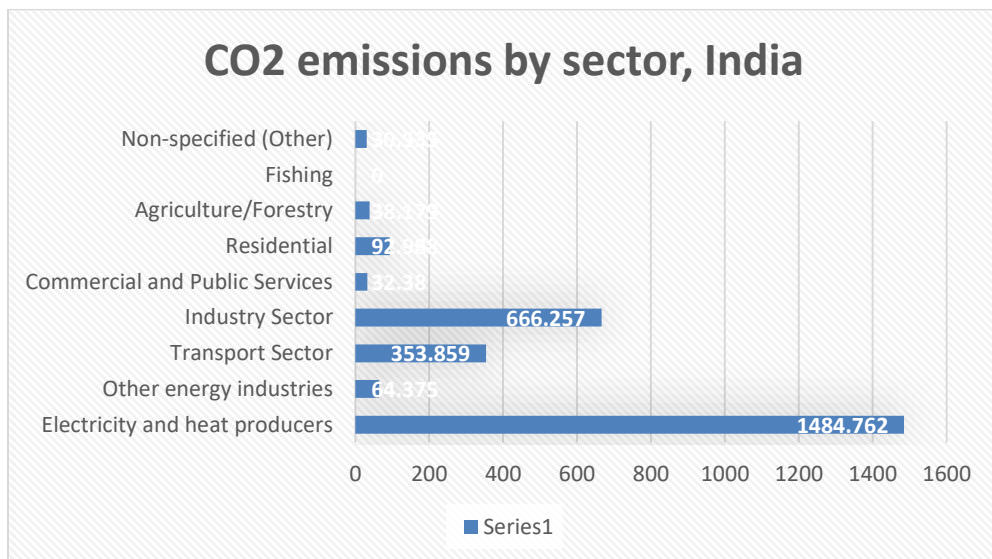
Impact of Climate Change in India:

India has been identified as one of the most vulnerable countries to be impacted by climate change. India is the most affected by extreme weather events and climate change over the past three decades (1995–2024), and it is currently ranked as 9th in the list of the world's countries as per the Climate Risk Index 2026. To overcome the situation, the Indian Government has launched a comprehensive strategy, “National Action Plan on Climate Change (NAPCC)” in the year 2008. The focus of the plan is to spread awareness about the impact of climate change among the people, adaptation of various plans to mitigate the impact of climate change, along with that this plan also focuses on promoting energy efficiency and natural resource conservation.

As we know, India is one of the strong developing countries with rapid growth of industrialization. It is also the most populous country in the world, with a population of over 150 crores. These two are considered the main reasons behind climate change in India.

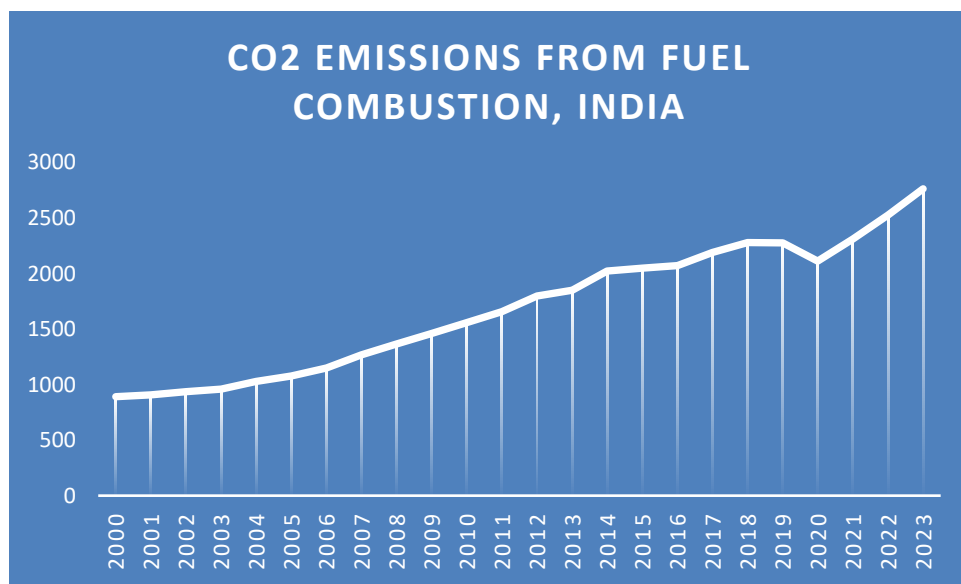
A typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year. Carbon dioxide (CO₂) is the main greenhouse gas released by vehicles. Other than carbon dioxide (CO₂) gas released by vehicles, gasoline-powered cars also emit smaller amounts of methane (CH₄) and nitrous oxide (N₂O) through their exhaust pipes. Although the amount of HFCs emitted is much lower than that of CO₂, these gases can have a strong impact on global warming because they trap much more heat in the atmosphere as compared to carbon dioxide.

As per data available in the International Energy Agency (IEA) India ranked 3rd in the world in terms of total CO₂ emission from energy. China is in the number 1 position, followed by the USA. Based on another set of data, India ranked 97th globally for per capita CO₂ emissions.



Source: <https://www.iea.org/countries/india/emissions>

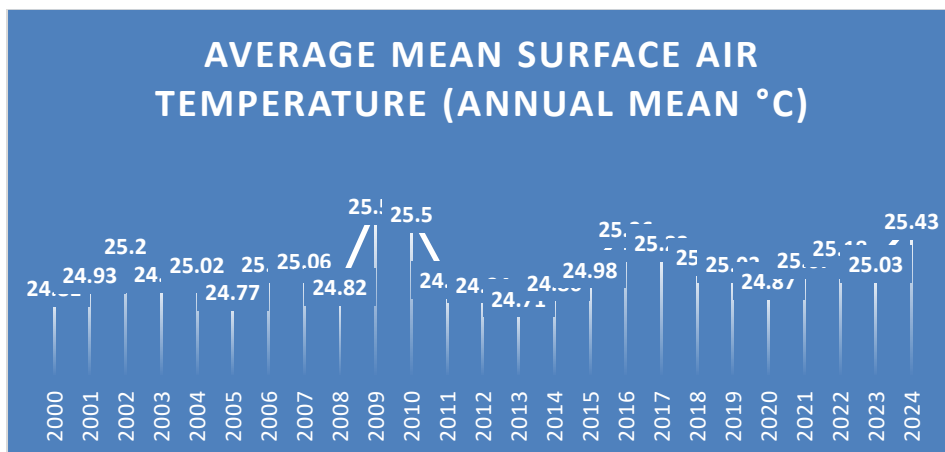
The Indian transport sector accounted for 7% of all greenhouse gas emissions. If we consider only CO₂ emissions by sector, Electricity and heat produce the maximum CO₂ emissions, by 54% of the total CO₂ emissions. The industry sector is the 2nd in the list of CO₂ emissions, whereas the transport sector results 13% of the total carbon emissions in India and stood 3rd in the list.



Source: <https://www.iea.org/countries/india/emissions>

If we look at the above graph, the CO₂ emission caused by fuel burning shows an increasing trend over the last 2 decades. The positive trend in CO₂ emissions is caused by the increasing trend of vehicle sales over the last two decades. If we look closely, we see that carbon emissions and the increasing trend of fuel combustion are interconnected.

Over the past two decades, India has witnessed a drastic change in its weather patterns. The weather in India became more extreme with higher temperatures every year, erratic rainfall, and floods in different geographical regions. Raising sea levels and cyclonic shifts make it more alarming. The graph below showing the average mean temperature rise in India.



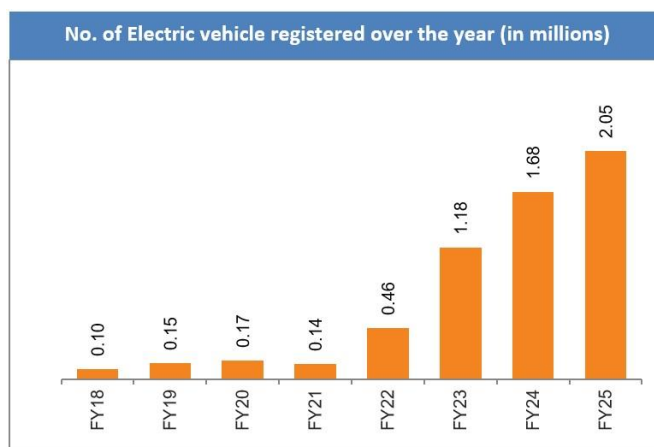
Source: <https://climateknowledgeportal.worldbank.org/country/india/climate-data-historical>

Current Scenario of EV market in India

Though fossil fuels like oil, coal, and natural gas are the main sources of carbon emissions, these factors contribute to a country's growth. Without these three components, an economy cannot run. India is one of the top oil importers in the world. On the other hand, the Indian transport sector is the biggest consumer of crude oil. The transportation sector plays a crucial role in employment generation and economic growth of the country, but it also accounts for a huge amount of carbon emissions every year. As per a news article issued by Hindustan Times (2025) written by Amit Bhatt, in India, passenger cars contribute about 14% of India's total greenhouse gas emissions, with road transport accounting for around 90% of that share.

As India's 14% carbon emissions are coming from the transport sector, out of which 90% is resulting from road transport, the Government of India has taken multiple initiatives and strategies to control this. Due to India's huge population and growing economy, demand for all types of vehicles is increasing every year. India's

automobile sector is the 4th largest automobile sector in the world. The huge use of automobiles also causes a huge amount of carbon emissions every year. To tackle this problem, a policy forum, The Electric Vehicles Initiative (EVI) associated with this matter, was established in the year 2010. The main objectives of this forum are to identify and recognise the opportunities offered by EVs in different countries in the world. Vehicles are one of the biggest sources of air pollution in India, contributing around 51% of the country's air pollution. In large cities, this share can increase to nearly 80%, affecting both human health and the environment. As the demand for fossil fuels continues to grow and their harmful environmental effects become more evident, finding cleaner and more sustainable energy alternatives for transportation has become a pressing necessity for India. The Government of India launched the National Electric Mobility Mission Plan (NEMMP) 2020 to encourage the use and production of electric vehicles across the country. The initiative seeks to reduce pollution caused by conventional vehicles while also decreasing dependence on fossil fuels and improving energy security. By promoting cleaner transportation options, electric vehicles are expected to play an important role in helping India move towards a more sustainable and low-carbon future. The Government of India has taken multiple initiatives to boost the sales of EVs in India, but it still accounts for only 8% of the total vehicle registrations in India. But the Central government has set a target to increase the EV sales to 30% for private vehicles and 70% for commercial vehicles, 40% of buses, and 80% of two- and three-wheelers by 2030. Below is the graph showing the increasing trend of EV use in India. In 2018, the number of EVs registered in India was 0.10 million, but within five years it had increased to 0.46 million. The biggest jump in EV registration took place in the year 2023. 156.52% growth has been witnessed in that particular year. In 2025, the number of registered EV vehicles has increased to 2.05 million.

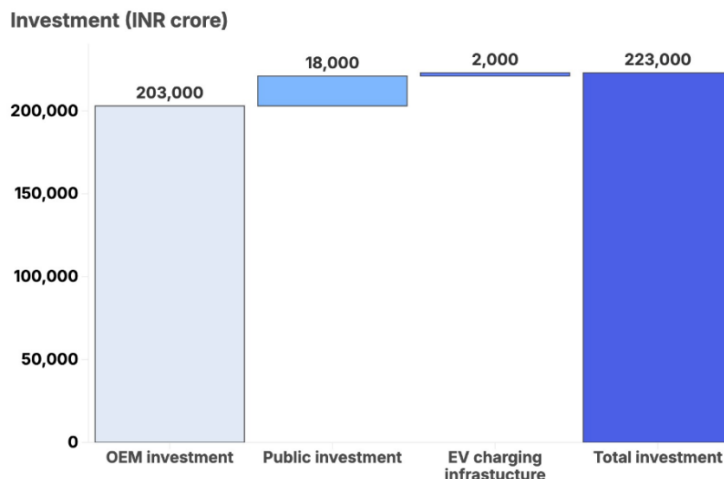


Source: PIB

The main problem faced by EV users is the availability of charging stations. Now this problem has been identified by the government and has launched an initiative named PM E-DRIVE scheme, which allocated Rs. 2,000 crores specifically for the installation of public EV charging stations nationwide. From 2022 to 2025, the charging station network has grown rapidly with 78% CAGR. Similarly, in the second phase of FAME India initiatives, the Ministry of Heavy Industries (MHI) approved a capital subsidy of Rs. 800 Crores to install 7432 EV charging stations in India.

Investment in the Indian EV sector

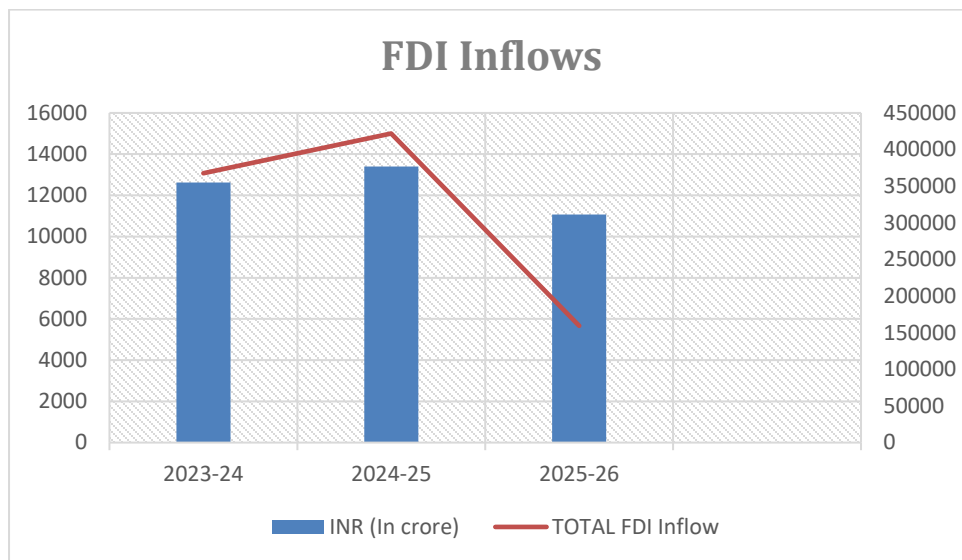
Due to the huge opportunity, the EV sector has witnessed a good number of investments in the sector in recent times. India has witnessed a significant increase in foreign investment in the last five years. Many big global names have shown interest in entering the Indian EV market in recent times. Tesla is one of them. Chinese companies such as BYD Auto, SAIC Motor, Changan Automobiles, and others have already entered the Indian EV market. Joint ventures and strategic partnerships with Indian companies provide a path to enter the Indian market. JSW MG Motor India has entered into a Joint venture contract with China's SAIC Motors in 2024. Other than that, many global automobile brands have invested a significant amount in the Indian EV sector. Hyundai Motors tops the list with an investment of ₹33,200 crore to expand its EV production by establishing two new factories in Tamil Nadu and Maharashtra. Tata Motors invested ₹12,500 crore to set up a Giga factory to power up its EV line. VinFast, the leading EV manufacturer in the world, also invested ₹ 16000 crore for setting up an integrated battery and EV manufacturing hub in Tamil Nadu. Between 2020 to 2025 FY Indian EV sector received a huge investment of ₹ 2.23 lakh crore.



Source: IEEFA estimates, company financials, and budget documents

The graph below shows the FDI inflow in the Indian automobile sector over the last five years.

The drop in FDI investment is the result of revealing the impact of disinvestment and diverse investor strategies. This drop of FDI inflow has been noticed in every economic sector.



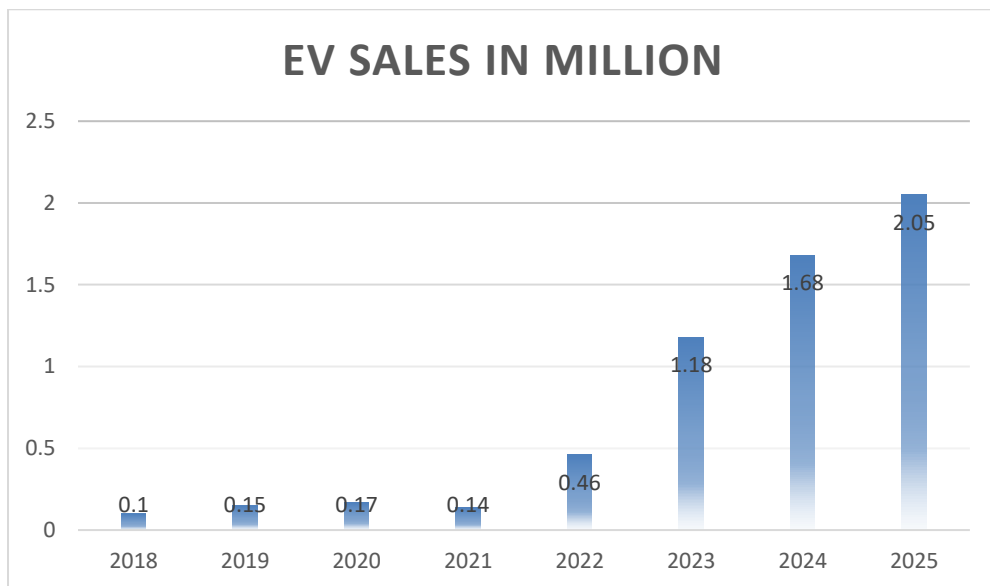
Source: RBI Database

Growing Trend in EV Market

Despite being the 2nd-largest car market in Asia, the Indian EV market is still very small compared to other countries. The global EV market grew 20% in 2025. Norway is the leading EV car market in terms of sales share, with around 97% of the new car sales in 2025. China is in second position with 55% of the total new car sales in 2025. Turkey is one of the fastest-growing EV markets in Europe, where in 2022 the market share was only 1%, and in 2025 the market share increased to 20%.

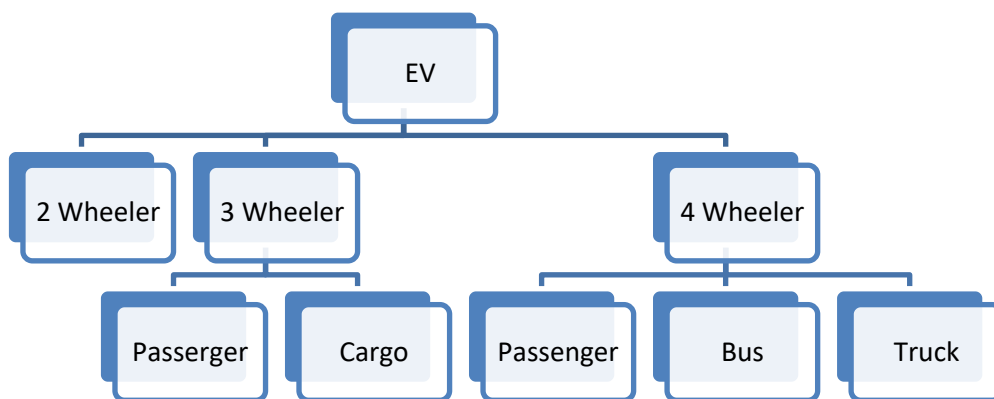
But the trend of EV sales is totally different in the United States. The EV car sales declined sharply in 2025 compared to 2024. The main reason behind this fall is the “Executive Order 14154” through which the US government ended support for EVs, including measures related to financial incentives and fuel economy standards.

EV sales in India grow from 50,000 units in 2016 to 1.68 million in 2024 to 2.05 million in 2025. It shows that the Indian EV sector grew at an exponential rate, but from the year 2024, there was a sudden slowdown in EV sales. The automobile market share of EVs was 6.4 in 2023, which reduced to 5.6 in 2024 and 5.2 in 2025.



Source: <https://www.ibef.org/industry/electric-vehicle>

The EV sector has been categorised into various categories and sub-categories. The structure of the Indian EV sector is:



Source: Author's computation

Out of these three main categories, the 2-wheeler segment has the highest market share. 55.29% market share has been captured by 2-wheelers, followed by 3-wheeler passenger car with 34.25% market share, and then 4-wheeler passenger car with 5.64% market share. E-Bus and E-Truck have the lowest market share with 0.90% and 0.34%, respectively.

Government Initiatives and Regulatory Changes

In recent years, the Indian government has introduced a number of policies and incentive programmes to promote the growth of electric vehicles (EVs) in the country. The focus has been not only on increasing EV adoption among consumers but also on strengthening domestic manufacturing and improving charging infrastructure. Subsidies for EV purchases, regulatory support, the development of public charging facilities, and preferential tax treatment are some of the key measures that have been implemented to accelerate India's transition towards cleaner and more sustainable transportation. The Indian government has set a target of 30% EV penetration by 2030. To achieve this goal, many initiatives have been taken like, PM E-drive scheme, where the government has invested ₹ 10900 crore to subsidize the commercial EVs and expand the EV charging network throughout the country.

GST reform also helps to boost the sales of EVs. Previously, where customers needed to pay 28% GST, now they only pay 5% GST for EVs.

Till nowadays, all EV manufacturers rely on China for the EV's battery. Through the Production-Linked Incentive (PLI), the government has invested ₹ 25938 crore in establishing domestic manufacturing of advanced chemistry cell batteries to reduce reliance on imports.

FAME India is the biggest initiative that the Indian Government has taken to speed up the volume of production of EVs in India. The word FAME stands for “Faster Adoption and Manufacturing of EVs” in India. The policy was introduced to encourage more people to switch to electric vehicles and support cleaner modes of transportation in India. As part of the National Electric Mobility Mission Plan (NEMMP), the government launched this subsidy scheme in 2015 to make electric vehicles more affordable and attractive to consumers. The initiative has been rolled out in two phases—FAME India Phase I and FAME India Phase II—both of which have played an important role in promoting the adoption of electric mobility and reducing dependence on conventional fuel-powered vehicles.

Major challenges faced by EVs in India

Despite strong policy efforts and growing participation from industry, the adoption of electric vehicles (EVs) in India has not progressed at the pace required to achieve the country's ambitious targets. This highlights the presence of several economic, infrastructural, and behavioural challenges that continue to influence consumers' willingness to adopt EVs. The goal of achieving 30% EV penetration in the overall vehicle population is therefore a complex and demanding task. While government initiatives such as the FAME scheme, the National Electric Mobility Mission Plan (NEMMP), and the Production Linked Incentive (PLI) scheme have provided considerable support for the development of the EV ecosystem, widespread

consumer acceptance and large-scale adoption of electric vehicles remain key challenges in India's transition towards sustainable transportation. Many previous studies have identified that infrastructure is the biggest problem that the Indian EV sector is currently facing. Lack of charging stations is the major concern shown by the prospective customers. Pricing is also a point of concern which hugely impacted the sales of EVs. In India, the maximum units of vehicle sales were recorded between the price segment of ₹ 6 lakhs to ₹ 8 lakhs. But the average EV price in India is above this price range. Another reason why EV sales are not gearing up is the huge maintenance cost. We may save fuel costs by buying EVs, but the maintenance costs of EVs is very high compared to normal cars. The EV batteries need replacement after 4-5 years, and the cost of installing a new battery is similar to the down payment of a new car.

Conclusion

The adoption of electric vehicles (EVs) in India is constrained by a range of economic, technological, infrastructural, and behavioural factors. Key barriers include the high upfront purchase cost of EVs, inadequate charging infrastructure, limitations in battery technology, dependence on imported raw materials, insufficient power availability, and inefficiencies in the supply chain. In addition, limited consumer awareness regarding EV performance and driving range, difficulties in accessing spare parts, inadequate fiscal incentives, concerns about operating costs and resale value, resistance to behavioural change, lack of confidence in new technology, limited social support, and insufficient promotional efforts further hinder their widespread acceptance. Moreover, the environmental advantages of EVs remain partly restricted because India's electricity generation continues to rely heavily on fossil fuels. Consequently, the full sustainability benefits of EVs can only be achieved through a cleaner energy mix with greater integration of renewable energy sources

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