International Journal on Science and Technology (IJSAT)
E-ISSN: 2229-7677 ● Website: www.ijsat.org ● Email: editor@ijsat.org

# From Crude-oil Dependence to Sustainable Mobility: A Demand and Supply Analysis of India's Electric Vehicle Market (2018-2026).

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**Abstract:**
The growing dependence on imported crude-oil represents significant economic, energy security and environmental challenges for India. Simultaneously, there has been a rapid expansion in the electric vehicle market in India as part of a strategic move towards sustainability and to lower the reliance on fossil fuel. The development of India's EV market is not solely dependent on consumer preferences, it is also influenced by the supply-side constraints such as battery availability, manufacturing capacity, charging infrastructure, and the input costs. This research examines how the changing prices of crude-oil and the government intervention have influenced the demand-supply dynamics of the electric vehicle market between 2018 and 2026. The study uses qualitative research design based on secondary data, that synthesises evidence from peer reviewed journal articles, international organisation reports, government publications, and industry data to analyse the interaction between public policy and market forces. Based on the demand and supply theory, this study explores how the volatility of crude-oil prices affected the consumer demand for EVs, while the government production incentives influenced market supply. The paper contributes to the literature by integrating market theory, sustainability and energy economics within the demand-supply framework, offering insights into the accelerated transition of India's transport system.

**Key Words:** Crude-Oil, Demand, Electric-Vehicles, Energy-Security, India, Price Volatility, Supply, Sustainable-Mobility.

## 1 Introduction:

Today, the world is witnessing a transition towards sustainable transportation as an important component to address climate change, strengthen energy security, and reduce the dependence on fossil fuels. Electric Vehicles (EVs) are emerging as an alternative to the conventional vehicles as their adoption would reduce petroleum consumption, and lower the transport-related emissions. The EV markets is growing not only in response to technological transition but also because of economic consideration for the growing vulnerabilities associated with the fossil fuel availability as global tensions rise.[1] Nations aim to find ways

[1] International Energy Agency. (2024). *India oil market report*. International Energy Agency.

to be self-sufficient and to reduce the interdependence on trade of fossil fuel trade.[2] The recent war situations have brought to light the increasing scarcity, inflationary trends, and political unrest due to the conventional dependence on fossil fuels. India similarly identifies EVs as a potential mechanism for addressing environmental pressures, dependence on imported petroleum and energy security concerns.[3]

India's rapid economic growth has witnessed substantial growth in the transport sector, making it highly dependent on imported crude-oil along with the international oil price movements, and global energy market disruptions.[4] India is the world's second largest net importer of crude-oil according to 2023 reports, with an approximate import volume of approximately 4.6 million barrels per day. The International Energy Agency (IEA) projects further growth as the domestic demand increases every year with the economic growth of the nation increasing leading to an increase in the standard of living of the people. The IEA estimates that increasing EV adoption will moderate the future oil demand growth reducing the daily demand by 480,000 barrels between 2023 and 2030.[5] India's oil demand would have increased by 1.68 million barrels per day by 2030 if the steps to reduce this demand were not taken on time.[6] The development of alternate modes of mobility extends beyond the environmental sustainability to encompass energy security and the problems associated with international petroleum markets.

From the perspective of economics, these changes in costs and benefits of conventional versus electric vehicles influence market demand, as well as the development of production capacity and the infrastructure, which determine market supply. Existing research on India identifies the operating cost, purchase price, charging infrastructure, government incentives, and consumer awareness, income levels[7] as factors affecting EV demand.[8] The nation faces supply-side constraints including lack of adequate charging infrastructure, domestic battery and manufacturing supply chains, and the resource availability to expand the EV market.[9] These factors imply that changes in the consumer demand cannot be studied in isolation from the supply-side response in the form of the infrastructure and production capacity.[10]

The government intervention affects both sides of the market. India's EV adoption policies are designed to reduce costs while encouraging the producers to expand domestic manufacturing and infrastructure. However, the existing evidence suggests that only policy incentives may not be sufficient to encourage consumers to shift from conventional vehicles to electric vehicles. Recent research identifies charging

2 Singh, V., Singh, V., & Vaibhav, S. (2021). Analysis of electric vehicle trends, development and policies in India. *Case Studies on Transport Policy*, *9*(3), 1180–1197. https://doi.org/10.1016/j.cstp.2021.06.006

3 Jain, M., & Singh, A. (2024). An empirical study on electric vehicle adoption in India: A step towards a greener environment. *Transport Policy*, *156*, 112–125. https://doi.org/10.1016/j.tranpol.2024.07.018

4 Yadav, R., & Yadav, R. (2024). Are consumers ready to adopt electric vehicles? Analyzing the barriers and motivators associated with electric vehicle adoption in India: Policy implications for various stakeholders. *Energy Policy*, *190*, 114173. https://doi.org/10.1016/j.enpol.2024.114173

5 International Energy Agency. (2024). *India oil market report*. International Energy Agency.

6 International Energy Agency. (2024). *India oil market report*. International Energy Agency.

7 Munshi, T., Dhar, S., & Painuly, J. (2022). Understanding barriers to electric vehicle adoption for personal mobility: A case study of middle income in-service residents in Hyderabad city, India. *Energy Policy*, *167*, 112956. https://doi.org/10.1016/j.enpol.2022.112956

8 Tarei, P. K., Chand, P., & Gupta, H. (2021). Barriers to the adoption of electric vehicles: Evidence from India. *Journal of Cleaner Production*, *291*, 125847. https://doi.org/10.1016/j.jclepro.2021.125847

9 Dua, R., Hardman, S., Bhatt, Y., & Suneja, D. (2021). Enablers and disablers to plug-in electric vehicle adoption in India: Insights from a survey of experts. *Energy Reports*, *7*, 3171–3188. https://doi.org/10.1016/j.egyr.2021.05.025

10 Patel, M., Singh, R., Arora, P., & Mahapatra, D. (2024). EV adoption in India: Barriers and policy solutions from manufacturers' and consumers' perspectives. *Energy for Sustainable Development*, *83*, 101583. https://doi.org/10.1016/j.esd.2024.101583

infrastructure and concerns about vehicle cost as major barriers to EV adoption.[11] These constraints highlight the importance of targeted policy measures required for the EV market to grow.[12]

Despite the growing literature on EV adoption and policy in India, much of it is focused on specific barriers, individual policy interventions, or consumer behaviour. Limited attention has been given to the interaction between crude-oil market conditions, simultaneous demand and supply adjustments, and government intervention, within a unified economic framework. This research paper addresses this issue by examining how crude-oil price volatility and government policies influenced the demand and supply dynamics of India's electric vehicle market between 2018 and 2026. The analysis is based entirely on secondary evidence from government publications, peer-reviewed literature, international organisations, and industry sources. The study applies demand and supply theory to interpret the development of India's EV market and their implications for sustainability and energy security, while providing an integrated perspective on India's transition from conventional fuel transportation toward electric mobility.

## 2 Literature Review:

### 2.1 Electric Vehicle Adoption and Consumer Demand:

The literature on EV adoption identifies a combination of factors influencing demand, such as economic, infrastructural, technological, and behavioural. Consumers' decisions are influenced by relative costs and attributes of EVs and conventional vehicles. Hidrue et al.(2011) found that fuel cost savings, charging time, vehicle price, and driving range were the attributes that affected consumers' willingness to pay for EVs. The operating costs are most relevant to this research because changes in conventional fuel prices lead to growing attractiveness of EVs. Li et al. (2017) identified psychological, demographic, and situational factors that influence the intentions of consumers to adopt EVs. Kumar and Alok (2020) in their research concluded that EV adoption depends on economic incentives, infrastructure, environmental concerns, consumer perceptions, and technological features. These studies imply that EV demand cannot be explained exclusively using environmental preferences as economic considerations are a main aspect of consumers' decisions.

The Indian literature supports these findings; Bansal et al. (2021) examined Indian consumers' willingness to pay for EV and found that it depended on the operating costs, charging time, and driving range. This implies that consumers consider not only the initial purchase price but the cost of ownership of EVs. Similarly, other Indian studies identified high purchase prices, availability of charging infrastructure, limited driving range, and inadequate awareness as barriers to EV adoption. The research findings of Tarei et al. (2021) demonstrate that the barriers are interconnected and not independent. For instance, the inadequate infrastructure can reduce consumers' willingness to purchase EVs even with financial incentives that make EVs an attractive alternative to conventional vehicles.[13]

11 Goel, P., Sharma, N., Mathiyazhagan, K., & Vimal, K. E. K. (2021). Government is trying but consumers are not buying: A barrier analysis for electric vehicle sales in India. *Sustainable Production and Consumption*, *28*, 49–61.

12 Patel, M., Singh, R., Arora, P., & Mahapatra, D. (2024). EV adoption in India: Barriers and policy solutions from manufacturers' and consumers' perspectives. *Energy for Sustainable Development*, *83*, 101583. https://doi.org/10.1016/j.esd.2024.101583

13 Tarei, P. K., Chand, P., & Gupta, H. (2021). Barriers to the adoption of electric vehicles: Evidence from India. *Journal of Cleaner Production*, *291*, 125847. https://doi.org/10.1016/j.jclepro.2021.125847

Both conventional vehicles and EVs serve as substitutes for personal transportation, but changes in their operating costs will affect demand for either type of vehicle. However, the substitution effect depends on the availability of EV alternatives which are affordable and practical for consumers.

2.2 Crude-oil prices, fuel costs and EV demand:

The economic transition from petroleum-dependent vehicles to EVs depend on the relationship between crude-oil prices and EV adoption. With an increase in crude-oil prices, the petrol and diesel prices increase which leads to a rise in the cost of operating conventional vehicles. EVs are the available substitutes in the market, providing consumers an economic incentive to shift towards EVs due to the change in relative prices.

Recent research by Fei et al. (2025), strongly supports the mechanism, as in 36 Chinese cities between 2017 and 2022, an increase in EV sales of 4.67% in response to 1 CNY/litre increase in gasoline prices.[14] The effect was more on the low cost EVs and the smaller vehicle segments, indicating that the response to price is conditional on the affordability and availability of substitutes.[15]

These findings are relevant to the Indian perspective as they demonstrate that the fuel prices can influence the EV demand through the substitution effect. However, they highlight that fuel prices alone do not lead to an equivalent increase in EV adoption, as the effect also depends on purchase prices, or the availability of charging infrastructure. This determines whether consumers will continue using conventional vehicles or will shift to EVs.

India remains highly dependent on crude-oil imports which makes studying price volatility important. It is not only the operational cost of conventional vehicles but also the impact on the import expenditure and a subsequent impact on the balance of payments. The expensive imports lead to inflationary pressure in the economy and an energy security crisis. The transition towards EVs can potentially reduce the transportation sector's exposure to international oil market conditions.

It is a bidirectional relationship: higher oil prices lead to increase the attractiveness of EVs, while greater adoption of EVs can reduce future petroleum demand. The IEA estimates that the EV adoption globally stands at replacing approximately 1.2 million barrels of oil per day in 2025.[16] This relationship is important for India as transport is a major source of petroleum demand. The 2026 IEA analysis highlights that India's EV market has accelerated in 2025, with sales of EVs increasing by 75% to approximately 165,000 units, which is nearly 4% of the total car sales.[17] Therefore, the EV market is becoming highly important for the country's future crude-oil demand trajectory.

14 Fei, Y., Qin, P., Chu, Y., Zheng, H., Tan-Soo, J.-S., & Zhang, X.-B. (2025). Does high gasoline price spur electric vehicle adoption? Evidence from Chinese cities. *Energy Economics, 142*, 108188. https://doi.org/10.1016/j.eneco.2025.108188

15 Fei, Y., Qin, P., Chu, Y., Zheng, H., Tan-Soo, J.-S., & Zhang, X.-B. (2025). Does high gasoline price spur electric vehicle adoption? Evidence from Chinese cities. *Energy Economics, 142*, 108188. https://doi.org/10.1016/j.eneco.2025.108188

16 International Energy Agency. (2026). Global EV outlook 2026: Trends in electric cars. OECD Publishing.

17 International Energy Agency. (2026). Global EV outlook 2026: Trends in electric cars. OECD Publishing.

2.3 Government Policy and EV Market Development:
EV markets require policy intervention because of technological uncertainty, environmental externalities, infrastructure coordination and relatively high initial cost of new technologies. Governments use a combination of purchase incentives, manufacturing incentives, tax benefits, regulatory measures, and infrastructure investment to encourage customers to adopt EVs (using Nudge Theory).

Ahman (2006) highlighted the need for government support to develop alternative vehicle technologies, the role of research and development, demonstrations and market incentives in response to changing market conditions. The study emphasised the importance of policy continuation to support technological transitions in the country. Dhar et al. (2017) examined alternative EV development pathways in India and found that the government policy intervention significantly affected the penetration levels of EVs and subsequent environmental outcomes. The analysis demonstrated that the environmental benefits of EVs depend partly on the carbon intensity of the electricity used to charge EVs. Therefore, EV adoption depends on the energy system of a country rather than solely on the automobile market.

Das and Bhat (2022) examined EV policy development in India, which includes Faster Adoption and Manufacturing of Hybrid and Electric (FAME) Vehicles programme, and National Electric Mobility Mission Plan. Government policy aims to stimulate demand and domestic technological development. The distinction between demand-side and supply-side policies is relevant to this study. Subsidies received by consumers reduce the effective price of EVs and can shift the demand curve outwards, while production incentives and infrastructure investment can increase the capacity of the market to supply EVs. Government intervention is not an external factor determining sales, but it can alter the market conditions on both sides of the market.

The effectiveness of such intervention depends on infrastructure such as charging stations, energy infrastructure, battery-swapping facilities, and charging points, as identified by Patel et al. (2024). India's EV transition has demand-side incentives, but supply-side infrastructure remains insufficient.

2.4 Supply-Side Constraints: Batteries, Manufacturing and Infrastructure:
Although previous literature on EVs focused on consumer adoption, it has now shifted towards supply-side constraints. EV production depends on battery technology, semiconductors, critical minerals, manufacturing capacity and charging infrastructure. These affect production costs and the ability of manufacturers to meet increasing market demand.

Tarei et al. (2021) demonstrated that the technological constraints and inadequate infrastructure are major barriers to EV adoption in India. Charging infrastructure is not only a consumer inconvenience but also a structural constraint affecting the wider Indian market.[18] Battery supply-chain bottlenecks present an additional challenge, as identified by Dhairiyasamy et al. (2024). The study identified dependence on raw materials, production costs, supply-chain complexity, technological changes and skilled labour shortages

[18] Tarei, P. K., Chand, P., & Gupta, H. (2021). Barriers to the adoption of electric vehicles: Evidence from India. *Journal of Cleaner Production, 291*, 125847. https://doi.org/10.1016/j.jclepro.2021.125847

as major challenges for India's EV battery ecosystem.[19] The analysis concludes that dependence on imported raw material exposes India to geopolitical risks and price volatility, while fragmented supply-chains create obstacles in coordination and quality control. [20]

These bottlenecks have direct implications for market analysis. If fuel prices continue rising or the government continues providing subsidies, then EV demand will increase, and producers must build sufficient production capacity to respond to this growth opportunity. Supply may be unable to respond to the rising demand if battery availability, charging infrastructure or manufacturing capacity remains limited. The market adjustment is characterised by an increase in sales that is smaller than the potential increase in demand.

The supply-side literature emphasises sustainability, stating that EVs reduce direct petroleum consumption, but the production of batteries creates new environmental and resource challenges. Therefore, sustainable mobility requires resilient battery supply-chains, domestic manufacturing capabilities, responsible mineral sourcing, and effective recycling systems.

2.5 Sustainability and Energy Security:

There is a relationship between EV adoption, energy security, and sustainability. EVs reduce petroleum consumption, and transport-sector emissions, but the benefits depend on the electricity generation patterns and cost associated with battery production.

Dhar et al. (2017) demonstrated that EV performance will improve as the electricity system becomes less carbon-intensive. This finding is significant for India, where the benefits of transportation electrification depend on the transition of the electricity sector. Battery-related supply-chain challenges mean that resource dependence will not be eliminated. Dhairiyasamy et al. highlight that India depends on imported battery related raw materials and is exposed to international supply and price risks.[21] For India, restructuring energy dependence is essential, rather than the complete elimination of dependence. This will be beneficial to reduce consumption of petroleum and exposure to the international crude-oil markets and thereby potentially reducing the transport sector's vulnerability to oil price shocks.

2.6 The 2026 Oil-Price Environment and India's EV Transition:

The IEA's Global EV Outlook 2026, published in May 2026, explicitly considers the implications of the energy crisis associated with the conflict in the Middle East on the EV markets, policy development, and oil consumption.[22] According to the IEA report, global electric car sales exceeded 20 million in 2025, with approximately one-fourth of all new cars sold worldwide being EVs. More importantly for the research

19 Dhairiyasamy, R., Gabiriel, D., Bunpheng, W., & Chan Choon Kit. (2024). A comprehensive analysis of India's electric vehicle battery supply-chain: Barriers and solutions. *Discover Sustainability, 5*, 361. https://doi.org/10.1007/s43621-024-00595-7

20 Dhairiyasamy, R., Gabiriel, D., Bunpheng, W., & Chan Choon Kit. (2024). A comprehensive analysis of India's electric vehicle battery supply-chain: Barriers and solutions. *Discover Sustainability, 5*, 361. https://doi.org/10.1007/s43621-024-00595-7

21 Dhairiyasamy, R., Gabiriel, D., Bunpheng, W., & Chan Choon Kit. (2024). A comprehensive analysis of India's electric vehicle battery supply-chain: Barriers and solutions. *Discover Sustainability, 5*, 361. https://doi.org/10.1007/s43621-024-00595-7

22 International Energy Agency. (2026). *Global EV outlook 2026*. OECD Publishing.

question, the adoption of EVs displaced approximately 1.2 million barrels of oil per day in 2025.[23] In 2026, the IEA projects further growth in EV sales, with global electric car sales potentially reaching 23 million.[24]

India's electric car sales increased by 75% in 2025, reaching approximately 165,000 units and nearly 4% of the total car sales in the year according to IEA reports. Domestic manufacturers accounted for 60% of the EV sales, while the Indian market is gradually developing its domestic supply capacity of EVs alongside rising demand.[25] India's EV registrations as of early 2026 have continued to grow, reaching approximately 3.3 lakh units in July 2026, representing an increase of 66% compared to July 2025.[26] Electric car sales have reportedly increased by 82% year-on-year, with the fuel prices rising.[27]

These developments illustrate the substitution mechanism, which indicates that the higher fuel costs increase the attractiveness of the EVs. However, 2026 evidence demonstrates that the relationship is not purely price-driven vehicle model availability, charging infrastructure, domestic production, consumer confidence and government policy continue to affect the market. As 2026 is still ongoing year and this is just the preliminary evidence rather than the complete yearly observation. Nevertheless, the period from 2018-2026 period captures the emergence of India's EV market, including the COVID-19 disruption, the 2021-2022 global energy price shock, renewed energy-market uncertainty, and subsequent EV-market expansion.

2.7 Synthesis and Research Gap:

The literature establishes four interconnected relationships. First, demand for EVs is influenced by the vehicle price, operating costs, consumer perceptions, range, and charging time. Second, conventional fuel price changes affect EV demand due to the substitution effect, demonstrating a positive relationship between fuel prices and EV sales.[28] Third, government intervention may influence the market forces by providing incentives to consumers, support to manufacturers and development of infrastructure. Finally, battery availability, raw material dependence and charging infrastructure are potential obstacles as the supply-chain responds to increased demand.

However, existing consumer studies focus on intentions and preferences, policy-specific and supply-chain research focuses on batteries, infrastructure and manufacturing obstacles. This creates an opportunity for integrated economic interpretation of EV transition in India. The current research addresses the gap by examining how crude-oil market conditions and government dynamics within the EV market between 2018–2026 in India. The study synthesises secondary sources and data instead rather than relying on complex econometric modelling to explain the demand and supply framework. The analysis considers how changes in price and availability of conventional fuels impact the relative demand for EVs. The

23 International Energy Agency. (2026). *Global EV outlook 2026*. OECD Publishing.

24 International Energy Agency. (2026). *Global EV outlook 2026*. OECD Publishing.

25 International Energy Agency. (2026). *Global EV outlook 2026*. OECD Publishing.

26 The Economic Times. (2026). India's EV sales hit record high as e-2W cross 2 lakh mark. The Economic Times.

27 The Economic Times. (2026). India's electric car sales jump 82% in July as high fuel prices boost EV demand. The Economic Times.

28 Fei, Y., Qin, P., Chu, Y., Zheng, H., Tan-Soo, J.-S., & Zhang, X.-B. (2025). Does high gasoline price spur electric vehicle adoption? Evidence from Chinese cities. *Energy Economics, 142*, 108188. https://doi.org/10.1016/j.eneco.2025.108188

government policies, battery supply, charging infrastructure, and manufacturing capacity also influence the ability of supply to respond to the opportunity.

The year 2026 is important because it provides contemporary information for the theoretical relationship. The combination of volatile oil prices, petrol dependence and increased EV adoption provides a useful topic to examine whether transition towards EV mobility represents an environmental response and an economic response to vulnerabilities in energy markets.

**3 Methodology:**

3.1 Research Design:

This study uses a qualitative, exploratory research design based on secondary data. The purpose of this study is to understand the relationship between crude-oil market conditions and the development of India's electric vehicle (EV) market between 2018 and 2026 using economic principles of demand and supply. A secondary-source approach is used in the study to interpret market changes and conditions over time rather than individual behaviour or causal statistical relationships. The analysis period from 2018 to 2026 covers the early development of India's EV market, the introduction of government support schemes, COVID-19 pandemic, the global energy price shock of 2021-2022, EV adoption acceleration, and the 2026 renewed oil-market volatility. The year 2026 is ongoing so the data is treated as preliminary rather than as a complete annual observation.

3.2 Data Sources:

The research is exclusively based on secondary sources. Academic journal articles based on energy economics, crude-oil prices, EV adoption, sustainability, EV supply-chains, and transport economics are used. Approximately 22 academic articles are referred to establish the theoretical and empirical foundation of the study. In addition to the academic literature, market and policy evidence is obtained from institutional sources which include the International Energy Agency (IEA), Niti Aayog, Government of India publications, the Ministry of Heavy Industries, the Ministry of Petroleum and Natural Gas, Reserve Bank of India, and other authorised government and industry sources. These sources provide information related to petroleum consumption, crude-oil prices, EV sales, government incentives, EV infrastructure and developments in the Indian market.

The secondary evidence has been selected based on relevance to the research question, credibility of the source, and information availability for the selected time period. Peer-reviewed academic studies provide theoretical and empirical claims, official institutional and government sources provide market statistics, recent developments, and policy information.

3.3 Analytical Framework:

The primary analytical tool is the demand and supply framework. The study does not apply econometric modelling, statistical software or primary surveys. Microeconomic principles are used to interpret changes in the market conditions. On the demand-side, the substitution effect is considered as EVs and conventional petrol-diesel vehicles are substitutes. These can increase the relative attractiveness of EVs and shift the demand for EVs to the right. Lower conventional fuel prices may reduce the financial incentive to switch to an EV for consumers. Government incentives such as purchase subsidies, tax

benefits and other consumer incentives can reduce the effective cost of EV purchase and ownership leading to a potential increase in quantity demanded. Consumer preferences, perception of EV technology, and environmental awareness are considered demand-side factors.

On the supply-side, the research examines factors affecting ability of manufacturers to respond to increasing market demand, such as critical mineral supply, battery availability, and costs, domestic manufacturing capacity, technological development, charging infrastructure and government incentives for producers. Manufacturing capacity, improvements and infrastructure can lead to increasing the supply of EVs in the Indian market, whereas high battery costs, shortages, and inadequate infrastructure can create supply bottlenecks. The market outcome is interpreted through changes in equilibrium, price and quantity, allowing the study to examine whether an increase in EV demand was accompanied by expansion in supply as well as whether supply-side obstacles may limit the growth of this market.

3.4 Comparative Trend Analysis:

The research uses comparative trend analysis from 2018 to 2026 to examine changes in the market. Major developments in EV adoption, government policy, crude-oil markets and supply conditions are compared during different phases of the given time period using statistical data. The given period is divided into five phases:

1. 2018 to 2019 represents early development of Indian EV market
2. 2020 represents the COVID-19 pandemic disruption and energy market shock
3. 2021-2022 are characterised by economic recovery and substantial energy price volatility across the globe
4. 2023–2025 represent the accelerated growth of India's EV market
5. 2026 represents the current period of oil-market uncertainty, and continued EV market expansion

This analysis compares directional changes rather than statistical analysis, such as examining increases in petroleum prices alongside increases EV adoption to determine market developments relevant to the substitution effect. Government interventions and supply-side developments are considered factors affecting changes in EV demand, but it may or may not result in equivalent EV sales.

3.5 Sustainability and Energy-Security Perspective:

This study combines energy security and sustainability as complementary dimensions of the economic analysis of India. EV adoption is examined in terms of consumer demand, market growth, reductions in India's dependence on imported crude-oil and its exposure to international crude-oil price volatility. However, this research identifies that EVs do not completely eliminate resource dependence as battery production requires critical minerals and may create additional environmental challenges in the future. Consequently, the sustainability analysis considers the potential decline in petroleum dependence and the newly identified challenges associated with raw materials, battery production, recycling, and manufacturing.

3.6 Limitations:

The methodology used for this paper has several limitations. First, the study relies exclusively on secondary data and does not directly measure individual consumers' preferences for adopting EVs.

Second, the demand and supply framework only provides economic interpretation of the market changes, but does not establish a statistical relationship between crude-oil prices and EV sales. Other factors, such as income, economic growth, technological improvements, vehicle availability, government policy, and changing consumer preferences also influence EV adoption in India. Third, the year 2026 is an ongoing year and its data are incomplete at the time of writing the paper. The evidence of 2026 is presented as year-to-date or preliminary information and is not directly treated as an annual observation.

Despite these limitations, the methodology is appropriate for answering the research question, as it provides a theoretically grounded interpretation of EV transition in India using credible and accessible secondary evidence.

**4 Analysis and Discussion:**

4.1 Evolution of India's Electric Vehicle Market 2018-2026:

India's EV market has evolved significantly between 2018 and 2026. At the beginning of 2018, EV adoption was limited due to high purchase prices, a limited number of models, limited availability, a lack of charging infrastructure, and uncertainty about battery technology. Over the years, government intervention, technological improvement, expanding production capacity and rising consumer awareness have gradually increased EV adoption.

During 2018–2019, India's EV market was in its first phase, with government policy support beginning to provide incentives to consumers and manufacturers. The introduction of Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME II) scheme in 2019 during the second phase was an important demand-side and supply-side intervention. Demand-side incentives reduced the purchase price of eligible vehicles, while supply-side policies supported producers in developing charging infrastructure.

The COVID-19 pandemic caused a disruption in 2020 leading to economic uncertainties as well as restrictions on mobility that affected demand for automobiles in general. However, the subsequent recovery during 2021–2022 was considerable due to volatility in international energy markets, geopolitical tensions, and rising crude-oil and petroleum product prices. This increased the operating costs of conventional fuel-based vehicles and strengthened the attractiveness of economically less costly alternatives such as EVs. From 2023 onwards, there has been a rapid expansion phase in the Indian EV market, greater model availability, improving consumer awareness, continued policy support, and increased infrastructure investment led to greater EV adoption. The market benefited from two- and three-wheeler EVs significantly because of lower purchase price and higher utilisation rates. The acceleration continued during the year 2025, according to the International Energy Agency (IEA), India's electric car sales increased by approximately 75% in 2025, reaching approximately 165,000 units and almost 4% of the total car sales. Domestic manufacturers accounted for approximately 60% of EV sales indicating increased domestic supply capacity to meet the rising demand.

In early 2026, EV registrations have reached 3.3 lakh units by July 2026, representing year-on-year growth of more than 66% for the Indian market. Electric car sales have grown substantially during 2018 –2026.

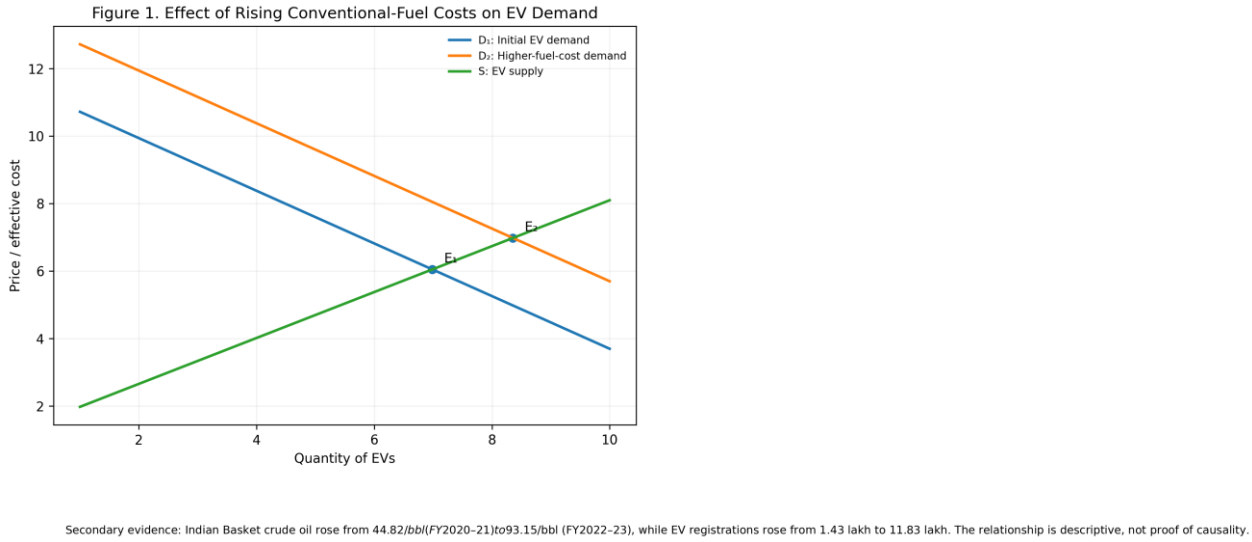
Although the year 2026 is not yet complete the EV market developments show a more established position for EVs within the Indian automobile market.

The development of India's EV market between 2018 and 2026 was influenced by several major economic and policy events. FAME–II was introduced in 2019 followed by the disruption caused by the COVID-19 pandemic in 2020, the recovery in economic activity and an increase in global energy prices during 2021–2022, continued EV market expansion during 2023, and the introduction of further policy support through EMPS and PM E–drive in 2024. These events provide a useful framework for examining how changes in fuel prices, government intervention, demand and supply-side capacity affected India's EV transition.

4.2 Crude-Oil Prices and the Demand for Electric Vehicles:

The relationship between EV demand and crude-oil prices is the main economic mechanism of this research. Conventional vehicles require petrol or diesel, which affects their operating costs of ownership due to volatility of petroleum prices. EVs, on the other hand, require electricity costs, therefore, an increase in petrol prices can relatively change the cost of using the two technologies.

According to conventional demand theory, when the price of a substitute increases, the demand for the alternative product increases, Ceteris Paribus. India's automobile market has been affected by increased fuel prices which has increased the relative attractiveness of EVs. This leads to a rightward shift in the demand curve for EVs. The diagram shows the original EV demand curve, D1 shifting to D2 while the supply curve remains initially unchanged, leading to equilibrium moving from E1 to E2 with equilibrium quantity increased. This demonstrates that higher petrol and diesel prices increase relative attractiveness of economically cheaper EVs.




Secondary evidence: Indian Basket crude oil rose from 44.82/*bbl*(*FY*2020–21)*to*93.15/bbl (FY2022–23), while EV registrations rose from 1.43 lakh to 11.83 lakh. The relationship is descriptive, not proof of causality.

**Figure one effect of an increase in conventional fuel prices on EV demand.**

The empirical literature review supports this relationship. Fei et al. (2025), analysed EV sales across major Chinese cities, and found a positive relationship between high gasoline prices with high EV sales. The degree of the effect varies according to vehicle features and affordability, as well as consumers' response

to fuel prices when alternative substitutes are available in the market. The Indian situation between 2021 and 2022 provides an equally useful illustration.

Quantitative evidence on Indian crude-oil prices helps explain this relationship. The Indian crude-oil price averaged approximately $60.47 per barrel between 2019 and 2022 before falling to $44.82 per barrel in 2020-21 during the COVID-19 period. As economic activities recovered, the prices increased sharply to $79.18 per barrel in 2021–2022, and further to $93.15 per barrel in 2022-23. This represents a substantial increase in the cost of conventional fuel and thereby increasing the relative attractiveness of EVs for consumers seeking to reduce their dependence on petrol and diesel.[29] The post-pandemic recovery and Russia-Ukraine war contributed to energy market volatility. The rising international crude-oil prices increased the Indian household fuel expenditure. Although India's fuel prices are largely influenced by exchange rates, domestic taxation, government policy, and refining margins; international oil prices still have an impact.

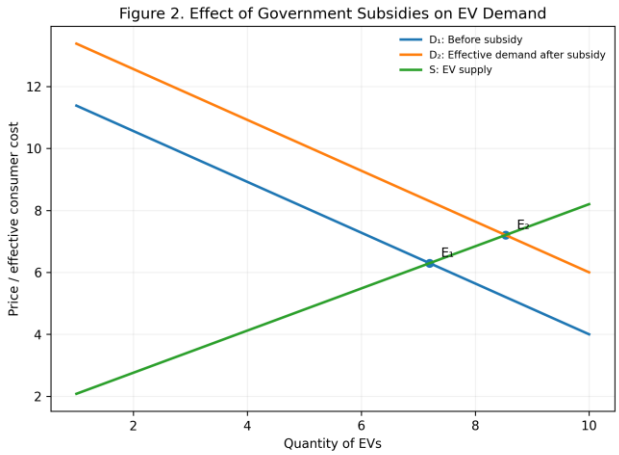
The before-and-after comparison is significant as the increase in crude-oil has been approximately 108%. The economic advantage of EV ownership is its lower running cost compared to conventional fuel vehicles. This does not mean all consumers will immediately substitute conventional vehicles for EV.

4.3 Purchase Price and the Limits of the Substitution Effect

The substitution effect that is created by rising fuel prices is constrained by the relatively high initial purchase price of many EV models. This creates a trade-off between operating cost and total cost of ownership consideration for any consumer. A consumer purchasing an EV considers initial vehicle price, expected electricity spending, financing costs, battery life, and resale value as well as maintenance charges. Even though EVs have lower operating costs than conventional vehicle, its initial premium price, often discourages some consumers who have limited credit facilities or who place greater weightage to immediate expenditure. Therefore, this explains why the response of EV demand to fuel prices is not uniform across vehicle segments and income groups. The Chinese research findings of effect of gasoline prices on EV sales was stronger due to lower price EV. This finding is relevant to Indian market as two-wheeler and three-wheeler EV have achieved faster adoption than EVs. The implication is that an increase in petrol or diesel prices may shift EV demand curve outward, but the degree of shift depends on consumers' ability to afford the substitute, and government subsidies to promote the substitution effect by reducing the purchase price.

[29] Petroleum Planning & Analysis Cell. (n.d.). *Petroleum Planning & Analysis Cell*. Ministry of Petroleum & Natural Gas, Government of India. https://ppac.gov.in

4.4 Government Policy as a Demand-Side Influence




FAME-II evidence: from 11 June 2021, the e-2W incentive increased from ₹10,000/kWh to ₹15,000/kWh and the maximum subsidy cap increased from 20% to 40% of vehicle cost.

**Figure two effect of EV purchase subsidy on market demand.**

Favourable government policies play an important role in transforming potential demand for EVs into actual market demand. The FAME programme has provided financial incentives and supported infrastructural development supporting EV adoption. A consumer subsidy helps reduce the effective price of owning an EV and therefore increases consumers' willingness to purchase a greater quantity of EVs. The scale of government intervention can be illustrated by the development of the Faster Adoption and Manufacturing of Electric Vehicles programme. The FAME – II scheme, which was introduced in 2019 with an initial outlay of ₹10,000 crores. The scheme has subsequently increased to ₹11,500 crores and has provided demand incentives for electric two-wheelers, three-wheelers, four-wheelers and buses. This has reduced the effective purchase price faced by the consumers.[30]

The diagram highlights the original demand curve, D1 shifting to D2 following a reduced price paid by consumers for EV ownership. The new equilibrium shows an increase in quantity demanded. However, the impact of subsidies depends on the design and duration of the policy. A temporary subsidy policy may increase purchases while only generating uncertainty if consumers expect the incentive to disappear in the long run. On the other hand, a long-term policy will encourage producers to invest in manufacturing capacity and suppliers to develop infrastructure supporting the EV market. This means that government intervention influences consumer demand while also supporting production and infrastructure development to increase supply.

The government support continued after FAME–II through the electric mobility promotion scheme (EMPS 2024) and PM E–drive. EMPS 2024 was introduced with an initial outlay of ₹500 crores, while PM E-drive was notified in September 2024 with an outlay of ₹10,900 crores. The continuation of these

[30] Ministry of Heavy Industries. (n.d.). Faster Adoption & Manufacturing of Electric Vehicles in India (FAME II).Government of India. https://heavyindustries.gov.in/en/fame-ii

programmes indicates that government intervention has remained an important factor supporting EV adoption and the development of the wider electric mobility ecosystem.[31]

4.5 Supply-side Response and Market Capacity:

The expansion of EV demand has a limited effect on actual market quantity if the producers are unable to match increased demand with sufficient supply. The Indian EV market needs to be examined not only from the consumers' perspective but also from the manufacturing and supporting infrastructural perspective. The availability of batteries is one of the most important supply-side factors. The production of EV batteries depends on the availability of lithium, cobalt, graphite, nickel, and other critical minerals. India's dependence on raw-material imports again exposes the domestic producers to volatile international prices, supply-chain disruptions, and geopolitical risks. Dhairiyasamy et al. (2024) have identified dependence on raw materials, supply-chain, fragmentation, production costs, and technological challenges as major constraints in building India's EV battery ecosystem. The charging infrastructure shortage is a second supply-side bottleneck. An EV requires a supporting network of charging facilities, and consequently, an increase in the number of vehicles without adequate infrastructural investment can reduce the value of EV ownership. Government intervention has attempted to reduce this bottleneck by expanding charging infrastructure. Under FAME–II, 2,877 charging stations were sanctioned in 68 cities across 25 states and union territories, while a further 1576 charging stations were sanctioned across 9 expressways and 16 highways. This expansion of charging infrastructure increases the supporting capacity of the EV market and can reduce one of the constraints limiting the adoption and use of electric vehicles.[32]

Patel et al. (2024) have identified charging and energy infrastructural issues as significant barriers to EV transition in India. Supply in EV market should not only include physical production of the vehicle but also the availability of servicing networks, battery replacement, and charging infrastructure. The diagram shows an outward shift in demand due to higher fuel prices and government incentives. Simultaneous supply constraints arises due to a lack of infrastructure, insufficient production capacity, and high battery costs. The equilibrium quantity increases but by less than it would if supply were highly elastic. This framework explains how rapid growth and consumer adoption do not necessarily result in transformation of entire automobile market.

4.6 The Interaction Between Demand and Supply:

India's EV transition cannot be attributed to a single factor as there are several demand-and supply-side forces affecting this interaction. The higher conventional fuel cost has increased the attractiveness of EVs. Government subsidies have reduced purchase price, technological improvement has enhanced vehicle range and performance, higher model availability has expanded consumer choice, and improved domestic

[31] Ministry of Heavy Industries. (n.d.). मुख्य पृष्ठ *[Home page]*. Government of India. https://heavyindustries.gov.in/hi

[32] Ministry of Heavy Industries. (n.d.). मुख्य पृष्ठ *[Home page]*. Government of India. https://heavyindustries.gov.in/hi

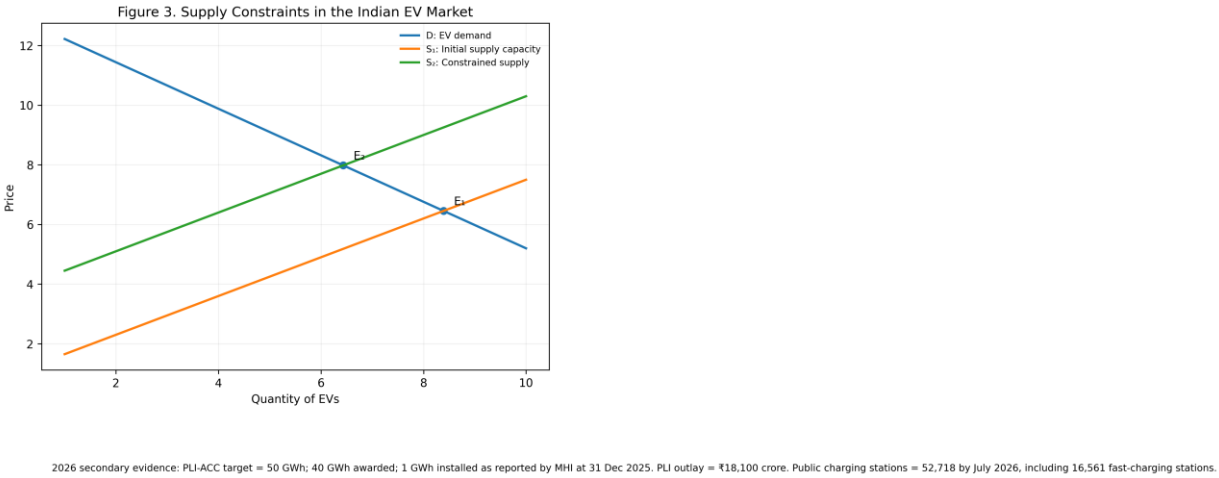



**Figure 3 supply-side constraints in the Indian EV market.**

production and charging capacity have allowed producers to respond to increasing demand. This has led to an expansion of the market as there is a simultaneous rightward shift in both demand and supply. Figure for simultaneous increase in EV demand and supply. The diagram shows D1 shifting to D2 and S1 shifts to S2. The equilibrium quantity has increased significantly. The effect on the equilibrium price is ambiguous because both curves shift. This explains how EV prices may not move in linear direction despite growth in demand. The framework also explains the importance of coordination between different policies. A demand subsidy without adequate supply capacity may generate only a limited increase in quantity and could create inflationary pressure on prices. Expanding manufacturing capacity without sufficient consumer demand may result in underutilised capacity and deflationary impact. A well-functioning market development would require demand and supply-side interventions to reinforce one

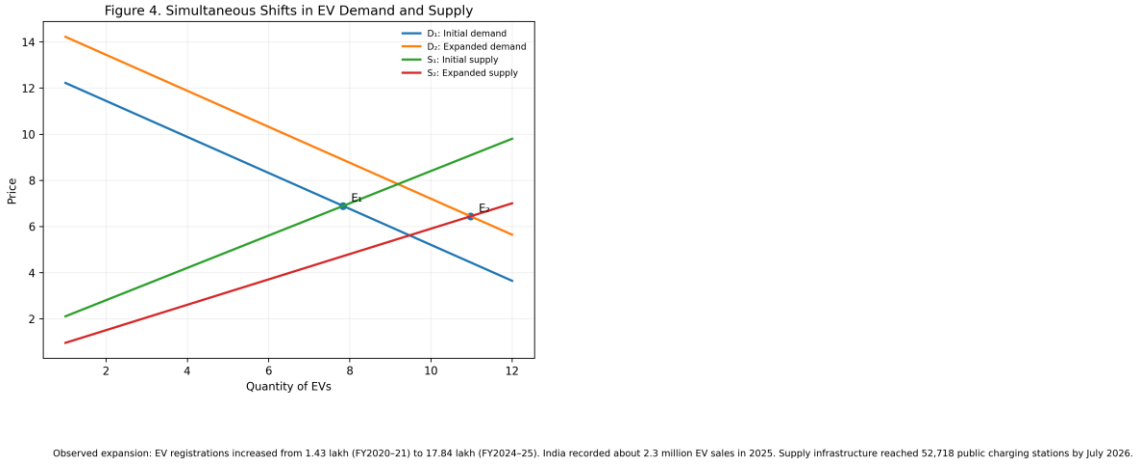



**Figure 4 – Simultaneous Shifts in EV Demand and Supply**

another.

4.7 2026:Oil-Market Volatility and the EV Transition:

The global oil markets have experienced disruption and volatility, increasing the need for oil-importing countries to have energy security. For India, this is significant as higher international crude-oil prices can increase the financial cost of imports even though physical import volumes have declined. At the same time, EV adoption has accelerated, as indicated by the IEA's 2026 report, which shows substantial growth in electric car sales during 2025, while early 2026 has shown continued growth in the overall EV registrations. This simultaneous occurrence of oil-market uncertainty and EV expansion is consistent with the substitution effect proposed in this research. When the cost of conventional fuel is uncertain or expensive, the economic value of vehicles with lower operating costs increases. Therefore, consumers perceive EVs not only as an environmentally sustainable alternative but also as a means of reducing exposure to fuel price volatility. However, the 2026 evidence should not be interpreted showing that oil prices alone caused an increase in EV sales. The market is simultaneously affected by falling battery costs, increased availability of models, increased domestic manufacturing capacity, supportive government policies, changing consumer preferences, and sufficient charging infrastructure. The conclusion here is that oil market conditions are a demand-side factor within a wider set of interacting factors affecting the entire market.

4.8 Sustainability and Energy Security Implications:

India is one of the world's major economies consuming oil and is highly dependent on imported oil. Increased EV adoption can reduce demand for petroleum in road transportation, thereby potentially reducing the country's exposure to international crude oil price volatility. The IEA has estimated that efficiency improvements and EV adoption together can avoid approximately 480,000 barrels per day of additional demand in India from 2023 and 2030. This highlights how individual changes in transportation demand can have significant macroeconomic effects. New supply-chain dependencies may affect this transition. EV battery production requires critical minerals which may be geographically concentrated outside India. Therefore, EV adoption may not completely eliminate the country's energy and resource dependence; instead, it may change the structure of that dependence from petroleum towards electricity, battery technology, and critical minerals. From a sustainability perceptive, the transition is two dimensional. First, EVs can reduce direct fuel consumption and transport-related emissions. Second, the sustainability of the transition depends on environmental performance of electricity generation, responsible sourcing of minerals, battery recycling and the development of resilient supply-chains.

## 5 Conclusion and Policy Implications:

5.1 Conclusion:

This research has examined the development of India's electric vehicle market between 2018 and 2026 using the market-forces framework incorporating demand-and supply-side effects. The analysis was undertaken to understand the extent to which volatile crude-oil market conditions, government interventions, and new supply-side developments have influenced the transition from conventional fuel powered vehicles towards electric mobility. The findings indicate that India's EV transition is an interaction between several economic forces rather than a single determinant. The changes in operational cost of conventional vehicles versus electric vehicles provide an important demand-side mechanism. The rising crude-oil prices have made ownership of conventional vehicles more expensive, thereby increasing the relative attractiveness of EVs because of their lower operating costs. The substitution effect provides

a theoretical explanation of why high fuel prices can contribute to an increase in demand for EVs. The existing empirical evidence supports this relationship, although the magnitude of the effect varies according to vehicle price, consumer characteristics, and the availability of EV alternatives. However, the analysis demonstrates that high fuel prices alone are insufficient to trigger a large-scale transition. EV adoption also depends on consumers' ability to purchase the vehicle initially and their confidence in the available infrastructure, reliable batteries and after-sales services. Consequently, the demand response to changes in fuel prices is influenced by affordability and availability of EV alternatives.

Policies such as FAME and government production incentives by the government have affected both demand and supply in the Indian market. The consumer incentives have helped reduce the effective purchase price of EVs and have resulted in an outward shift in demand, while production and infrastructural policies have increased supply capacity in the country. The supply-side analysis demonstrates that the expansion of EV demand has created new challenges in terms of battery costs, critical-mineral availability, manufacturing capacity requirements, and charging-infrastructure development. These constraints have restricted producers' ability to respond to rising demand. The Indian EV transition also requires simultaneous development of battery supply-chain, vehicle production capacity, and charging networks across the country. The developments observed in the year 2026 reinforce the relevance of the relationship between oil-market, uncertainty and EV adoption. Electric mobility increasingly represents environmental transition along with being a potential response to energy-price volatility, and energy security concerns for the Indian economy. Overall, the research findings demonstrate that the EV transition is contributing to an economic restructuring of transportation demand and supply in the Indian market. Crude-oil prices have influenced the relative attractiveness of electric vehicles over conventional vehicles.

5.2 Policy Implications:

The findings highlight several implications for policy makers. First, the policies should support demand and supply simultaneously. Demand-side subsidies encourage consumers to adopt EVs, but their effectiveness may be limited. If producers cannot supply sufficient vehicles, batteries and charging facilities, the effectiveness of demand-side subsidies may be limited. The policies therefore need to coordinate consumer incentives with supply-side production and infrastructure development. Second, the presence of charging infrastructure should be treated as an essential component of the supply of EVs. Inadequate charging infrastructure increases the perceived cost of ownership and can therefore suppress demand. The expansion of charging infrastructure, particularly along the major highways in the country and in smaller cities, will reduce range anxiety and improve the attractiveness of EVs.

Third, India needs to strengthen domestic battery and critical mineral supply-chains. This will reduce exposure to international supply disruptions and price volatility. These policies should be accompanied by battery recycling, responsible mineral sourcing and technological innovation policies. Fourth, EV policies should become more predictable over the long term. Frequent changes in subsidies can create uncertainty for consumers and producers. A stable policy environment can encourage producers to make long-term investments in production capacity, charging infrastructure, and ongoing research and development. Finally, EV policy should be integrated with India's energy security strategy. EV adoption can reduce future petroleum demand and therefore the country's exposure to international crude-oil price

shocks. The benefit will be greater if the electrification of transport occurs alongside decarbonisation of electricity generation and the development of domestic battery supply-chains.

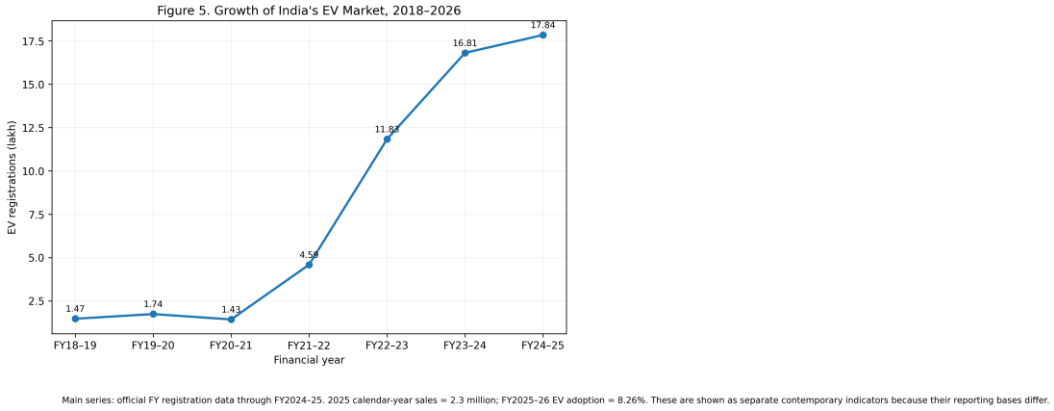



**Figure 5 – Growth of India's EV Market, 2018–2026**

5.3 Limitations and Scope for Future Research:

There are several limitations in this research. First, it relies entirely on secondary data and therefore does not directly measure consumer preferences or willingness to purchase EVs. Second, the market framework of demand and supply provides an economic interpretation of market changes but does not establish a statistical relationship between crude-oil prices and EV adoption. Multiple factors, including government policy, income, consumer preferences, and technological change, influence EV demand simultaneously. Third, 2026 data remain incomplete as the year is ongoing. The 2026 evidence should therefore be interpreted as an indication of current market development rather than as an annual observation. Future research could address these limitations by using economic methods to estimate the quantitative relationship between EV sales in India and petrol prices. Primary consumer research could examine whether the fuel price expectations influence consumers' vehicle purchase decisions. Further research could investigate regional disparity in EV adoption, the effect of charging infrastructure on demand and the relationship between India's long-term dependence on crude-oil imports and EV adoption.

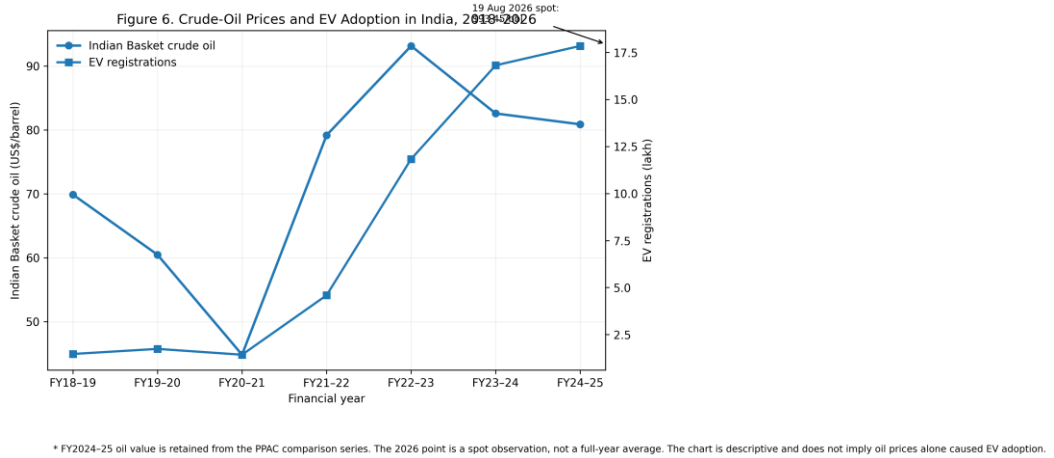



**Figure_6_Crude_Oil_EV_Adoption_2018_2026**

5.4 Final Perspective:

India's transition towards electric mobility represents not just a technological change in the automobile industry but also an economic adjustment to changing energy prices, environmental pressures, energy security concerns, and government policies. The evidence from 2018–2026 suggests that the transition is likely to accelerate when demand-side incentives and supply-side capacity are strengthened simultaneously. EV adoption should not be viewed as an environmental policy alone, as it is also represents an economic strategy for reducing a country's exposure to volatile international fuel markets for a country while reshaping its transportation energy system. The success of this transition will depend on whether India can support the growth of EV demand, develop its domestic supply-chains and ensure that electricity generation and battery supply systems adequately support the EV market in an economically and environmentally sustainable manner.

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