Study on the Propensity for Renewable Energy: Electric Vehicles in India

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Abstract

India, a nation undergoing rapid development, is presently confronted with a critical juncture in its endeavours to address environmental degradation and satisfy its escalating energy needs. This research extensively examines the evolving patterns of renewable energy adoption within the nation, focusing specifically on the increasing prevalence of electric vehicles (EVs). As the global community confronts the complexities of climate change, India has established itself as a leader in the transition to sustainable energy sources. This research examines the complex interplay between economic, environmental, and social determinants with the aim of identifying the primary motivations underlying the widespread adoption of electric vehicles among the populace of India. Growing demand has been observed for more environmentally friendly modes of conveyance in light of the environmental movement. Consumer perceptions of electric automobiles are significantly impacted by governmental initiatives, including but not limited to regulation reduction, subsidy enhancement, and infrastructural development. The article explores the significance of renewable energy sources, such as solar and wind power, in bolstering the electrification of transportation even further. To optimise the environmental benefits of electric vehicles (EVs), the integration of renewable energy sources into the power grid is deemed essential. The research underscores the significance and feasibility of incorporating renewable energy sources into electric vehicles through the application of experimental trials and case studies. The study emphasises the importance of adopting a holistic perspective when weighing the advantages and disadvantages of electric vehicles and pure energy, so as to encourage the widespread adoption of renewable energy sources. The stakeholders in India, including politicians, corporations, and others, who are at the forefront of sustainable transit initiatives, are currently facing a worsening of the preexisting difficulties. The study provides valuable suggestions for successfully navigating the complex landscape of renewable energy and electric vehicle integration, in accordance with the country's objective of attaining energy self-sufficiency and a more ecologically sustainable future.

Keywords: Renewable Energy, Electric Vehicles, , Sustainable Development Goals.

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1. Introduction

The transportation demands in India have experienced a substantial increase due to the rapid development of the nation's infrastructure and population (Bansal & Goyal, 2020). There are now concerns regarding energy security, pollution, and bottlenecks due to the increase in demand. While the growth of the automotive industry in India contributes positively to the country's economy, it also intensifies the problem of pollution and strengthens our adverse reliance on oil (Patidar, 2019). Transportation-related energy consumption accounts for 19 percent of the overall energy consumed on a global level. Nevertheless, projections indicate that this proportion would surge to 21.0 percent by 2040. Automobiles, aircraft, and ships are included in this category (Sharma & Chandel, 2020). India has acknowledged the imperative of engaging in the electric vehicle revolution as a means to address these challenges. Electric vehicles are anticipated to offer a practical substitute for conventional automobiles in the congested urban landscape of India (Sharma & Chandel, 2020). Considering that India is a developing country, is it essential that we be kept abreast of its progress regarding the adoption of electric vehicles? The current body of research on the proliferation of electric vehicles in India is limited in scope and offers only a cursory insight into the subject. Sharma and Anwar (2021) emphasise that the Indian central government and regional administrations are employing a variety of punitive and incentive measures to ensure the effectiveness of this environmentally conscious transport initiative. Furthermore, Ahmad and Dewan (2007) conducted a study which revealed that the implementation of electric vehicles in Delhi could potentially yield substantial benefits, including a 24 percent reduction in petroleum costs, emissions, and an improvement in air quality. Shrilatha et al. (2021) report that certain consumers in Tamil Nadu are purchasing electric vehicles (EVs) expeditiously to qualify for government subsidies, whereas others exhibit reluctance stemming from apprehensions regarding diminished mileage. Significant customer interest in electric cars has been generated in Madhya Pradesh due to their affordability, extensive charging infrastructure, and exceptional fuel economy (Mahajan et al. 2021). Saw and Kedia (2023) report that the electric car registration rates in the Indian states of Delhi, Uttar Pradesh, Gujarat, and Karnataka are significantly low, falling below 2 percent, 1 percent, and 0.5 percent, respectively. Despite the existence of numerous studies that have examined consumer preferences regarding electric cars in India, there is a notable dearth of research that specifically investigates trends at the state level and registration data. Therefore, our

objective is to examine the complexities associated with the expansion and widespread adoption of electric vehicles (EVs) in different Indian states.

2. Objective of The Study

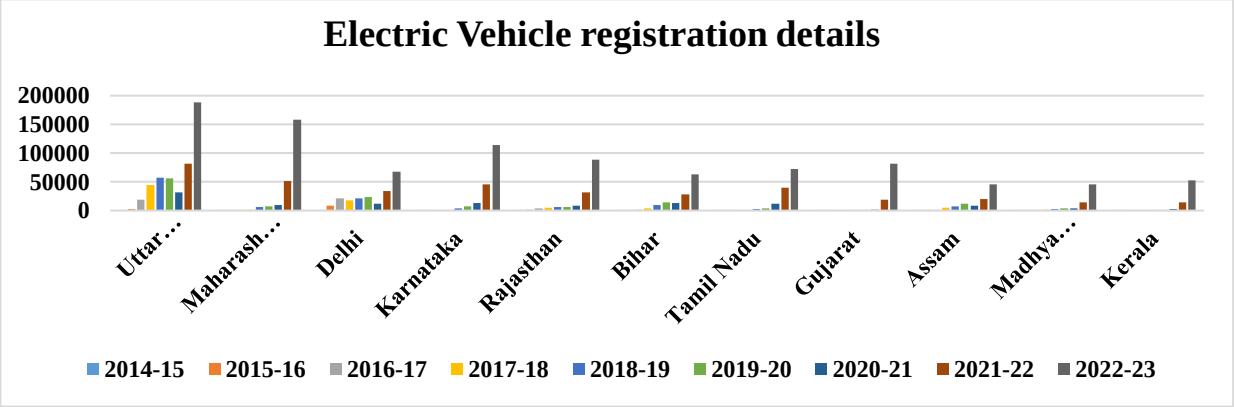
The aim of this research is to examine the pattern and preference for electric vehicles throughout the Indian provinces.

Table 1: Electric Vehicles Registration Across Major States in India from March 2014 To March 2023.

Uttar Pradesh	119	2424	19502	44364	57229	56224	31592	82028	188946
Maharashtra	936	999	820	1452	6288	7395	9409	51442	158683
Delhi	52	8647	21556	17956	21429	23682	11809	34522	67124
Karnataka	639	694	626	755	3892	7176	13006	46186	114075
Rajasthan	76	1459	3775	4662	5655	5926	8196	31391	88328
Bihar	11	179	1406	4267	9995	14262	13289	28274	62606
Tamil Nadu	157	81	90	130	2195	4199	11937	39624	71844
Gujarat	67	99	147	218	732	893	1684	19042	81114
Assam	7	27	353	4675	7899	12019	8959	20435	45290
Madhya Pradesh	37	182	957	1741	3238	3564	4382	14099	45284
Kerala	20	27	30	75	401	622	2189	14861	52281

Source: Compilation from Economic survey and ministry of new and renewable energy reports

Figure 1 Trend of Electric Vehicles Registration Across Major States of India.



Source: Economic survey and ministry of new and renewable energy reports

From 2014 to 2023, the following table and figure present the EV registration data for the most important Indian states. The data presents several significant patterns. A prime example can be observed in the substantial surge in the registration of electric vehicles in Uttar Pradesh, which is recognized as the most densely populated state in India. The data exhibited a substantial increase, peaking at 188,946 units in 2022-23, up from 119 units in 2014-15. Concurrently, Maharashtra has experienced a steady surge in registrations, which will reach a substantial 158,683 units in 2022–23, up from 936 units in 2014–15. In Delhi, 52 electric vehicles were formally registered for the fiscal year 2014-2015. As of fiscal year 2022-23, the previously mentioned quantity had escalated to 67,124. Karnataka experienced a

comparable upward trend, with its total units increasing from 639 during the 2014-15 fiscal year to 114,075 during the 2022-23 fiscal year. The number of registered electric vehicles in Rajasthan experienced a substantial surge, expanding from 76 units during the 2017-18 fiscal year to 88,328 units during the 2022–23 fiscal year.

From a meagre 11 units produced in 2014-15 to an extraordinary 62,606 units manufactured in Bihar by 2022-23 represents a substantial escalation. Tamil Nadu experienced substantial fluctuations in the number of registrations, which rose from 157 units in the initial year to 71,844 units in 2022-23. The quantity of electric vehicles that have been officially registered in Gujarat has exhibited a sustained upward trend, ascending from 67 units in 2017-18 to a noteworthy 81,114 units in 2022-23. Similarly, there has been a steady upward trend in the number of electric vehicle (EV) registrations in Assam, which will reach 45,290 units by the end of the fiscal year 2022-23, up from 7 units in the fiscal year 2017–18. Since its establishment, Madhya Pradesh has experienced substantial expansion, rising from a mere 37 units in its early stages to a remarkable 45,284 units by 2022-23.

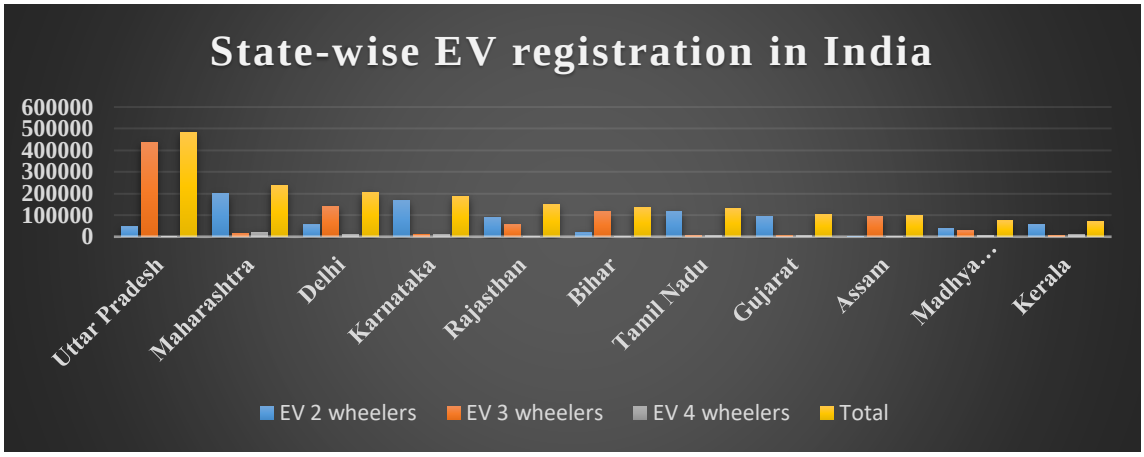
It is anticipated that Kerala will attain a remarkable milestone of 52,281 units by the fiscal year 2022-23, which reflects the state's consistent and ongoing development trajectory. A number of states experienced a substantial decline in the registration of electric vehicles (EVs) due to the COVID-19 pandemic, which presented difficulties. Registrations of electric vehicles have increased steadily in these states since the outbreak of the epidemic. Statistics indicate that EV registrations in the most densely populated Indian states have exhibited a consistent upward trend.

Table 2 Major State Wise Different Types of EV Registration in India from March 2014 to March 2023.

Uttar Pradesh	45590	435012	1826	482428
Maharashtra	200804	14803	21817	237424
Delhi	54626	139581	12570	206777
Karnataka	165907	8920	12222	187049
Rajasthan	89478	56890	3100	149468
Bihar	17634	116255	400	134289
Tamil Nadu	116311	7606	6340	130257
Gujarat	94360	3719	5917	103996
Assam	3053	95926	685	99664
Madhya Pradesh	38516	28665	6303	73484
Kerala	57162	5119	8225	70506

Source: Economic survey and ministry of new and renewable energy reports

Figure 2: Major State-wise different types of EV Registration in India



Source: Economic survey and ministry of new and renewable energy reports

The data pertaining to the quantity of electric vehicles (EVs) registered in the primary states of India between 2014 and 2023 is presented in Figure 2 and Table 2. The data is classified by segment. Uttar Pradesh has exhibited the most electric vehicle inventory of any state, amounting to a remarkable 482,428 units. The state's notable accomplishment can be ascribed to its considerable populace and proactive efforts to promote the adoption of electric transportation. As electric three-wheelers attempt to fulfil the transportation requirements of urban regions, they are unmistakably the center of attention. With a cumulative count of 237,424 electric vehicles, Maharashtra has established itself as the second most populous state with regard to registered electric vehicles. Major metropolitan areas such as Mumbai and Pune have significantly contributed to this extraordinary achievement. The prevalence of electric two-wheelers in major metropolitan areas can be primarily attributed to their convenience in navigating congested roads and brief distances, resulting in a considerable user base. Delhi, the nation's capital and a densely populated metropolitan area, has accumulated 206,777 electric vehicle registrations, which places it in third place. As a result of the municipality's efforts to mitigate pollution and automobile emissions, the sale of electric two-wheelers and three-wheelers has increased substantially. By leveraging Bengaluru's status as a technological epicenter, Karnataka attains the fourth position with 187,049 registered electric vehicles. Rajasthan has surpassed all other states in India in terms of population with the registration of 149,468 electric vehicles. This noteworthy data point encompasses the enrollment of electric tricycles and electric motorcycles, suggesting that electric vehicles are becoming increasingly prevalent in both suburban and rural regions. Having registered 134,289 electric vehicles, Bihar is presently the sixth most populous state in India. Electric three-wheelers are being actively advocated by the state as a viable solution

to mitigate the environmental impact of urban transportation-related pollution. Tamil Nadu holds the seventh position in the state of electric vehicle registrations, boasting a cumulative count of 130,257. The electric vehicle (EV) markets for two-wheelers and three-wheelers in the state exhibit distinct patterns, whereas the quantity of EV four-wheelers maintains a relatively stable value. Gujarat, where 103,996 electric vehicles have been registered, is the sixth most populous state in the country of India. A considerable segment of these registrations concerns electric two-wheelers, which are commonly employed for transportation within urban areas. Eighth in the nation in terms of the total number of electric vehicle registrations is Assam. Assam's sustainable public transportation initiatives are predicated on electric tricycles. Madhya Pradesh is ranked ninth in terms of the cumulative number of registered electric vehicles, amounting to 73,484. Kerala ranks twelfth in the overall registration of electric vehicles, boasting a substantial count of 70,506. The substantial increase in this notable figure can be predominantly ascribed to the extensive adoption of electric motorcycles and scooters as means of transportation within urban areas. Maharashtra holds the dominant position among the states in terms of the registered electric two-wheelers, with Karnataka trailing closely behind. In terms of registered electric three-wheelers, Uttar Pradesh ranks first, followed closely by Bihar. At present, Delhi and Maharashtra lead in the registration of electric four-wheelers. This comprehensive analysis illuminates the expansive and auspicious terrain of electric vehicle adoption in significant Indian states.

3. Conclusion

A comprehensive examination of the registrations of electric vehicles (EVs) in key Indian states reveals a favorable trend towards a future characterized by enhanced security and environmental sustainability. The data presented presents an extensive examination of the surge in the adoption of electric vehicles from 2014 to 2023, highlighting a significant shift towards transportation options that are more environmentally sustainable. Notably, substantial progress is possible even in densely populated and thriving regions, as evidenced by the surge in electric vehicle (EV) registrations in populous states such as Uttar Pradesh and Maharashtra. The enduring appeal of electric vehicles is evidenced by the consistent growth in their adoption rates throughout multiple states in India. This phenomenon can be ascribed to technological progress, governmental financial incentives, and an increasing public consciousness and apprehension regarding environmental matters. The progressive rise in the registration of electric vehicles in these jurisdictions demonstrates their commitment to mitigating pollution and emissions. The sustained growth of the electric

vehicle (EV) movement during the recovery phase following the pandemic serves as evidence of the enduring character of the transition towards more ecologically sustainable options. State-by-state variations in EV adoption rates highlight the necessity for state-specific strategies and legislation. The prevalence of electric two-wheelers in densely populated regions, including Mumbai and Bangalore, states with substantial populations such as Uttar Pradesh and Bihar, and states with inadequate infrastructure like Maharashtra and Delhi, demonstrates the versatility of electric vehicles to accommodate a wide range of transportation needs. The attainment of a secure and more sustainable future is not a pipe dream but rather a feasible objective. Based on prevailing adoption trends and the considerable attention from influential states in India, it is probable that electric mobility will soon emerge as the predominant mode of transportation across the entire nation.

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