

# Assessing Fiscal Trade-Off in Uttar Pradesh's Shift Towards Electric Mobility

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## Abstract

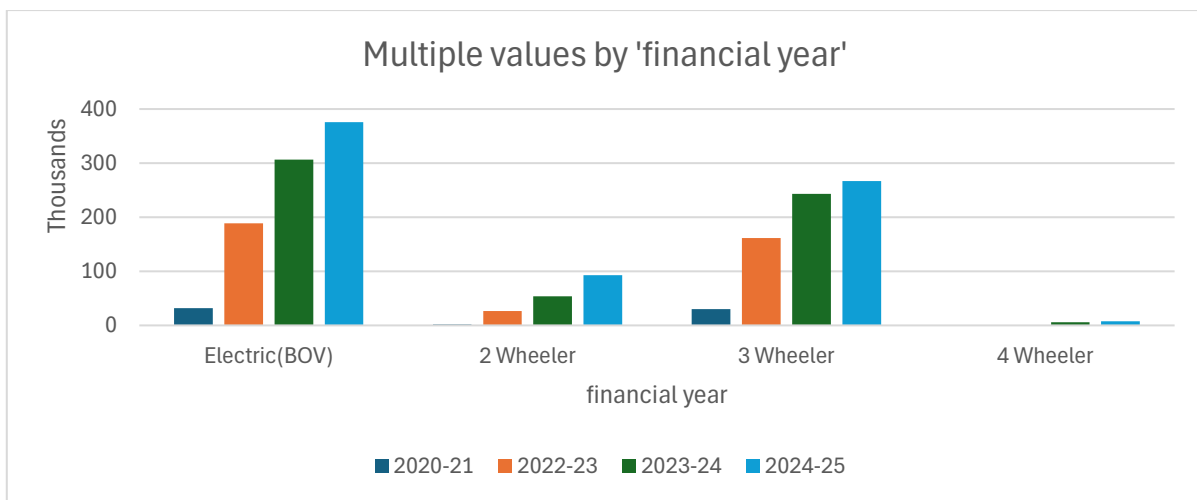
The rapid adoption of electric vehicles (EVs) in India stands for a significant shift toward sustainability. The accelerating adoption of EVs in Uttar Pradesh, driven by state and central government incentives such as road tax exemptions, registration fee waivers, and demand-side subsidies under schemes like Faster Adoption and Manufacturing of Electric Vehicles (FAME) India. With the rising share of EVs and government support in the form of incentives and tax exemptions aiming to promote sustainable mobility, there are implications for the state's fiscal situation and the adoption of EVs in different segments of vehicles. This study focuses on two key aspects of Uttar Pradesh's EV transition: quantifying the expected fiscal expenditure associated with EV-related subsidies and tax exemptions, and which segment of EVs is having more influence from given incentives.

Using secondary data from the FAME India dashboard, the VAHAN vehicle registration portal, and UP Budget documents, the research estimates the direct costs incurred by the state through financial incentives. Fiscal expenditure to promote EV adoption is estimated using a formula based on the policy guidelines. The findings suggest that even with continued provisioning of EV subsidies and exemption from road tax, state governments still have a lower impact on fiscal revenue due to factors such as lower adoption of EVs, the amount of subsidy allotted to different segments of EVs, and road tax exemption provisioned as per policy. The findings underscore the importance of balancing environmental ambitions with fiscal stability and suggest the need for a phased, data-driven approach to incentivize growth of electric mobility in Uttar Pradesh.

## Introduction

Electric vehicles (EVs) are at the forefront of the global shift toward sustainable and low-emission transportation systems. As concerns over climate change, air pollution, and fossil fuel dependence intensify, EVs have appeared as a condemnatory part in the transition to greener mobility. Over the past decade, EV uptake has accelerated speedily around the world. According to the International Energy Agency (IEA), global EV sales transcended fourteen million units in 2023, with China, Europe, and the United States leading the adoption. This growth has been pushed by technological advancements, declining battery costs, and overarching government support through fiscal incentives and regulatory measures. Despite this progress, sustaining EV growth requires careful steady stability of environmental goals with fiscal realities, particularly as in India, state governments depend heavily on indirect taxes to fund public expenditures, in which revenue earned from taxes on vehicles is a major source.

India, the world’s third-largest automotive market as of 2024–25, having roughly 27 million passenger vehicles and over 20 million two-wheeler vehicles running on non-renewable fuels like petrol and diesel, highlighting their continued dominance in India’s road transport fleet, is experiencing robust expansion, which stood at approximately 5.1 million units in 2023 and is projected to surge to 7.5 million units by 2030, reflecting a compound annual growth rate of over 5% (Karunakar et al., 2021). Amid this, the Government of India has set progressive targets for EV penetration, aiming for 30% of new vehicle sales to be electric by 2030. Driving this transformation, the government has carried through a range of incentives like the FAME scheme, now in its second phase (FAME-II), which provides substantial purchase subsidies. Additionally, policy measures such as lower Goods and Services Tax (GST) rates and incentives under the PLI (Production-Linked Incentive) scheme and state-level subsidies and tax waivers. However, this push for clean mobility comes at a fiscal cost, as this sector is a significant revenue source specifically for state governments, as in India state governments are dependent on indirect taxes (SIAM report on automobiles 2024). EVs constituted around 5% of new vehicle sales in 2024, with ambitious policy commitments aiming for a 30% EV share by 2030. The EV market is projected to expand dramatically: from between US\$8 and 23 billion in 2024 to US\$118 billion by 2032. While these policies accelerate adoption across two-wheelers, three-wheelers, and private cars, they also raise fiscal challenges, since vehicle-related taxes remain among the top five revenue sources for state government in India. While national-level policies are condemning, the role of state governments is equally important in shaping localized EV adoption trends. Uttar Pradesh (UP), India’s most populous state with over 241 million (17% of the national total), has one of the fastest-expanding vehicle ecosystems in the country. As of FY 2024–25, the state recorded 3.79 million new vehicle registrations, pushing its total on-road fleet beyond fifty million vehicles, having a projected annual growth rate of 9% of the motorized population (CEEW report on vehicle ownership 2025). On the electric mobility front, UP has emerged as a national leader. The state consistently ranks among the top three in EV registrations, with over 414,000 EVs as of mid-2025, led by e-rickshaws, which account for 85% of sales. To accelerate this transition, the state introduced the Uttar Pradesh Electric Vehicle Manufacturing and Mobility Policy 2022, which provides 100% road tax and registration waivers and direct purchase subsidies, alongside manufacturing incentives. In 2024–25, taxes on vehicles alone are expected to yield ₹12,505 crore, the sixth largest source of state revenue.



**Table 1. Units of electric vehicles sold in Uttar Pradesh (FY 2020–21 to 2024–25).**

However, these fiscal incentives come with trade-offs. While they constructively lower the upfront cost of EVs and stimulate demand, they also result in revenue foregone, particularly from established sources, which form a sizeable part of state tax revenues. As EV uptake grows, Uttar Pradesh faces a dual fiscal challenge: rising expenditure on EV subsidies and declining income from taxes. These dynamic raises important questions about what the long-term fiscal cost of subsidy could be as per the sale of EVs and how subsidy does impact different segments of electric vehicles.

Against this backdrop, this research focuses on quantifying the fiscal expenditure incurred by Uttar Pradesh through EV subsidies and tax exemptions under varying EV segment adoption. By analysing these two dimensions, the study aims to provide policymakers with evidence-based insights to design an EV strategy that balances environmental ambition with fiscal responsibility.

### Review of related literature

Wagh's (2023) study talked about momentum in the surge of electric vehicles in India. Showed how 30% of vehicles adopted as EVs would save \$60 billion of oil imports and a 37% cut in emissions, and how affordability led to a rise in EV ownership, but the total cost of ownership is still high due to limited charging infrastructure. Thereafter showed growth in EVs by vehicle classification, such as 2W, 3W, 4W, and E-Buses. Also showing the role of various schemes such as the Faster Adoption and Manufacturing of Electric Vehicles Scheme, PM-eDrive, the National Electric Mobility Mission Plan, and product-linked incentives in the creation of demand, providing infrastructure support for charging, and supporting the manufacturing process of EVs in India.

Sarkar, Sheth, and Ranganath (2022) evaluated the feasibility and sustainability of the electric rapid transit system in Ahmedabad. The paper used a social cost-benefit analysis approach to study economic (revenue and fuel saving), environmental (air pollution), and social benefits (travel time saving). A 25-year analysis at a 12% discount rate yielded a benefit-cost ratio of 1.45. A 50% environmental benefit is expected, along with a 29% reduction in fossil fuel use. The outcome showed positive justification from the point of view of the benefits gained by the society as well as profitable returns and value addition of infrastructure investment, eventually confirming the use of such a transportation system.

Sheldon, Dua, and Alharbi (2021), targeting the US, China, and European countries, studied the subsidy cost per tonne of CO<sub>2</sub> and also saved the cost-effectiveness of subsidy policy. The focus was to consider the long-run effect of current subsidies in promoting PEC adoption. Did a detailed examination of elements like tailpipe emission, vehicle price, and subsidy incentives. A vehicle with a similar body type was used as a replacement to ensure accurate estimation of tailpipe emission savings. Results showed that the subsidy cost per added net tonne of CO<sub>2</sub> avoided had a very linear relationship with the percentage of PEV price subsidized by the government. Also showed that the USA and China have the highest absolute CO<sub>2</sub> savings; subsidizing high-end PHEVs or luxury BEVs is inefficient. Suggested targeted subsidy based on income and vehicle price cap to improve cost-effectiveness of subsidies.

Sunanda and Paruchare (2024) had assessed economically two-wheeler battery electric vehicles via considering the effectiveness of existing subsidy and tax rate on cost of ownership compared with traditional two-wheelers under various combinations of consumer fiscal incentives. For calculation of total cost of ownership, first purchase price and operation-maintenance cost were considered; the author selected TVS brand vehicles. Analysis showed cost per KM is low in EV, but due to substantial battery replacement cost, the total cost of ownership of EV is near equal to traditional vehicles. Scenario-based modelling conducted by the author from high to low subsidy and findings suggest subsidy is needed to

make total cost of ownership remain lower than traditional two-wheelers. Therefore, the affordability of EVs depends on electricity cost, battery cost, and subsidy structure.

Shrimali (2021) asserts that there are three types of subsidy: capital expenditure subsidy (includes a one-time subsidy at the time of purchase), operating expenditure subsidy (yearly subsidies given in per-kilometer terms based on distance travelled per year), and financing expenditure subsidy (sharing of financing costs such as interest rate subsidy). Together, they can be compared for net present value. Based on analysis of total cost of ownership considering the operation and maintenance cost, the author assessed that no subsidy is needed for 2Ws, 3Ws, 4W taxis, or buses. Subsidies needed for: 4W personal cars, 4W long-haul trucks. The most cost-effective subsidy choice is a CAPEX subsidy that drives early scale. And making the FINEX subsidy as least cost-effective as possible. It is recommended to subsidize only segments needing help, like 4W-personal cars and 4W-trucks, to use the CAPEX subsidy only.

Ghosh & Sarkar (2022) assess the effectiveness of the electric vehicle subsidy in achieving the intended CO<sub>2</sub> reduction, targeting the 4W passenger vehicle only. For annual emission of combustion vehicle tailpipe emission, and annual average distance travelled were taken for EV tailpipe emission, which was replaced by EV efficiency and electricity emission intensity. For the cost of emission reduction, the total subsidy was divided by the annual emission reduction and the expected vehicle life, and the cost was taken for both diesel and petrol vehicles compared with EVs. Results showed the equivalent annual emission for each state is different. States with high dependency on coal-based electricity generation emission for EVs are more than 80 percent of that of petrol. Subsidy is beneficial for states where electricity generation is less dependent on fossil fuels. Arguing that current Indian EV subsidies are expensive for CO<sub>2</sub> reduction, and cost-effectiveness varies sharply by state grid CO<sub>2</sub> intensity.

Soman et al. (2020), in a comprehensive study by the Council on Energy, Environment and Water, explored the potential role of India's electric vehicle (EV) transition. The study examined whether achieving 30% EV sales penetration would contribute positively to India's energy security, economic growth, environmental goals, and fiscal stability. The research employed a Gompertz function-based vehicle stock model to project vehicle ownership trends across distinct categories. The model projected a 2.7-fold increase in total vehicle stock between 2016 and 2030. Under the EV30 scenario, India's oil import bill was projected to decrease by ₹1.1 lakh crore. The scenario also delivered significant environmental benefits: 17–18% reductions in particulate matter (PM), NO<sub>x</sub>, and CO emissions. From a fiscal perspective, the study highlighted that petroleum tax revenues for central and state governments would decline by approximately 15%, causing pre-emptive diversification of fiscal revenues.

Khurana and Saini (2021) have applied econometric modelling on the data to evaluate to see how financial incentives and public charging stations influence electric vehicle penetration across Indian states. They found there is a statistically significant correlation between the number of charging stations and EV sales, echoing global findings. Notably, the number of charging stations was a stronger predictor of EV sales than subsidies in certain states, underscoring the importance of physical infrastructure in complementing financial incentives. Their model supports the statistical tests used in this paper (such as regression and correlation) and reinforces the need for multivariable analysis in understanding EV adoption patterns.

### **Research Objectives:**

To quantify the total fiscal expenditure incurred by Uttar Pradesh through EV-related subsidies and road tax exemptions.

To analyze the distribution of fiscal incentives across different EV segments (2W, 3W, 4W).

**Research Questions**

How much fiscal expenditure has Uttar Pradesh incurred through EV subsidies and road tax exemptions since the implementation of the UP EV Policy 2022?

What is the comparative fiscal impact of subsidies and tax exemptions across two-wheelers, three-wheelers, and four-wheelers?

**Data Sources and method**

**Data descriptions**

Analysis is done by using the secondary data from various sources targeting the data for subsidies, tax exemptions, EVs sold year-wise, and further categorizing EVs into their types, then selecting the EVs for cost estimation of maximum tax benefit provided under different segments of EVs as per the cost. According to the segment-wise analysis, the maximum per-unit subsidy as per the UP-government’s EV policy 2022 was estimated, which was capped to a limited number of units. The vehicle selected for cost estimation for the largest subsidies and max road tax exemption was selected as per earlier research studies. Since the maximum EVs sold in the 3W segment are used for the commercial segment, therefore, as per the UP EV policy, the subsidy granted to the 3W segment is limited to the number as mentioned in the policy.

Parameter	Value	Source
Road tax rate	Tax is levied structurally as per ex-factory price	UP Transport Department MV Tax rates. Different tax rates are levied accordingly, from 2 to 8 percent for 2W and 3 to 11 percent for 4W
2W ex-factory price	₹1,00,000 (average 5 percent tax)	NITI Aayog’s 2022 FAME II analysis, CSEP 2025 paper (mean 2W EV price ~₹1L for urban markets)
3W ex-factory price	₹2,50,000 (benefits capped to number of vehicles sold for commercial vehicle)	CSEP 2025 paper—market price of typical L5 electric auto (main EV 3W segment), cross-validated with VAHAN registration data & market leader pricing (e.g., Bajaj RE Compact, Bajaj RE, and Piaggio Ape E City)
4W ex-factory price	₹14,50,000 (8 percent tax)	CSEP 2025 paper—average of Nexon EV (₹15–₹17L on-road, ₹7–₹8L ex-factory), MG ZS EV, and mid-segment EV cars targeted in UP market

**Table 2. Estimated subsidy outlay and road-tax exemptions across segments in Uttar Pradesh.**

### Methodology

After sourcing the data, study creates a fiscal modelling approach to estimate the impact of Uttar Pradesh’s EV transition on its fiscal condition. The analysis focuses exclusively on direct subsidies provided on purchase of EV under the Uttar Pradesh EV Policy (2022) and Motor Vehicle (MV) registration tax revenue which is forgone due to 100% tax exemptions for EVs. The policy implemented starting in FY 2022–23 providing subsidies and exemptions; hence the study only considers vehicles registered post-policy till the end of fiscal year 2024-25.

For estimation of subsidy for each vehicle segment, the following formula is formulated to compute total subsidy outlay:

$$\text{Subsidy} = \text{Units Sold Post-Policy (considering the policy Cap)} \times \text{Subsidy per Unit}$$

Units Sold Post-Policy = cumulative units sold from FY 2022–23 onward.

Policy Cap = maximum number of units eligible for subsidy under the UP EV Policy.

Subsidy per Unit = segment-specific fixed amount defined in the policy.

For Registration Tax Revenue Forgone, the total road tax exemption is calculated using the following formula:

$$\text{Road Tax Exemption} = \text{Eligible Units} \times (\text{Average Vehicle Price} \times \text{Road Tax Rate})$$

Eligible Units = number of vehicles allowed as per policy for different segments of EVs.

Average Vehicle Price = estimated average ex-factory price per vehicle, drawn from validated market sources.

Road Tax Rate = segment-specific tax rate applicable in Uttar Pradesh

The analysis using the above method covers the two-wheeler (2W), three-wheeler (3W), and four-wheeler (4W) EV segments aligned with the structure of the UP EV Policy. The policy was implemented starting in 2022 till fiscal year 2024-25; hence, the study only considers vehicles registered post-policy. The policy cap is only present for three-wheelers, as they are mostly used for commercial purposes. Using this method, we tried to provide an approach to assessing the fiscal cost of EV incentives in Uttar Pradesh, focusing on formula-driven, policy-grounded calculations.

### Results

Uttar Pradesh’s EV transition fiscal impact is based on total sales since the 2022 UP EV Policy, including purchase subsidies and registration tax exemptions.

According to data obtained from FY 2022–23 onward, the following number of EV units sold in these three major segments, for two wheelers its 80,203 units, three-wheelers numbers are 404,679 units and for four wheelers its 14141 units.

Segment	Subsidy Disbursed (₹ crore)	Road Tax Exempted (₹ crore)
2W	40.10	40.10
3W	60.00	31.25
4W	141.41	164.04
<b>Total</b>	<b>241.51</b>	<b>235.39</b>

**Table 3. Comparative subsidy outlay and road-tax exemptions by vehicle segment (2W, 3W, 4W) in Uttar Pradesh.**

Based on the formula formulated, segment wise maximum allotted subsidies multiplied by number of units sold at each specific segment (considering the policy cap for three-wheeler segment), hence subsidies provisioned for each segment as shown on table. And accordingly, the formula derived for tax exemption, eligible units multiplied by average price of taken vehicle for this study of specific segments and further multiplying with tax rate of each segment, hence road tax exemption calculated as given in above table.

### Analysis

The analysis shows that the subsidies provisioned, and revenue forgone varies significantly by vehicle category, showing differences in both unit prices and policy design. The results shows that although a small share of total EV registrations (14,141 units) of four-wheelers (4Ws), accounted for the largest share of subsidy disbursement (₹141.41 crore, 58.55%) and road tax exemptions (₹164.04 crore, 69.69%). This differential impact is attributed to the high average ex-factory price and their higher applicable tax rate. Comparing with 2Ws, having a larger base (80,203 units) contributed ₹40.10 crore in subsidies and road tax exemptions, showcasing the moderate subsidies and tax exemption burden due to lower average unit price. Which is aligning with earlier findings by Kumar & Chakrabarty (2020), who noted that the total cost of ownership for 2Ws makes them naturally competitive with 2W combustion segment, reducing the need for sustained subsidies.

The 3W segment being the highest-selling category in UP (404,679 units), subsidies were capped at 50,000 units by the policy, limiting total subsidy to ₹60 crore. Tax exemptions for 3Ws (₹31.25 crore) are also moderate. However, primarily used in the commercial sector, having strong environmental and social externalities (shared mobility, reduced urban emissions, livelihood support), though their fiscal burden is moderate, the social return on fiscal investment is higher compared to private-use 4Ws as per Shrimali (2021), who argued that subsidies should prioritize commercial-use and high-impact segments.

The accumulating impact of incentives from post policy onwards is evaluated to ₹476.9 crore, with subsidies and tax exemptions having almost equal contribution. Although the numbers are importantly less than 0.1% of UP's annual budget of 2024-25, suggesting the short-term fiscal burden caused by policy incentive is manageable, and the long-term growth in EVs cars segment could magnify costs, if criteria of incentives remain unchanged. This reverberates with national-level projections made by Kaur, Das, & Tongia (2025), highlighting the EV adoption under existing incentives could erode fiscal revenues beyond fuel taxes, extending to GST and registration revenues.

### Conclusion

The findings of this study analysed the possible fiscal challenge that could occur in Uttar Pradesh's EV transition. The results shows that the state's current EV policy has promoted EVs adoption across EV vehicle segments while maintaining moderate level of fiscal impact. Although, the analysis showed that fiscal costs are uneven across segments, with private owners of four-wheelers disproportionately benefiting from subsidies and tax exemptions.

From the perspective of policy, that Uttar Pradesh should consider a phased manner of providing incentives to different EVs segment. Gradual changes of purchase subsidies and tax exemptions for private 4Ws as this segment is already attracting consumers, further preventing excessive revenue losses as adoption rises. Fiscal support in form of subsidies and tax exemption should remain concentrated on three-wheelers, further expanding to public buses, where social benefits (shared mobility and emission reductions) significantly outweigh fiscal costs. Adding to it, expanding investment in charging infrastructure may

provide more sustainable long-term support than direct subsidies addressing the structural adoption barriers.

The analysis shows that while EV adoption is a pathway to decarbonize Uttar Pradesh's transport sector, fiscal sustainability must remain central to policy design, balancing via continuous monitoring and periodic policy recalibration.

### Research limitations and future scope

The study focuses on primarily direct impacts of subsidies and road tax exemptions on UP's fiscal. It does not take account of fiscal impact of indirect subsidies for charging infrastructure and concessional electricity tariffs. It goes through short term period limited to EV adoption since the implementation of post-UP EV Policy (2022). As such, it does not capture long-term adoption trajectories such as battery costs or technological improvements which can itself reduce cost of EVs. Study is based on assumption on estimation of average vehicle prices and tax rates approximated from market sources and policy reports. Variations in ex-factory prices, dealer profit margins, and tax compliance could lead to deviations from actual figures showcasing fiscal impact.

Future research can adopt long-term scenario analysis incorporating varying EV adoption rates, declining battery costs, and evolving policy frameworks, to project cumulative fiscal impact in longer time frame. Expanding the analysis to include charging infrastructure investments, electricity subsidies, and environmental benefits would provide a more holistic cost-benefit framework. A comparative assessment between states like Maharashtra, Tamil Nadu, and Karnataka with high EV adoption rate, would help identify best practices in balancing EV promotion with fiscal stability.

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