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EV Competitiveness Beyond Incentives

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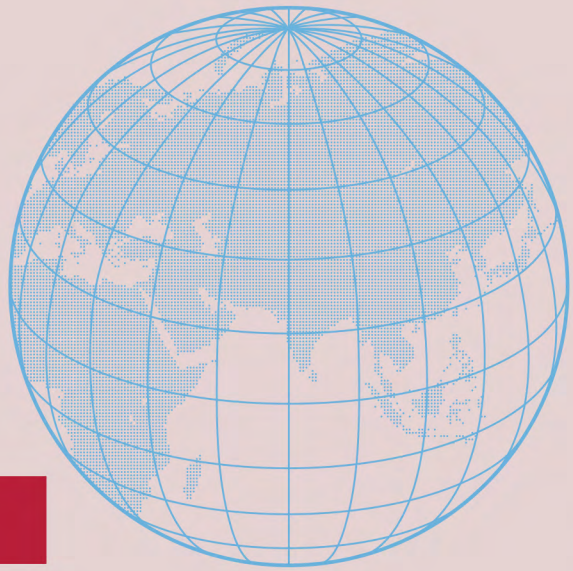

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EV Competitiveness Beyond Incentives

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Abbreviations

ABR	Average Billing Rate
AOC	Annual Operational Cost
CBIC	Central Board of Indirect Taxes and Customs
CNG	Compressed Natural Gas
CRF	Capital Recovery Factor
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles
GST	Goods and Services Tax
GVW	Gross Vehicle Weight
ICCT	International Council on Clean Transportation
ICE	Internal Combustion Engine
IPC	Initial Purchase Cost
kWh	Kilowatt-hour
Li-ion	Lithium-ion
LNG	Liquefied Natural Gas
MoEFCC	Ministry of Environment, Forest and Climate Change
MoRTH	Ministry of Road Transport and Highways
MV	Motor Vehicle
OEM	Original Equipment Manufacturer
PM E-DRIVE	PM Electric Drive Revolution in Innovative Vehicle Enhancement
RV	Resale Value
TCO	Total Cost of Ownership
VKM	Vehicle Kilometres

Executive Summary

This paper examines the reliance of electric vehicles (EVs) on the existing incentives, particularly tax concessions, to become financially attractive in India. In practical terms, the study attempts to understand how long the purchase of EVs in different segments may require preferential tax treatment to remain cost-competitive compared to conventional vehicles. Electric passenger cars and electric two-wheeled vehicles are taken as a case in point.

Higher upfront costs of EVs vis-à-vis internal combustion engine (ICE) variants remain a significant barrier to EV adoption. To bridge this gap with ICE vehicles, governments at the Central and State levels have provided fiscal incentives—primarily purchase subsidies and tax incentives. The latter includes lower tax rates for EV sales under the national Goods and Services Tax (GST) and the State-level Motor Vehicle (MV) tax regimes. Furthermore, a majority of States that are large vehicle sales markets offer MV tax waivers for the purchase of electric passenger cars and electric two-wheeled vehicles.

Together, these national and state tax measures have significantly lowered an EV's on-road price, narrowing the gap with its ICE counterpart. While purchase subsidies (such as those available under the PM Electric Drive Revolution in Innovative Vehicle Enhancement [PM E-DRIVE] scheme) are time-bound, tax concessions have been more stable and open-ended, forming the backbone of India's EV affordability strategy. However, the GST rate on conventional vehicles has recently undergone a major change that can potentially alter the relative vehicle cost economics.

Goods and Services Tax Rate Rationalisation and its Impact on Electric Vehicles

Under the GST regime, conventional ICE vehicles were historically taxed at 28% GST + 1% to 22% Compensation Cess. Following GST 2.0 rationalisation (effective from September 22, 2025), the tax structure now features the following:

- An 18% GST on a majority of ICE vehicles;
- Abolition of Compensation Cess;
- Continuation of 5% GST rate for EVs.

Although GST 2.0 maintains the 5% rate on EVs, lowering ICE vehicle taxes from 28% to 18% reduces EVs' relative price advantage:

- The on-road price gap between EVs and comparable ICE vehicles has widened by ₹1.1 lakh to ₹1.5 lakh for passenger cars.
- Similarly, for two-wheeled vehicles, the price gap has grown by about ₹7,000 post-GST 2.0.

Hence, while EVs retain lower operating costs, their upfront competitiveness has weakened. However, continued dependence on tax incentives may not be fiscally sustainable. Tax revenue constitutes a large share of Centre and State revenue receipts, which determine the government's ability to deliver vital services to citizens and implement various programmes and schemes. A calibrated tapering down of existing incentives is needed for those who have already played their part in realising the policy objectives—in this case, promoting electric two-wheeled vehicles and electric passenger cars. This could potentially free up much-needed fiscal bandwidth for the government to channel commensurate fiscal support towards decarbonising hard-to-abate transport segments like heavy-duty vehicles, aviation, and shipping.

What Does This Research Address and How?

As EV penetration rises, preferential tax treatment could erode public revenues. Additionally, falling lithium-ion (Li-ion) battery prices are expected to reduce EV production costs further, thus diminishing the possible need for heavy tax support. EV–ICE price parity could be achievable even under the same tax rates in the near future. Therefore, it is important to test the thesis that EVs continue to rely on the existing tax incentives to become cost-competitive vis-à-vis ICE variants.

This study seeks to shed light on how future prices of EVs and the resulting vehicle cost-competitiveness may play out, potentially impacting the dependence of EV uptake on tax incentives in India. The analysis employs a total cost of ownership (TCO) framework and focuses on passenger cars and two-wheeled vehicles. Passenger cars, in turn, have been segmented into private and commercial in consideration of the current vehicle registration norms. The TCO of a vehicle includes its cost of acquisition and operational costs, such as fuel and maintenance costs over its lifetime, which reveals the total cost incurred throughout the vehicle's lifespan.

Whether there is dependence of EV adoption on a tax incentive is premised on the hypothesis that the EV's per km TCO does not reach parity with the baseline ICE vehicle within the first five years of vehicle owner-

ship. Baseline ICE vehicle is the one that has the largest share in a particular vehicle segment (i.e., private passenger car, commercial passenger car, or two-wheeled vehicle). If TCO parity is reached by the fifth year of ownership following possible tax hike(s), it is assumed that the EV is no longer dependent on the concerned tax incentive(s). The fifth year of ownership is chosen as the decisive year since vehicle ownership by an original buyer in India averages four to five years, and EV buyers are unlikely to wait longer to realise the cost advantage of EVs over conventional vehicles.

Key Findings of the Study

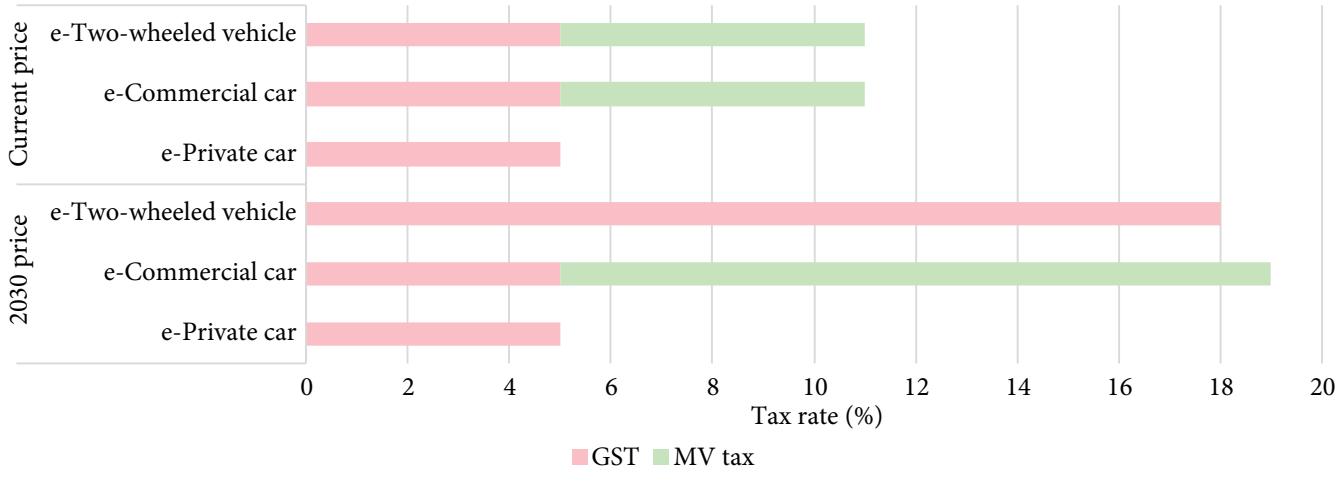
Based on the EV cost-competitiveness analysis, the research indicates the following scope to rationalise EV tax incentives.

- Privately owned electric passenger cars continue to depend on the existing tax incentives till at least 2030. This includes a preferential GST rate of 5% on EV sales and an exemption on MV tax. Maintaining the status quo is necessary until the costs of electric cars decrease further.
- Our analysis suggests that electric commercial passenger cars are cost-competitive in the current price scenario, even after the removal of the MV tax waiver; however, retaining the 5% GST rate is necessary. States can levy MV tax on this electric car segment up to the rate of 6%. From 2030 onwards, the MV tax rate can be further raised up to 14%, with GST maintained at 5% without compromising the electric commercial car's cost competitiveness. These tax hikes would enable the States to reduce their tax revenue losses.
- Considering current prices, electric two-wheeled vehicles can remain cost-competitive even when the MV tax is levied up to 6% with the continuance of the current 5% GST rate. In this case, only States would be able to recover their tax revenue losses.
- Electric two-wheeled vehicles may not have to depend on preferential GST treatment beyond 2030. There can be room to raise the GST rate to 18%, provided they continue to benefit from the MV tax exemption and current demand incentives.

Figure ES1 summarises the possible tax scenarios based on the EV cost-competitiveness analysis.

One may view this outcome with some degree of scepticism. The study's results are indicative and conditional. Among the array of factors, the assumed value for average daily vehicle kilometres (VKM) for a certain vehicle segment has a substantial bearing on the results. Although effort has been made to arrive at a reasonable average value, real-world usage varies widely and lacks robust data. The analysis is also contingent on the possible decline in Li-ion battery price. Despite this caveat, the given assessment has the merit of providing visibility of the possible scope for the government to rationalise the existing tax incentives for EV buyers.

Figure ES1: Possible Tax Scenarios Based on Present and Future Electric Vehicle Prices



Source: Authors' calculations.

Note: GST is applicable on the ex-factory price of a vehicle, whereas MV tax is levied on the ex-showroom price.

GST = goods and services tax; MV = motor vehicle.

1. Introduction: Underlying Factors Influencing Electric Vehicle Purchase Decision

Vehicle purchase decisions are typically shaped by a practical calculus that combines affordability, perceived utility, and risk management. For most households and small businesses, the vehicle is both a consumption good and sometimes a productive asset. As a result, consumers evaluate not only the purchase price but also recurring operating expenses, cost of financing, and the reliability of supporting infrastructure. In the case of EVs, this decision frame is strongly influenced by the extent to which EVs are seen as a "cost-effective and low-risk" alternative to ICE vehicles for a given use case, like daily commute, commercial last-mile delivery, and intercity travel.

In this consumer behaviour riddle, there are multiple factors that possibly influence purchase decisions in favour of or against EVs. These include product availability, upfront costs, cost of financing, operating cost savings during use, access to charging options, environmental motivation, and user experience (Elango et al., 2025; NITI Aayog & Rocky Mountain, 2019).

In this context, product availability and fit-for-purpose options refer to the availability of EV models that align with consumer requirements. Vehicle segment, driving range, payload, seating capacity, and brand trust play an important role in shaping adoption outcomes. India's vehicle market is highly segmented, each with distinct duty cycles. EV uptake will possibly accelerate when credible products are available in high-volume segments and when after-sales service, warranties, and spare parts availability satisfy the consumer expectations.

As batteries need to be charged for driving EVs, reliable access to public charging infrastructure and home charging options (private or shared) are an enabling condition for EV adoption. On the one hand, households with dedicated parking and the ability to install home chargers face lower range anxiety and a higher willingness to opt for EVs. In contrast, residents of dense urban areas, rental housing, and multi-dwelling units often face structural barriers related to permissions, shared parking, and electrical capacity, which raise challenges to adoption (Singh & Paul, 2025). On the other hand, the availability, reliability, and user experience of public charging infrastructure influence consumer perceptions of EV usability. Charger density, uptime, interoperability of payment systems, transparent pricing, and strategic siting boost consumer confidence in the support infrastructure.

Information, awareness, and environmental motivation can positively influence consumer attitudes towards EVs. However, empirical studies indicate that environmental motivations generally act as supporting factors rather than primary drivers in mainstream vehicle purchase decisions in India (Deloitte, 2024). Similarly, user experience, which largely depends on vehicle performance and comfort, tends to reinforce adoption only once core conditions are met.

A core condition that strongly influences consumer vehicle choice in India is the relative financial attractiveness of a vehicle option. It is composite in nature—a combination of upfront costs and purchase affordability, operating costs and savings, and cost of financing or borrowing. This reflects the high price sensitivity and liquidity constraints faced by a median vehicle buyer. While EV adoption decision is influenced by multiple factors, the dominant underlying driver is the relative cost of ownership, typically assessed in comparison with ICE alternatives (Elango et al., 2025; Kumar & Chakrabarty, 2020).

A major barrier to EV adoption has been the high upfront cost of an electric variant compared to an ICE vehicle.

Regarding the structure of this paper, Section 2 provides a detailed overview of the fiscal incentives available to EV buyers, particularly tax concessions, and how these play out in making EV ownership economically attractive on the back of recent tax reforms. This is followed, in Section 3, by an explanation of the need for assessing the dependence of EV adoption on tax incentives, which is the objective of this research paper. Section 4 elucidates the methodology applied to address the research objective. Sections 5, 6, and 7 share the analyses and the results for the different EV segments separately. Section 8 concludes the paper with the key policy recommendations based on the findings from the EV cost-competitiveness analysis.

2. Fiscal Incentives to Reduce the Cost of Electric Vehicle Ownership

There is a clear convergence, both globally and in India, towards vehicle electrification as a possible climate- and environment-friendly transport solution. There can be other strategic imperatives for the Government of India to promote EVs, such as reducing petroleum import dependence and making the domestic auto sector internationally competitive with technology evolution. To make EVs cost-competitive with ICE vehicles, the government has offered a range of fiscal incentives for EV buyers at the national and sub-national levels. These include purchase subsidies (also known as demand incentives) and tax incentives. These two types of incentives are found to play out differently. Implementation of the Central government-supported EV subsidy schemes, namely Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) and PM E-DRIVE, as well as State-sponsored purchase subsidies like in Delhi and Uttar Pradesh shows a clear pattern: Demand incentives are time-bound and gradually tapered down.[1] This is possibly part of a policy recalibration that balances government spending against new priorities, such as targeting yet-to-be electrified vehicle segments. In the case of offering tax incentives for EV buyers, the government, both at the Central and State levels, is found to be more generous. Many of the EV tax concessions are not tied to sunset clauses or eligibility criteria and have remained in force to date.

2.1 What are These Electric Vehicle Tax Incentives?

To understand tax concessions, one has to understand the baseline tax level, i.e., the taxes applicable to conventional vehicles. Since the time the GST regime with the "One Nation, One Tax" structure kicked off on July 1, 2017, ICE vehicles have been taxed at the highest GST slab of 28%. In addition, a Compensation Cess[2] ranging from 1% to 22% was levied on these vehicle sales.[3] The 56th GST Council Meeting, held on September 3, 2025, led to significant changes in GST rates aimed at simplifying the tax structure and encouraging more consumption. Post the GST rate rationalisation that leans towards a two-rate structure, effective from September 22, 2025, the majority of ICE vehicles currently come under the lower tax bracket of 18%; the 28% tax slab has been abolished.[4] Furthermore, Compensation Cess is no longer applicable. In contrast, EVs traditionally benefit from a GST rate of 5%[5] and were always exempted from Cess. GST 2.0, as the new tax regime, which is popularly known, maintains the status quo with respect to sales of EVs.

At the sub-national level, State governments offer tax incentives for EVs in the form of full or partial waivers on MV tax at the time of vehicle registration. Six States, namely Maharashtra, Karnataka, Tamil Nadu, Uttar Pradesh, Rajasthan, and Madhya Pradesh, accounted for 64% of electric two-wheeled vehicle registrations in the country in FY 2024–25, and currently offer a complete waiver from MV tax on registration of electric two-wheeled vehicles. Except for Kerala, the top four states (Maharashtra, Karnataka, Tamil Nadu, and Uttar Pradesh) that accounted for 58% of electric passenger car registrations in India in FY 2024–25 have given similar treatment to electric car registration. Kerala, which makes up 12% of the country's electric passenger car registrations, levies a concessional MV tax of 5% on electric cars regardless of their price. In contrast, MV tax rates on conventional passenger cars in Kerala depend on the price of the car: 10% for cars priced under ₹5 lakh, 13% for cars between ₹5 lakh and ₹10 lakh, 15% for prices ranging from ₹10 lakh to ₹15 lakh, and so on (Government of Kerala, 2025).

It is clear that, compared to purchase subsidies, the eligibility criteria and sunset clauses for tax incentives have been relaxed. Essentially, tax concessions provide a longer and more stable rope of support to EV adoption in the country.

[1] For example, demand incentive for an electric two-wheeled vehicle purchase has been reduced from ₹10,000 per kWh of EV battery under FAME-II to ₹5,000 per kWh under PM E-DRIVE (capped at ₹10,000 per vehicle). This incentive amount will be further halved to ₹2,500 per kWh for FY 2025–26 (Kohli, 2024; Ministry of Heavy Industries, 2024).

[2] The Compensation Cess was introduced along with GST and was meant to compensate States for revenue losses arising from GST implementation. It is set to expire in March 2026.

[3] The effective Compensation Cess rate depended on the fuel type, engine size, length, and ground clearance of an ICE vehicle.

[4] Two-wheeled vehicles with engine capacity more than 350 cc, passenger cars with above 1,500 cc engine capacity, and lengths longer than 4 metres currently attract a flat GST rate of 40%, with no additional cess.

[5] EVs were taxed at 12% GST from 2017 to 2019.

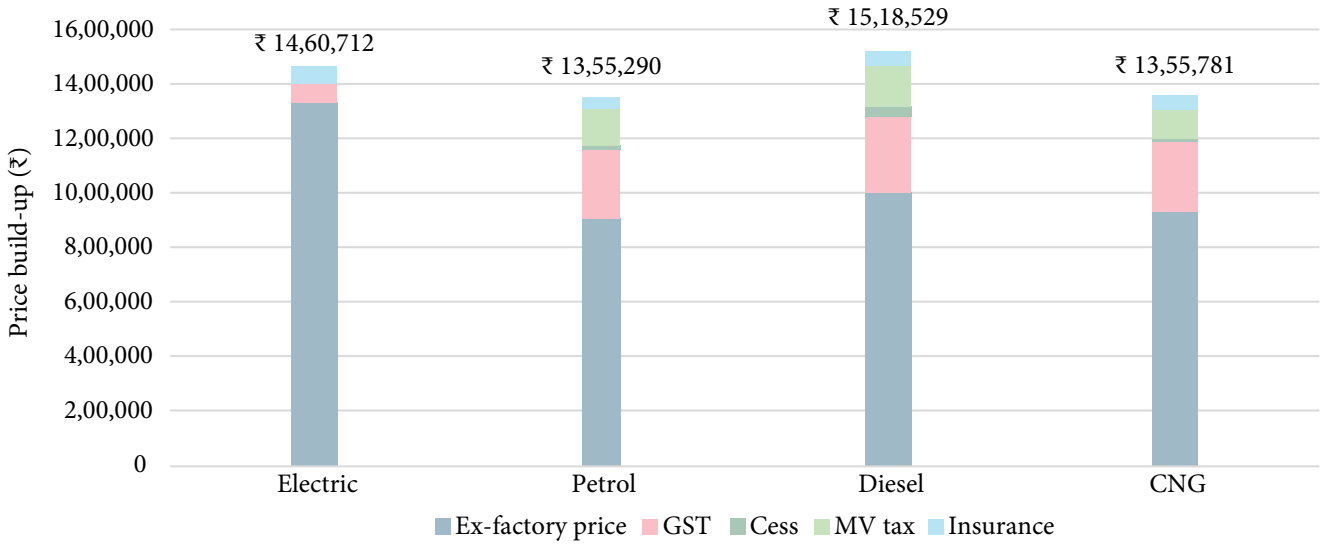
2.2 Role of Tax Incentives in Bridging the Vehicle Cost Differential

The impact of tax incentives for EVs on the vehicle's cost competitiveness becomes visible when breaking down and comparing the on-road vehicle prices across different fuel variants. On-road price is the final price at which a vehicle is sold to the consumer. The role of differential tax treatment becomes starker when the on-road vehicle price comparison is made between pre- and post-GST 2.0.

To understand this, the breakdown of on-road vehicle prices across different fuel variants is recreated in the context of the previous GST rate structure. This structure was the state of play for six of the GST regime's initial eight years and shaped the crucial early years of India's EV journey, a period that saw the registration of over 65 lakh EVs. Figure 1 disaggregates the on-road price of a popular passenger car model (Tata Nexon Creative) across its four fuel variants, electric, petrol, diesel, and Compressed Natural Gas (CNG), into key price components: ex-factory price,[6] taxes (GST, Cess, and MV tax), and insurance. Despite the electric variant having the highest ex-factory price (₹13.3 lakh), its on-road price (₹14.6 lakh) was lower than the diesel variant (₹15 lakh), which had the highest on-road price. This difference was due to preferential tax treatment to electric passenger cars, which attracted only 5% GST and were exempted from Cess and MV tax, while diesel cars were levied with 28% GST, 3% Cess, and 11% MV tax.[7] Furthermore, while the ex-factory price of the electric car was 1.5 times the petrol version, the on-road price of the former was only 1.1 times higher. Clearly, tax incentives helped bring down the delivered cost of an EV.

Figure 2 shows the breakdown of the on-road price of two-wheeled vehicles. While the ex-factory price of the electric variant was around 58% higher than the petrol counterpart, the gap reduced to 18% when the final delivered price was taken into consideration. The ex-factory price of the electric type considered in the earlier calculation accounts for a demand incentive of ₹5,000. If this incentive is ignored, its ex-factory and on-road prices become higher than the petrol variant by 66% and 23%, respectively.

Figure 1: Breakup of On-road Passenger Car Prices Considering Pre-GST 2.0 Rates



Source: Authors' calculations.

Notes: The ex-factory prices of passenger cars are estimated using the ex-showroom[8] prices as of July 2025; refer to Table A5 in Appendix B for details.

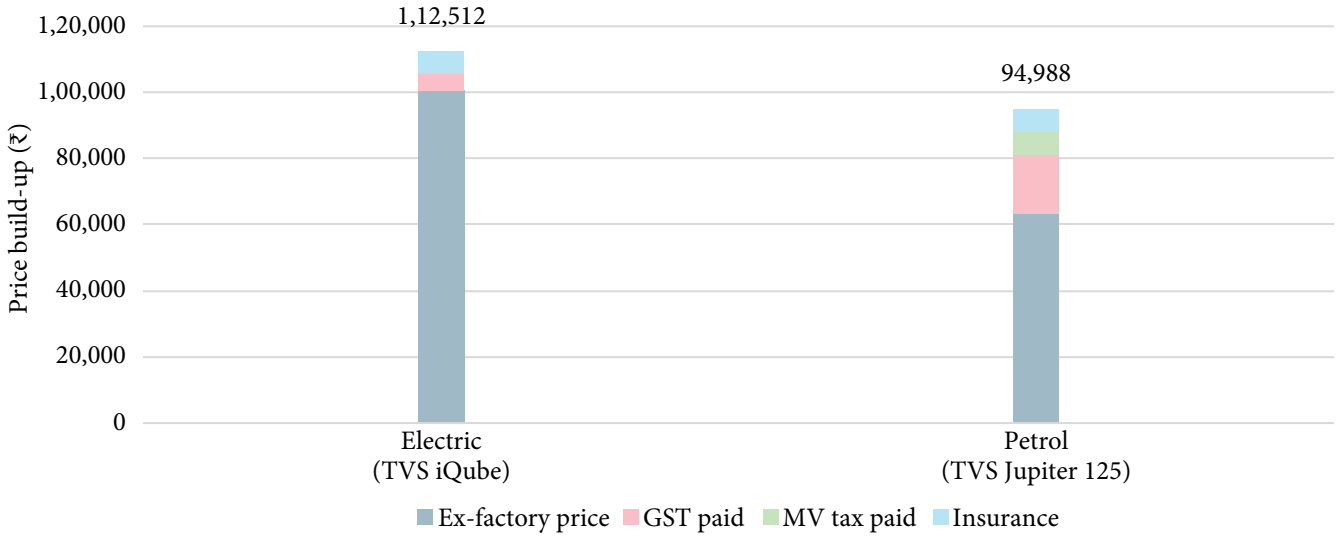
Cess = compensation cess; CNG = compressed natural gas; GST = goods and services tax; MV = motor vehicle.

[6] The ex-factory price refers to the cost of a vehicle set by the manufacturer before any taxes are applied.

[7] MV tax for the diesel car is the weighted average MV tax rate for the top 10 States with the highest ICE vehicle sales. Refer to Appendix A for details.

[8] The ex-showroom price of a vehicle includes adding registration charges, insurance, and MV tax to the ex-factory price.

Figure 2: Breakup of On-road Prices of Two-wheeled Vehicles Considering Pre-GST 2.0 Rates

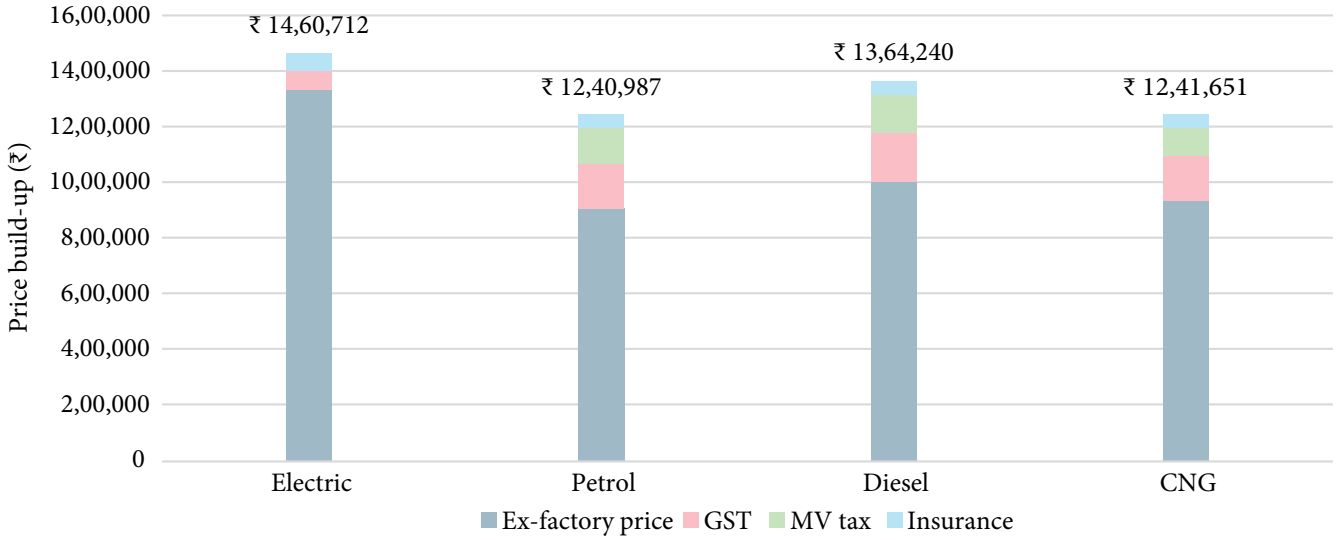


Source: Authors' calculations based on prevailing car prices and tax rates.

Notes: Refer to Table A7 in Appendix B for details.

GST = goods and services tax; MV = motor vehicle.

Figure 3: Breakup of On-road Passenger Car Prices Considering GST 2.0 Rates



Source: Authors' calculations based on prevailing passenger car prices and tax rates.

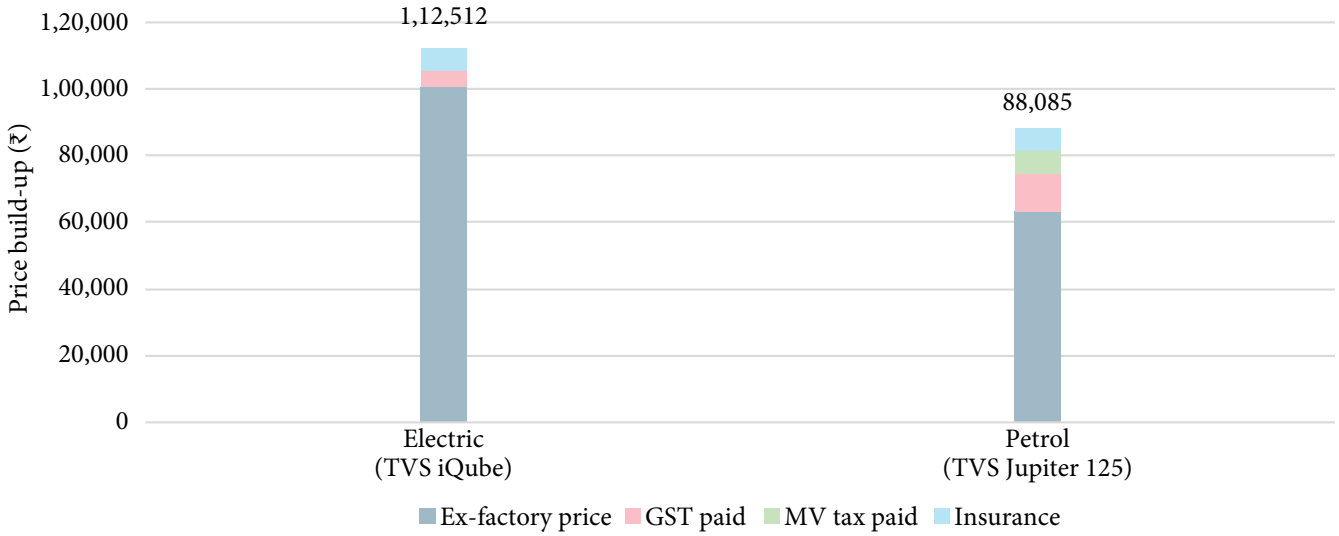
Notes: CNG = compressed natural gas; GST = goods and services tax; MV = motor vehicle.

Similar to cars, the differential tax treatment played a crucial role in narrowing the gap between electric and petrol two-wheeled vehicles in their final delivered prices.

Does Goods and Services Tax 2.0 Have a Bearing on the Attractiveness of Electric Vehicle Adoption?

GST rate rationalisation to make the sales tax regime two-tiered does not change the tax calculation for EV sales and hence, apparently has no bearing on the cost of EV adoption. However, to figure out the EV's current cost competitiveness, one has to factor in the new tax scenario applicable to conventional vehicles. After all, competitiveness is not absolute but relative. This means that the baseline tax rate on vehicle sales is being slashed from 28% to 18%, along with doing away with the levy of Cess; the cost differential between an EV and its ICE counterpart has undergone a change. Figure 3 and Figure 4 show the breakdown of on-road prices of the different fuel variants of a passenger car and a two-wheeled vehicle, respectively, considering the current applicable GST rates.

Figure 4: Breakup of On-road Prices of Two-wheeled Vehicles Considering GST 2.0 Rates



Source: Authors' calculations based on prevailing car prices and tax rates.

Notes: GST = goods and services tax; MV = motor vehicle.

In contrast to the current on-road prices of passenger cars, the price differential between the electric variant and its ICE counterpart was lower during the pre-GST 2.0 era, as compared to post rate-rationalisation. In the given case, the price gap widened in the range of ₹1.1 lakh to ₹1.5 lakh. Prior to GST 2.0, the on-road price of the diesel car was around 4% higher than its electric counterpart. Following the removal of the 3% Cess and lowering the GST rate, its on-road price is now around 7% lower than the EV. The reduction in ex-showroom prices of ICE vehicles has also lowered the amount of MV tax collected on them, amplifying the price advantage of ICE cars relative to electric ones.

Similarly, the difference in on-road prices between an electric two-wheeled vehicle and its petrol counterpart has increased following the reduction of the GST rate to 18% on the latter. In the given case, the gap has increased by ₹7,000.

The earlier calculations underscore the fact that, as far as the upfront cost of vehicle adoption is concerned, EV's competitiveness has been hurt post-GST rate rationalisation. Does this mean that EVs are likely to fall out of favour among future vehicle customers? As widely acknowledged, the financial merit of driving an EV lies in its lower operational and maintenance costs over ICE variants, owing primarily to the former's superior energy economy during driving. Taking the case of Tata Nexon, its electric version consumes 82% lower energy or fuel than a petrol one.[9] This potentially leads to substantially lower recurring expenses for an EV user.[10] How an EV's higher upfront price and lower operational and maintenance costs impact its cost competitiveness has to be seen.

3. Need for Evaluating the Reliance of Electric Vehicle Adoption on Tax Incentives

3.1 Rationale for the Assessment

Incentives play a crucial role in narrowing the price gap between EVs and ICE vehicles and kickstarting EV uptake in the country. Although demand incentives have been extended to certain EV segments with restrictive terms and conditions, tax concessions for EV purchase constitute nearly all of the incentives available to the majority of EV owners. Such forms of incentives have to be treated relative to the applicable taxes on conventional vehicles. As shown earlier, changes in tax rates on ICE vehicles potentially alter the price difference between the two vehicle technologies and indirectly impact the attractiveness of EV adoption.

[9] The comparison is based on the certified fuel economy of the concerned vehicle models.

[10] Preferential electricity tariff for EV charging in some states contribute to bringing down the operational cost of an EV further.

One should bear in mind that the preferential tax treatment to EVs is unlikely to last forever. Tax concessions end up eroding the government's revenue collection, which poses a major fiscal challenge. During the five-year period from 2018–19 to 2022–23, the government has forgone ₹4,257 crore of GST collection only in the electric two-wheeled vehicle and electric passenger car segments. During the same time, states incurred ₹1,600 crore of tax revenue loss due to the MV tax waiver on these two EV segments. As EVs reach a sizeable share of the vehicle sales, continued lower tax rates on EV sales may not be fiscally sustainable for the government.[11] Additionally, there will be a limited case for extending concessional tax rates, as the purpose of the tax incentives is to help EVs compete with conventional counterparts on a cost basis. A calibrated tapering down of existing incentives that have already played their part in realising the policy objectives can potentially free up much-needed fiscal bandwidth for the government to channel commensurate fiscal support towards decarbonising hard-to-abate transport segments like heavy-duty vehicles, aviation, and shipping.

In this context, declining Li-ion battery prices driven by technology maturity and significant scale-up in production capacity across the battery value chain potentially reduce the dependence of EVs on government largesse. Between 2019 and 2025, battery prices have almost halved from US$180 per kilowatt-hour (kWh) to US$90 per kWh, translating to a decline in the costs of battery-driven EVs (Goldman Sachs, 2024). With battery prices projected to decline further in the future, the price differential between EVs and ICE vehicles is expected to come down even further. This presents a not-so-distant scenario when EVs become cost-competitive with conventional vehicles with applicable tax rates at par.

There are several studies that have analysed the cost parity between EVs and ICE vehicles in different vehicle segments. For example, a study by the Council on Energy, Environment and Water compared the total costs of ownership of various vehicle types, such as two-wheeled vehicles, three-wheeled vehicles, cars, and buses, across fuel technologies including EVs, petrol, diesel, CNG, Liquefied Natural Gas (LNG), and hydrogen for different States in India (Elango et al., 2025). Kumar and Chakrabarty (2020) have also evaluated the cost competitiveness of EVs with their ICE counterparts and proposed policy options for accelerating EV uptake in India. While both these studies compare the cost parity of EVs with ICE vehicles, they have not focused on examining the role of tax incentives in making EVs cost-competitive. Kaur et al. (2024) focus on the truck segment and assess the role of incentives such as purchase subsidies, interest rate subventions, road tax and toll waivers, and gross vehicle weight (GVW) relaxation for battery-driven electric trucks on their cost competitiveness. On the one hand, these studies are based on the older GST regime, wherein the difference in the tax rates between EVs and ICE vehicles was larger compared to GST 2.0. On the other hand, the assessments have not focused on understanding the dependence of EV uptake on preferential tax treatment.

This engenders the need to shed light on the current and future reliance of EV adoption on tax incentives.

3.2 Research Objective

This study aims to assess the reliance of EVs on existing incentives, particularly tax concessions, to become cost-competitive vis-à-vis ICE variants. In practical terms, how far can EV tax incentives be scaled back while keeping EVs financially attractive compared to conventional vehicles?

Electric passenger cars and electric two-wheeled vehicles are taken as a case in point.

3.3 Approach for the Evaluation

The study employs a TCO framework to evaluate the cost competitiveness of EVs relative to their ICE counterparts. TCO refers to the total cost incurred in buying and using a product over its operational lifespan, which thus reveals the true cost beyond the initial purchase price.

It is important to consider TCO for the evaluation of a vehicle and not just its upfront cost. From a vehicle owner's perspective, the merit of opting for an EV is to benefit from the cost savings during its use, which helps to cover the initial price differential with a comparable ICE vehicle. The TCO framework allows one to factor in both the cost of acquisition of the vehicle and the recurring cost during use.

Whether EVs continue to depend on tax incentives in future is premised on the hypothesis that an electric

[11] Governments face the challenge of navigating a balance between promoting sales of desired goods and maintaining buoyancy in tax revenue collection.

passenger car or an electric two-wheeled vehicle is able to register per kilometre (km) TCO[12] parity with the baseline ICE vehicle, by the fifth year of vehicle ownership. If TCO parity is reached any time after the fifth year of ownership, it is assumed that EV adoption becomes unattractive.

The rationale for choosing the fifth year of ownership as the decisive year is based on the average duration of vehicle ownership by an original buyer in India, which ranges between four and five years for both passenger cars and two-wheeled vehicles (India Blue Book 2023; Ken Research, 2022). Furthermore, when consumers choose an EV over a conventional vehicle, they are opting for a relatively newer technology, i.e., the purchase decision has a risk premium. In this case, consumers are unlikely to wait for a longer period to realise cost parity with ICE vehicles. They would expect to see total cost savings within a shorter timeframe.

It is important to highlight here that the analysis is based on the premise that tax incentives are meant to make EVs a cost-competitive alternative to the baseline conventional vehicle and not necessarily the most economical option among all existing vehicle types.

4. Methodology to Evaluate the Dependence of Electric Vehicles on Tax Concessions

Given the price-sensitive nature of Indian consumers, it is assumed that TCO would play a significant role in shaping decisions regarding vehicle purchase.

The following steps are involved in carrying out a time-series analysis of the dependence of electric passenger cars and electric two-wheeled vehicles on tax incentives.

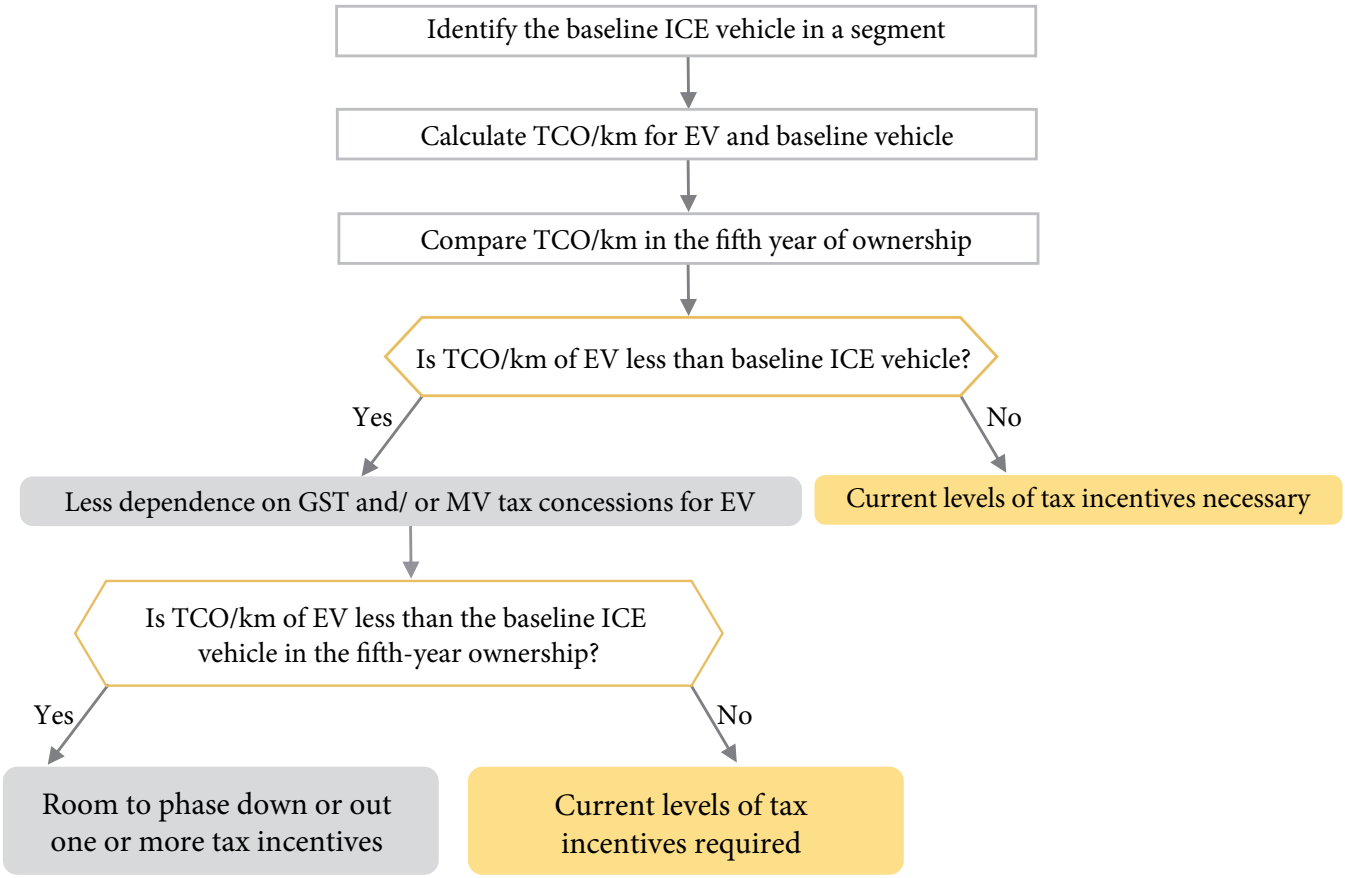
- **Identify the Baseline ICE Vehicle for Each Vehicle Segment:** For each vehicle segment, a baseline ICE vehicle is identified. Baseline vehicle is established based on the largest share of vehicle sales using a particular conventional fuel in a particular vehicle segment over the period from FY 2019–20 to FY 2024–25.[13]
- **Calculate TCO per km for Both EV and ICE Variants:** The study carries out a time-series analysis of TCO per km for an EV and the corresponding baseline ICE vehicle. The TCO estimation for an EV factors in its current as well as possible future ex-factory prices in 2030, which takes into account the projected Li-ion battery price. The purpose is to understand when an EV may possibly achieve per km TCO parity with the baseline ICE vehicle.
- **Compare TCO in the Fifth Year of Ownership:** Comparison of TCO per km between an EV and the corresponding baseline ICE vehicle is made in the fifth year of ownership. If the TCO per km of the EV is found to be less than that of the baseline vehicle in the fifth year, the study evaluates the scope to reduce or remove one or more EV tax incentives.
- **Model Tax Scenarios to Evaluate Cost Competitiveness:** The analysis simulates different tax scenarios by increasing GST rates and/or MV tax rates. If EV TCO per km is less than the baseline ICE vehicle by the fifth year of ownership, it potentially indicates room to phase down or out one or more tax incentives. Increasing GST and/or MV tax rates on an EV is considered feasible, provided the resulting EV TCO per km remains less than the baseline vehicle by the fifth year.

Figure 5 represents the employed methodology in the form of a Decision Tree. A Decision Tree helps one make decisions by mapping out different choices and their possible outcomes.

[12] In simple terms, TCO per km refers to adding up all costs of owning and using a vehicle over its lifetime and subsequently dividing by total kilometres driven over the same period.

[13] The rationale of choosing this period is to not only consider the fuel use landscape in recent times but also capture the pre-pandemic situation.

Figure 5: Methodology to Evaluate the Dependence of EV Adoption on One or More Tax Incentives



Source: Authors' representation of the methodology.

Notes: EV = electric vehicle; GST = goods and services tax; ICE = internal combustion engine; MV = motor vehicle; TCO = total cost of ownership.

4.1 Total Cost of Ownership Framework

The TCO model considers three categories of inputs to determine the TCO per km:

- **Cost of Acquisition:** It includes initial purchase cost (IPC), taxes paid, insurance cost, cost of financing, and financial incentives as applicable.
- **Operational Cost:** It comprises the cost of fuel or electricity and vehicle maintenance costs, including battery replacement if needed.
- **Vehicle Usage Details:** This includes parameters such as the vehicle holding period and average kilometres driven per day.

This study uses the following formula to calculate the TCO per km, wherein future costs are discounted to their present values (Wu, Inderbitzin, & Bening, 2015):

$$\frac{TCO}{km} = \frac{(IPC - \frac{RV}{(1+r)^{N)}}) \times CRF + \frac{1}{N}\sum_{n=1}^{N}\frac{AOC}{(1+r)^n}}{Annual\ VKM}$$

IPC = Initial Purchase Cost of the Vehicle

RV = Resale Value

CRF = Capital Recovery Factor

AOC = Annual Operational Cost of the Vehicle

Annual VKM = Annual Vehicle Kilometres Travelled

r = Discount Rate

N = Ownership Period of the Vehicle (in years)

CRF is calculated as follows:

$$CRF = \frac{r \times (1+r)^N}{(1+r)^N - 1}$$

It is used to annualise the capital cost, which determines the annual repayment required to purchase the vehicle.

4.2 Vehicle Segments

The study evaluates the scope for tapering down tax incentives across three vehicle segments: private passenger cars, commercial passenger cars, and two-wheeled vehicles. These segments cumulatively comprised 90% of total vehicle sales during the period from FY 2019–20 to FY 2024–25.

However, these segments differ in their applicable tax rates, average kilometres travelled, and battery replacement requirements, all of which impact the vehicle TCO. For all vehicle segments, the analysis assumes a discount rate of 10% and an ownership period of 10 years.

- **Private Passenger Cars:** Private passenger cars are assumed to have an average daily VKM of 33 km (International Transport Forum, 2023). Based on the daily utilisation and the warranty offered by the EV maker for the model considered in this study, battery replacement is not expected within the ownership period.
- **Commercial Passenger Cars:** Commercial passenger cars are expected to travel longer distances daily, with an average VKM of 132 km per day (International Transport Forum, 2023). Due to this higher utilisation and considering the EV model's battery warranty, one-time battery replacement is assumed over the ownership period in the fifth year of ownership.
- **Two-wheeled Vehicles:** For two-wheeled vehicles, the average daily VKM is assumed to be 33 km (Sati, Powell, & Tomar, 2021). Based on the vehicle utilisation and battery warranty provided by the manufacturer for the electric two-wheeled vehicle model considered in the study, it is assumed that one-time battery replacement would be required in the fifth year of ownership over the vehicle's lifetime.

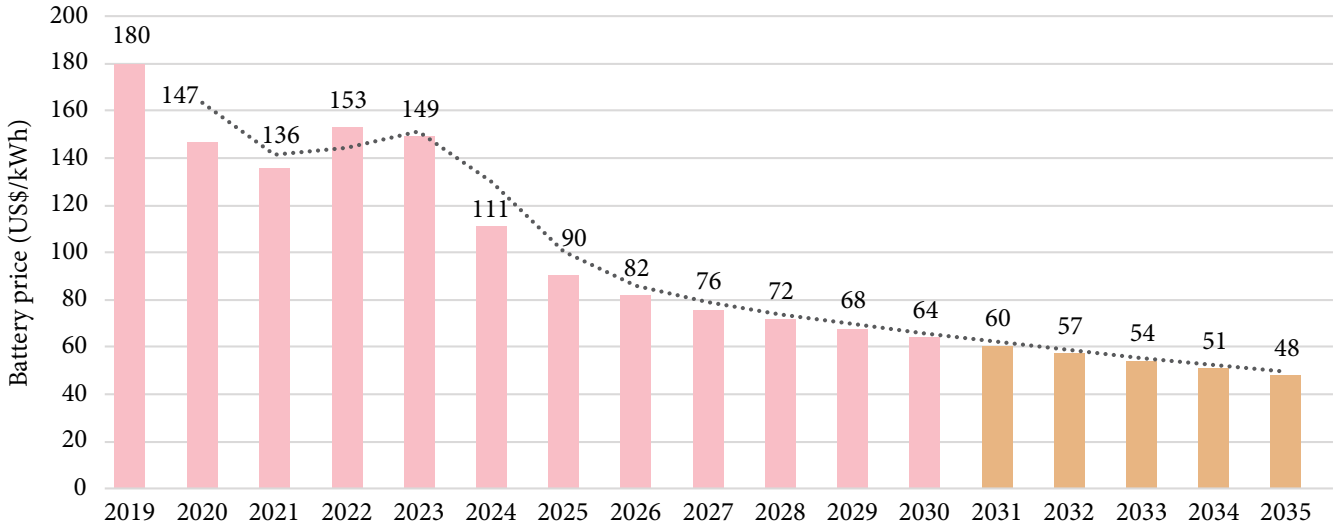
Unlike passenger cars, no distinction has been made between private and commercial two-wheeled vehicles. This is because the registration of a two-wheeled vehicle as a commercial vehicle is subject to State-specific policies, and only a handful of States namely, Karnataka, Himachal Pradesh, and Uttarakhand, have separate registrations for private and commercial two-wheeled vehicles. Furthermore, between FY 2019–20 and FY 2024–25, commercial two-wheeled vehicle registrations accounted for only 0.1% of the total two-wheeled vehicle registrations in the country.

For values of the parameters that are keyed in the TCO model, refer to Appendix B.

4.3 Lithium-ion Battery Price Forecasts and Electric Vehicle Price Projections

The TCO analysis incorporates the projected decline in EV prices on account of the fall in Li-ion battery prices. Technological innovation, economies of scale, and a decline in the raw material costs, such as lithium, have led to an 18% decline in battery prices in 2023 compared to 2019. Battery prices are expected to reduce further by 46% in 2030 compared to the 2023 prices (Goldman Sachs, 2024).

Figure 6: Historical Lithium-ion Battery Prices and Projections (US$/kWh)



Source: Goldman Sachs (2024) and authors' calculations.

Notes: Data from 2024 to 2030 are forecasts by Goldman Sachs. Projections from 2031 to 2035 (orange bars) are estimated by taking into account the consistent decline in battery prices from 2028 to 2030, averaging around 5.6%.

Price projections for EVs in 2030 are estimated based on the anticipated reduction in battery price. These are expected to translate to a 7.5% reduction in the ex-factory price of an electric passenger car model and 5% for an electric two-wheeled vehicle model, compared to 2025 ex-factory prices. The possible inflation in the cost of other components of a vehicle is considered to be similar between an EV and its conventional counterpart.

4.4 Tax Scenarios

The tax scenarios include the following:

- **Increasing GST rate on EVs** from the existing 5% to 18% for both electric passenger cars and electric two-wheeled vehicles. These tax rates are in accordance with the current GST slabs set by the GST Council in India.
- **Removing the MV tax exemption on electric private or commercial passenger cars and levying rates of** 6%, 10%, 14%, or 18%, as per the prevailing MV tax rates for ICE passenger cars in the top 10 States with the highest ICE passenger car sales. Refer to Tables A1, A2, and A3 in Appendix A for details.
- **Levying MV tax on electric two-wheeled vehicles** at 6%, 8%, 10%, or 12%, according to the MV tax rates applicable to petrol two-wheeled vehicles in the top 10 states by vehicle sales. Refer to Table A4 in Appendix A for details.

4.5 Caveats in the Assessment

The results from this study are contingent on several input parameters that can be dynamic in nature in a practical world. Therefore, the assessment findings should be considered with some caution. One should be aware of the following key limitations:

- The comparative TCO assessment has been carried out based on specific popular models of electric passenger cars and two-wheeled vehicles, as well as their ICE counterparts. The TCO comparison is likely to differ at a model stock level.
- The value of the average daily VKM for a vehicle segment has a major bearing on the outcome of the TCO analysis. The average daily distance covered by a vehicle in reality varies from one user to another, depending on several factors, such as the requirement to commute. Hence, averaging such a dynamic value invariably limits capturing the variations. There is a lack of real-world data to understand the range of the daily VKM registered by the vehicle population in the country. Another research in the form of a blog has flagged this lacuna (Das & Tongia, 2025).
- The prices of petrol, diesel, CNG, and electricity have been considered to be constant for both 2025 and 2030, as projecting future fuel and electricity prices involves significant uncertainty and is beyond the scope of this analysis.
- The price projection of electric variants for 2030 is linked to the publicly available Li-ion battery price forecast. However, such forecasts are subject to uncertainty.

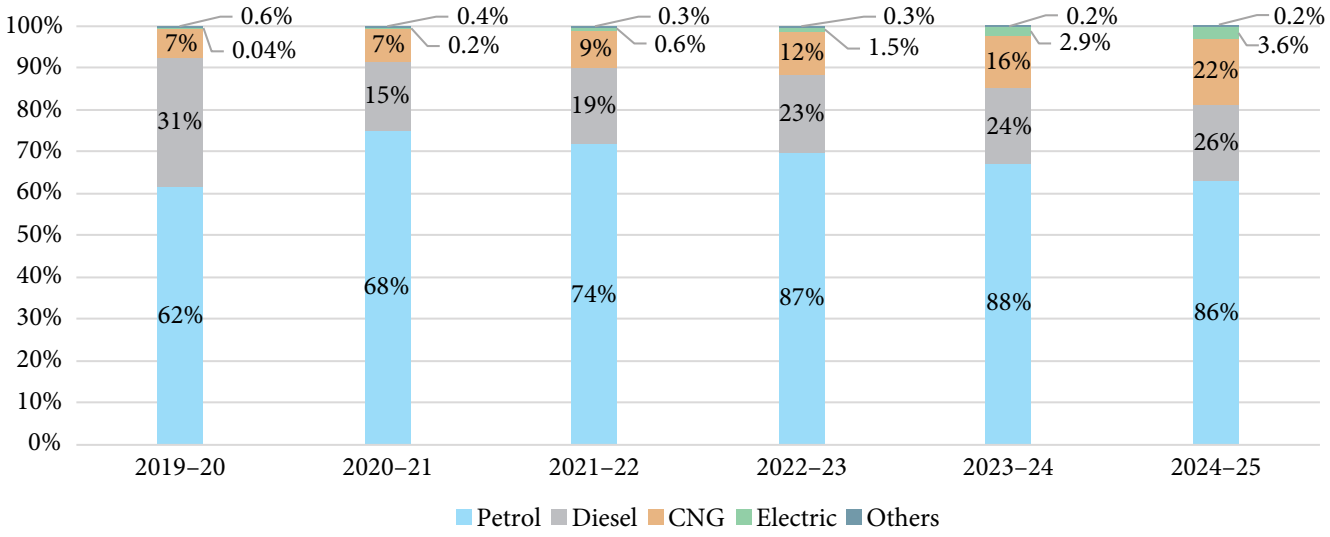
5. Dependence of Electric Private Passenger Cars on Tax Incentives

5.1 Identifying Baseline Internal Combustion Engine Private Passenger Car

In India's private passenger car segment, the petrol variant is the most popular choice. As shown in Figure 7, petrol cars have consistently accounted for the highest registrations among private cars from FY 2019–20 to FY 2024–25. However, their share in total car registrations has been declining since FY 2020–2021. Petrol cars accounted for 75% of total car registrations in FY 2020–21, which fell to 70% in FY 2022–23 and further dropped to 63% in FY 2024–25. Based on cumulative vehicle registrations from FY 2019–20 to FY 2024–25, petrol cars have the highest share with 68% of registrations among private cars. Hence, the petrol car is considered the baseline conventional vehicle in this segment.

Diesel is the second most popular variant in the private car segment, with diesel cars accounting for 20% of cumulative private car registrations between FY 2019–20 and FY 2024–25. While the share of electric cars in total private car sales is gradually rising, they made up only 1.3% of the cumulative car sales in the last six FYs.

Figure 7: Private Passenger Car Registrations by Fuel Type

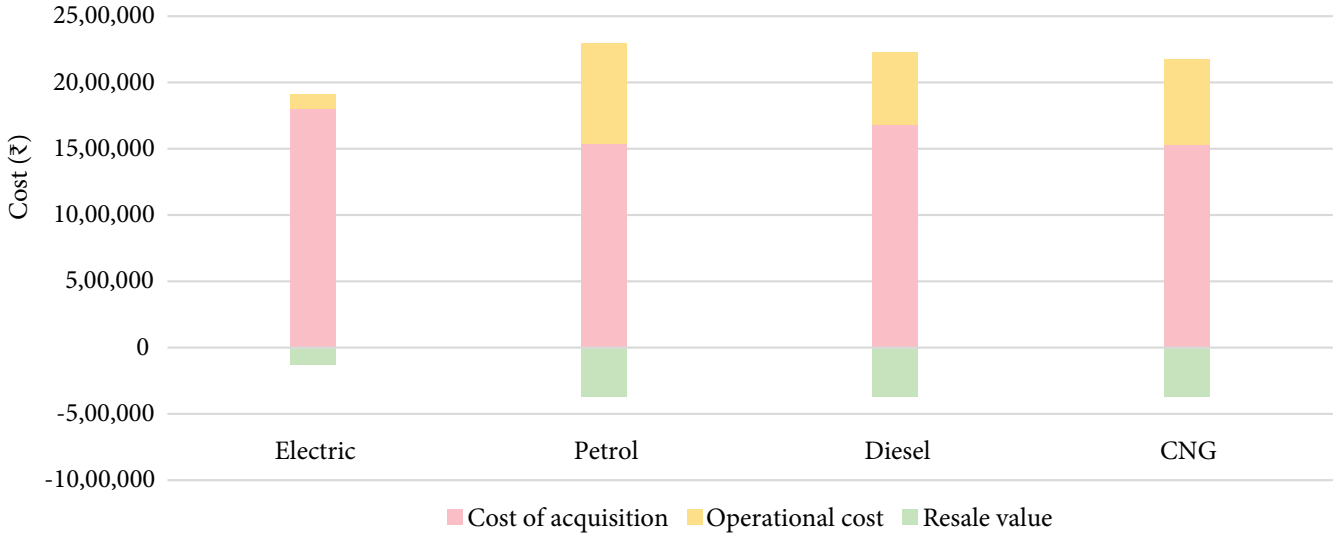


Source: Authors' analysis based on the Ministry of Road Transport and Highways.

Notes: Petrol car sales share includes petrol, petrol/ethanol, petrol/hybrid, and strong hybrid cars. Diesel car sales share includes diesel and diesel/hybrid cars. CNG car sales share includes CNG and petrol/CNG cars.

CNG = compressed natural gas.

Figure 8: Acquisition and Operational Cost of Private Passenger Cars After 10 Years of Ownership



Source: Authors' calculations based on inputs in Appendix B.

Notes: Cost of acquisition consists of ex-factory price, taxes paid (goods and services tax and motor vehicle tax), interest paid on financing, and insurance costs. Operational cost consists of fuel and maintenance costs. The costs are not discounted to present values.

CNG = compressed natural gas.

The following sections assess the total cost of owning an electric private passenger car vis-à-vis a comparable ICE version and analyse the reliance of the electric variant on tax incentives. Two separate cases have been considered: 1) based on the present electric car price and 2) based on the projected 2030 price.

5.2 Reliance on Tax Incentives Based on the Current Electric Passenger Car Price

Figure 8 shows the breakdown of cost components that make up the TCO of a private car over its 10-year ownership. Among all car types, the electric version has the lowest operational cost, which offsets its higher acquisition cost. Its RV remains much lower than the ICE variants, hence only slightly reducing

the net cost burden. In contrast, the petrol variant has the lowest acquisition cost but the highest operational cost among all car types.

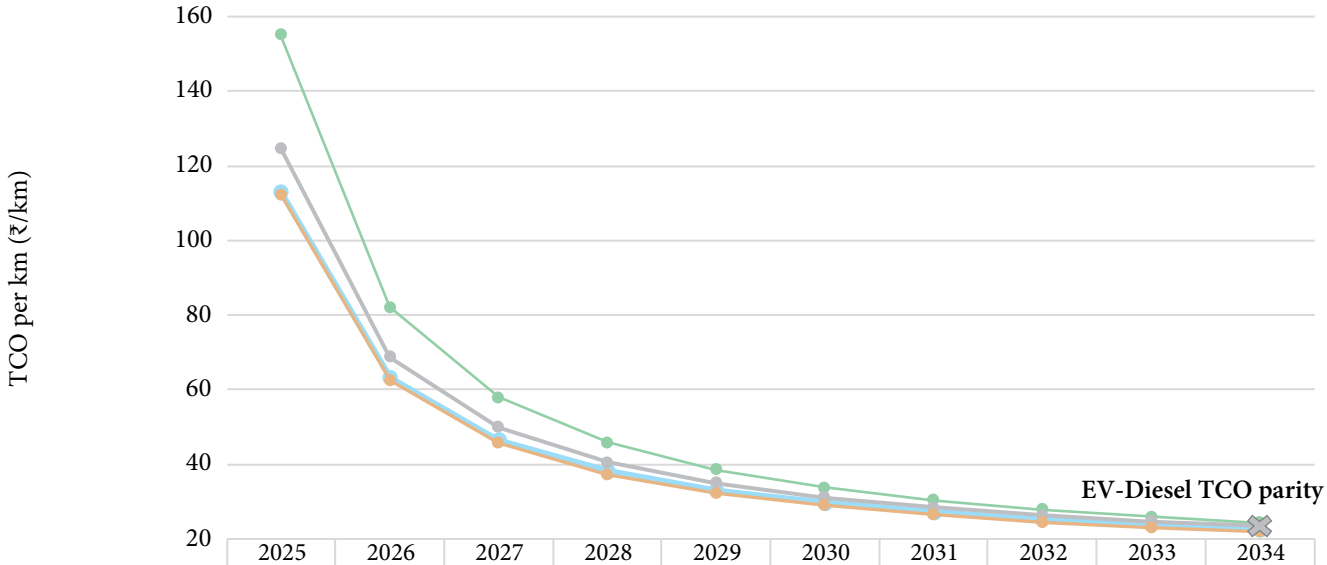
Post GST 2.0, the cost of acquisition for ICE vehicles decreased not only due to lower tax rates but also due to reduced interest expenditure on financing, as the principal loan amount declined. The reduction in acquisition cost is expected to correspondingly lower the RV of ICE vehicles over time.

Figure 9 shows the per km TCO comparison between private electric and ICE cars over a 10-year ownership period. In the first year of ownership, an electric car has the highest TCO per km at ₹155.25, followed by diesel (₹124.73), petrol (₹112.96), and the CNG version (₹112.09). Over time, EVs experience a steep decline in TCO per km, driven by lower operational costs.

- **EV's TCO parity with petrol and CNG:** An electric car is not expected to reach TCO parity with a petrol or CNG car even after 10 years of ownership.
- **EV's TCO parity with diesel:** When compared to a diesel car, the electric car is expected to reach TCO parity in the 10th year of ownership.

Given the current electric car prices, continued concessions on GST rates and exemption on MV tax rates are required to help private electric cars compete with the baseline petrol car. Removal of any of the tax incentives, i.e., increasing the GST rate from the existing 5% or removing the MV tax exemption, will further increase the EV's total cost per km (Figure 10).

Figure 9: Total Cost of Ownership Comparison Between Electric and ICE Private Passenger Cars Purchased in 2025

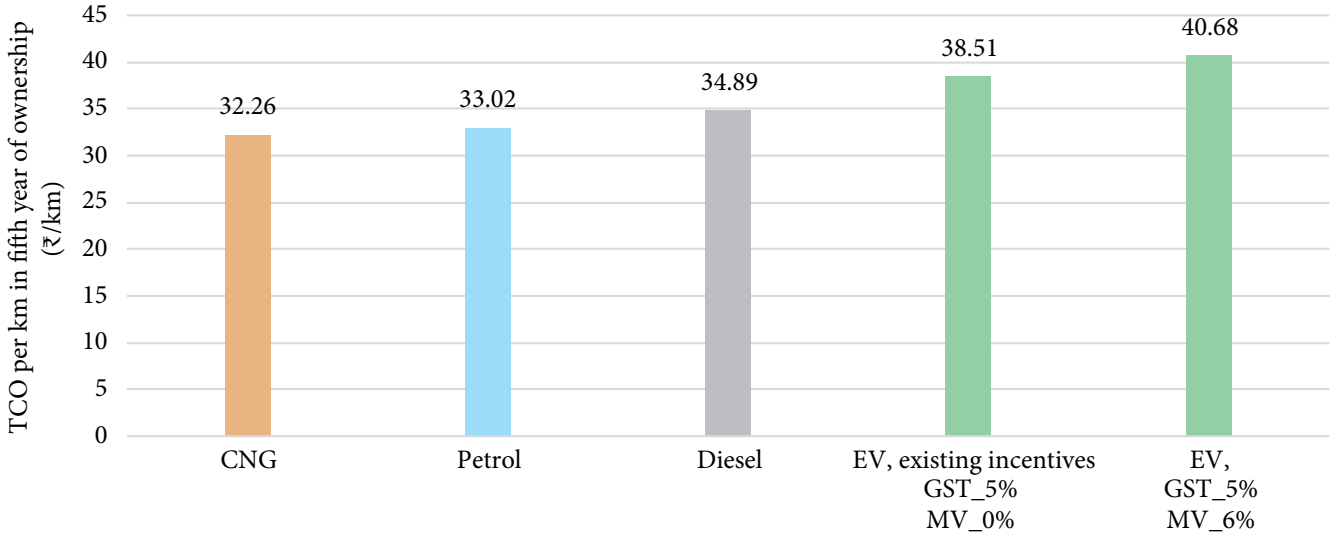


	2025 (Year 1)	2026 (Year 2)	2027 (Year 3)	2028 (Year 4)	2029 (Year 5)	2030 (Year 6)	2031 (Year 7)	2032 (Year 8)	2033 (Year 9)	2034 (Year 10)
2025 Electric	155.25	82.17	57.86	45.74	38.51	33.71	30.31	27.78	25.83	24.29
Petrol	112.96	63.22	46.54	38.12	33.02	29.59	27.11	25.24	23.76	22.57
Diesel	124.73	68.69	49.95	40.55	34.89	31.10	28.38	26.34	24.74	**23.47**
CNG	112.09	62.37	45.71	37.33	32.26	28.86	26.41	24.56	23.12	21.95

Source: Authors' calculations.

Notes: CNG = compressed natural gas; TCO = total cost of ownership; EV = electric vehicle.

Figure 10: Total Cost of Ownership per km in the Fifth Year of Ownership of an Electric Private Passenger Car Purchased in 2025



Source: Authors' calculations.

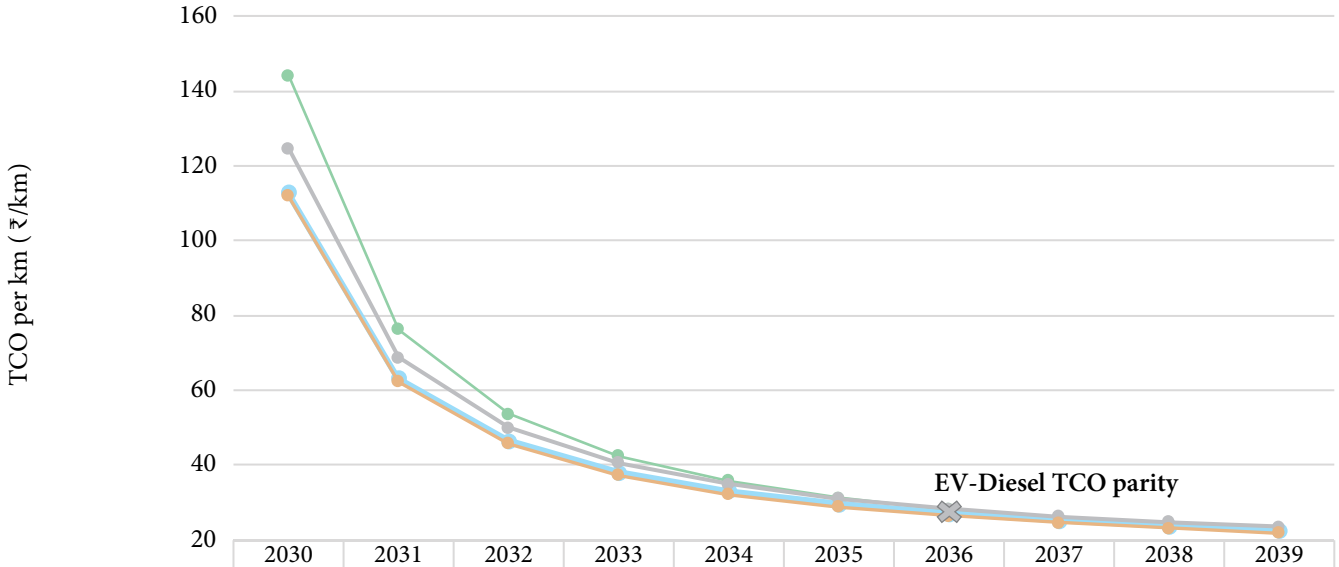
Notes: CNG = compressed natural gas; EV = electric vehicle; GST = goods and services tax; MV = motor vehicle; TCO = total cost of ownership.

5.3 Reliance on Tax Incentives Based on the 2030 Electric Car Price

The ex-factory price of an electric passenger car is expected to decrease in line with declining battery prices. For the electric passenger car model considered in this study, which has a 45-kWh battery pack, this translates to a 7.5% decline in the ex-factory price of the car in 2030 compared to its 2025 price.

Even if existing tax incentives for EVs are extended till 2030, the TCO per km of an electric private passenger car purchased in 2030 is not expected to reach parity with a baseline petrol car even after 10 years of vehicle ownership (Figure 11).

Figure 11: Total Cost of Ownership Comparison Between Electric and ICE Private Passenger Cars Purchased in 2030

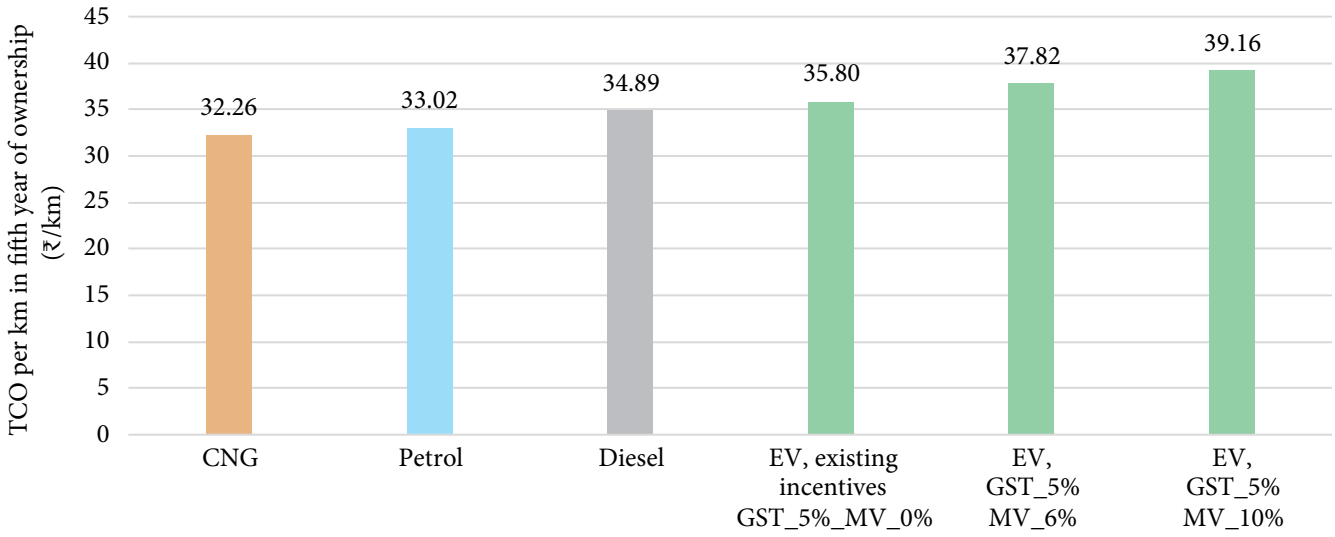


	2030 (Year 1)	2031 (Year 2)	2032 (Year 3)	2033 (Year 4)	2034 (Year 5)	2035 (Year 6)	2036 (Year 7)	2037 (Year 8)	2038 (Year 9)	2039 (Year 10)
2030 Electric	144.21	76.35	53.78	42.52	35.80	31.35	28.19	25.84	24.02	22.59
Petrol	112.96	63.22	46.54	38.12	33.02	29.59	27.11	25.24	23.76	22.57
Diesel	124.73	68.69	49.95	40.55	34.89	31.10	**28.38**	26.34	24.74	23.47
CNG	112.09	62.37	45.71	37.33	32.26	28.86	26.41	24.56	23.12	21.95

Source: Authors' calculations.

Notes: CNG = compressed natural gas; TCO = total cost of ownership; EV = electric vehicle.

Figure 12: Fifth-year Total Cost of Ownership per km of Private Passenger Car Purchased in 2030



Source: Authors' calculations.

Notes: CNG = compressed natural gas; EV = electric vehicle; GST = goods and services tax; MV = motor vehicle; TCO = total cost of ownership.

Since the electric variant is not cost-competitive with the baseline petrol car by the fifth year of ownership, even after factoring in the possible decline in ex-factory price in 2030, increasing taxes on EVs would further widen the gap in TCO per km (Figure 12).

6. Dependence of Electric Commercial Passenger Cars on Tax Incentives

6.1 Identifying Baseline Internal Combustion Engine Commercial Passenger Car

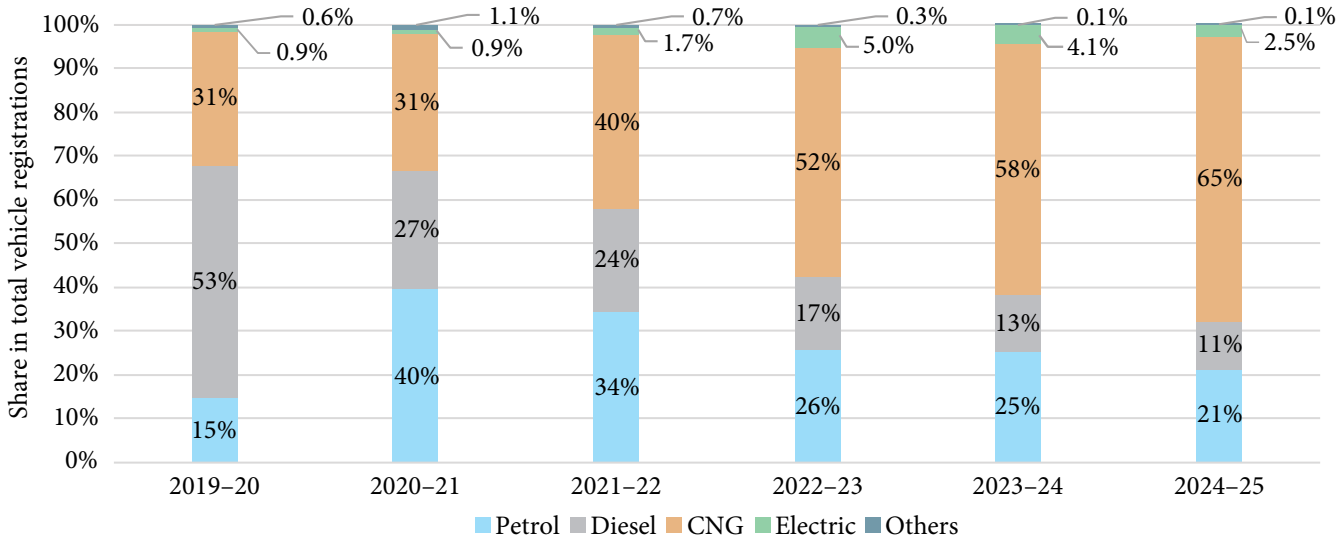
In the commercial passenger car segment, the share of CNG cars in total car registrations has grown from 31% in FY 2019–20 to 65% in FY 2024–25. On a cumulative basis, CNG cars accounted for 53% of total commercial passenger car registrations over the given period (Figure 13), making CNG cars the baseline ICE vehicle for this segment.

EVs accounted for 0.9% of commercial car registrations in both FY 2019–20 and FY 2020–21. This share rose to 1.7% in FY 2021–22 and peaked at 5% in FY 2022–23. However, EV penetration has slowed in the last two years, with EVs making up 4.1% of commercial car registrations in FY 2023–24 and further dropping to 2.5% in FY 2024–25. Over the entire assessment period, EVs made up about 3% of total commercial passenger car registrations (Figure 13).

6.2 Reliance on Tax Incentives Based on the Current Electric Passenger Car Price

The operational costs for all the ICE variants exceed their acquisition costs over a 10-year ownership period (Figure 14). In contrast, the electric car, despite having a higher acquisition cost than ICE variants, offers an advantage when it comes to operational cost savings. The operational cost of the electric car is lower by 70%, 75%, and 80% compared to a diesel version, CNG type, and petrol variant, respectively.

Figure 13: Commercial Passenger Car Registrations by Type of Fuel

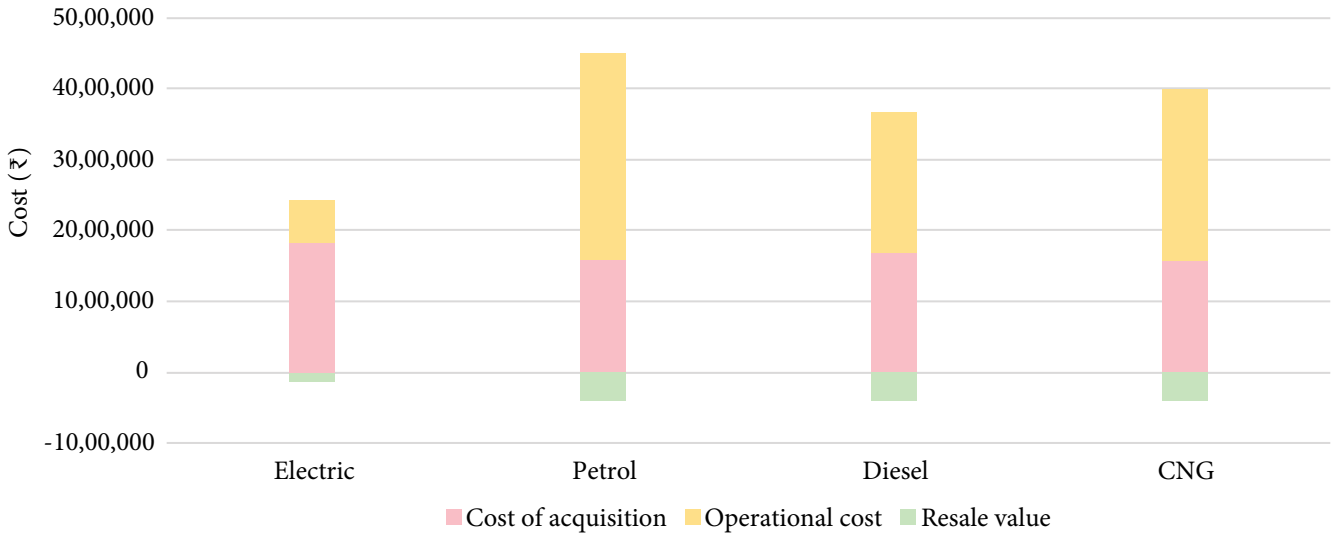


Source: Authors' analysis based on the Ministry of Road Transport and Highways.

Notes: Petrol car sales share includes petrol, petrol/ethanol, petrol/hybrid, and strong hybrid cars. Diesel car sales share includes diesel and diesel/hybrid cars. CNG car sales share includes CNG and petrol/CNG cars.

CNG = compressed natural gas.

Figure 14: Acquisition and Operational Cost of Commercial Passenger Cars After 10 Years of Ownership



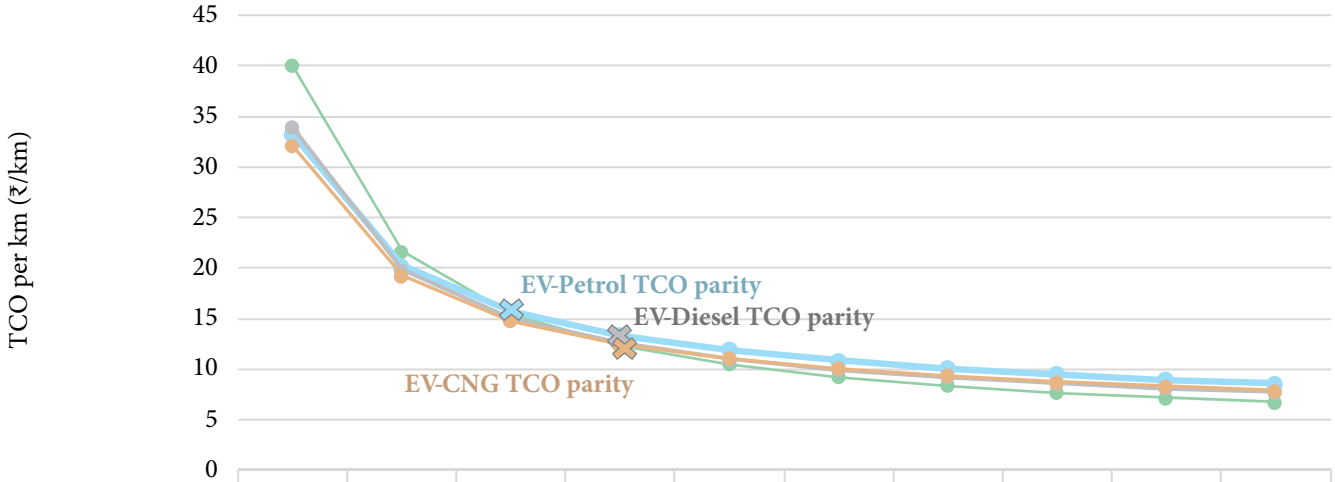
Source: Authors' calculations.

Notes: Cost of acquisition consists of the ex-factory price, taxes paid (goods and services tax and motor vehicle tax), interest paid on financing, and insurance costs. Operational cost consists of fuel costs and maintenance costs. The costs are not discounted to present values.

CNG = compressed natural gas.

In the first year of ownership, the commercial electric passenger car has the highest TCO per km at ₹40.13, primarily due to its higher upfront cost (Figure 15). However, the TCO per km declines sharply compared to ICE variants over time, reaching the lowest among all the fuel types by the fourth year of ownership. The electric car achieves TCO per km parity with a petrol car by the third year of ownership and with the baseline CNG car by the fourth year of ownership. The steep drop in EV TCO per km is driven by lower operational costs (fuel and maintenance) compared to ICE vehicles, even after factoring in the cost of one-time battery replacement over the 10-year ownership period of an electric car.

Figure 15: Total Cost of Ownership Comparison Between Electric and ICE Commercial Passenger Cars Purchased in 2025



	2025 (Year 1)	2026 (Year 2)	2027 (Year 3)	2028 (Year 4)	2029 (Year 5)	2030 (Year 6)	2031 (Year 7)	2032 (Year 8)	2033 (Year 9)	2034 (Year 10)
2025 Electric	40.13	21.63	15.45	12.35	10.49	9.24	8.35	7.69	7.17	6.75
Petrol	33.31	20.22	**15.72**	13.38	11.90	10.87	10.09	9.48	8.98	8.56
Diesel	34.02	19.83	15.01	**12.54**	11.02	9.97	9.20	8.60	8.12	7.72
CNG	32.16	19.22	14.79	**12.50**	11.07	10.08	9.34	8.76	8.29	7.89

Vehicle holding period

Source: Authors' calculations.

Notes: CNG = compressed natural gas; EV = electric vehicle; GST = goods and services tax; TCO = total cost of ownership.

As shown in Figure 16, under the current tax regime (GST at 5% and MV tax at 0%), the electric car has a lower TCO per km at ₹10.49 compared to the baseline CNG car (₹11.07) in the fifth year of ownership.

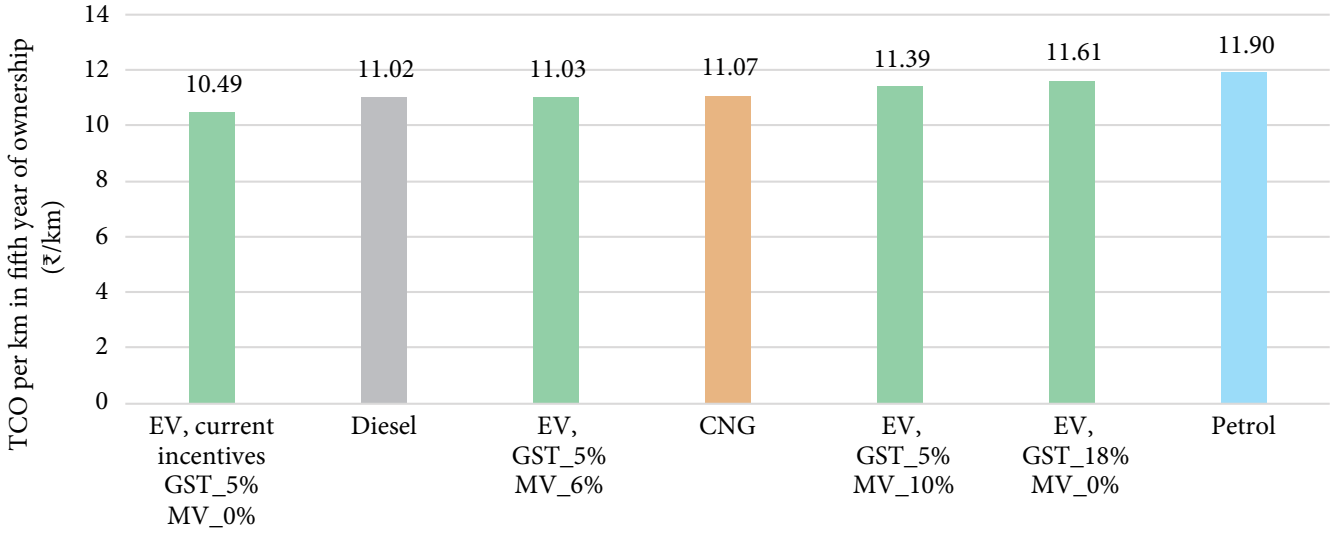
The EV TCO is found to be competitive with a baseline CNG car when the MV tax on commercial cars is increased to 6% while retaining the GST at 5% rate. However, this scenario would allow only State governments to raise tax revenue collection.[14]

6.3 Reliance on Tax Incentives Based on the 2030 Electric Passenger Car Price

In the first year of ownership, the electric car has the highest TCO per km at ₹37.26 per km, followed by diesel (₹34.02 per km), petrol (₹33.31 per km), and CNG (₹32.16 per km) (Figure 17). However, as the holding period increases, the electric variant shows a steeper decline in TCO per km, outperforming all other fuel types by the third year. The electric car attains TCO parity with the petrol car in the second year of ownership and with diesel and baseline CNG cars by the third year of ownership.

[14] This is because MV taxes are levied and collected by State governments, and any adjustment to MV tax rates does not contribute to the central revenue.

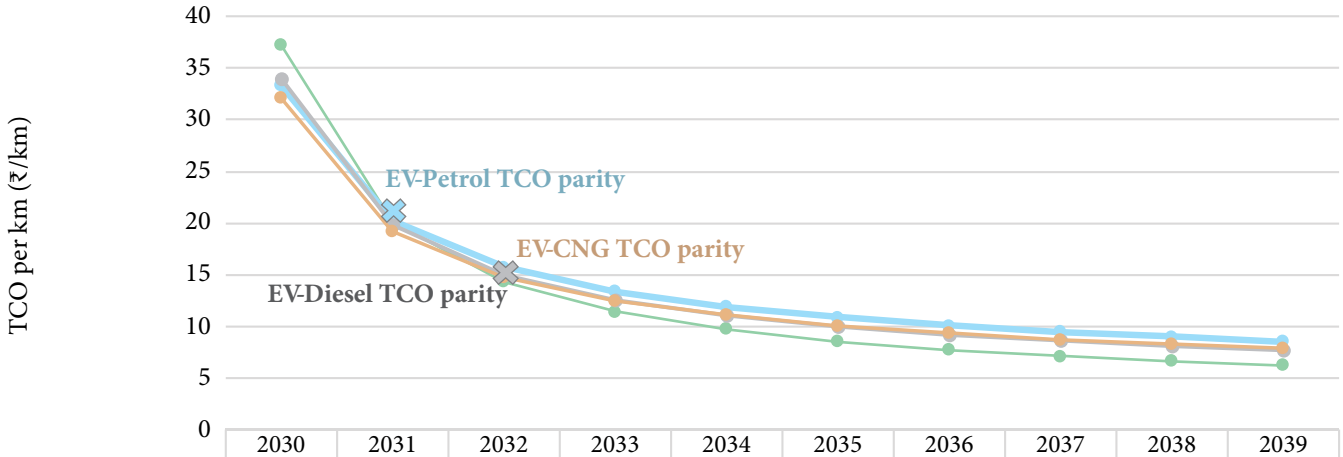
Figure 16: Fifth-year Total Cost of Ownership per km of Commercial Passenger Cars Purchased in 2025



Source: Authors' calculations.

Notes: EV = electric vehicle; GST = goods and services tax; MV = motor vehicle; TCO = total cost of ownership.

Figure 17: Total Cost of Ownership Comparison Between Electric and ICE Commercial Passenger Cars Purchased in 2030



	2030 (Year 1)	2031 (Year 2)	2032 (Year 3)	2033 (Year 4)	2034 (Year 5)	2035 (Year 6)	2036 (Year 7)	2037 (Year 8)	2038 (Year 9)	2039 (Year 10)
Electric 2030	37.26	20.06	14.32	11.45	9.72	8.56	7.74	7.12	6.63	6.25
Petrol	33.31	**20.22**	15.72	13.38	11.90	10.87	10.09	9.48	8.98	8.56
Diesel	34.02	19.83	**15.01**	12.54	11.02	9.97	9.20	8.60	8.12	7.72
CNG	32.16	19.22	**14.79**	12.50	11.07	10.08	9.34	8.76	8.29	7.89

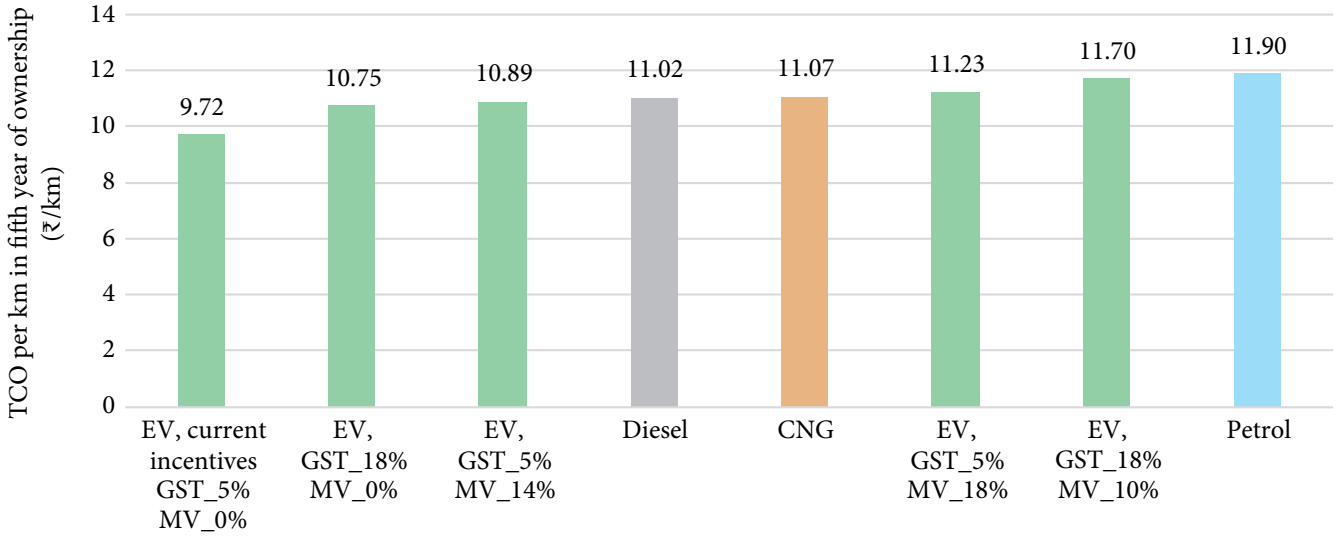
Vehicle holding period

Source: Authors' calculations.

Notes: CNG = compressed natural gas; EV = electric vehicle; GST = goods and services tax; TCO = total cost of ownership.

Under the current incentive regime (GST at 5% and MV tax at 0%), the EV has a TCO per km of ₹9.72 per km in the fifth year of ownership. A commercial car purchased in 2030 is cost-competitive with a baseline CNG car, even with 18% GST. The GST framework does not allow for differential rates based on vehicle registration (private vs commercial). Therefore, the study finds that a possible scenario is to continue the 5% GST and increase the MV tax to 14% for electric commercial car registrations, allowing the electric version to retain the cost advantage.

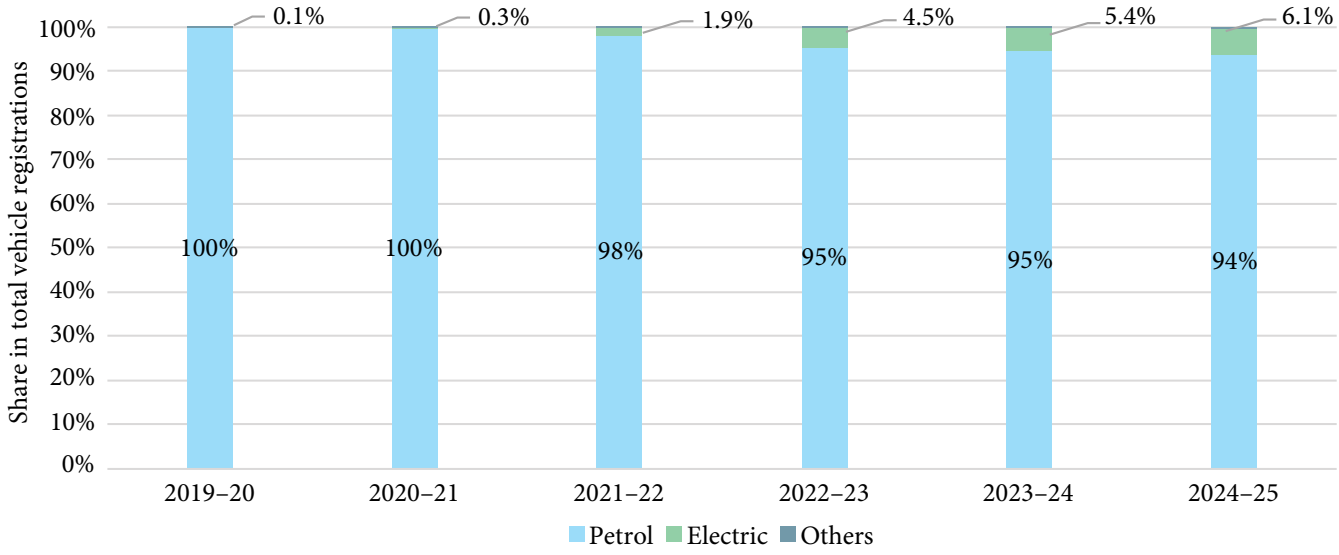
Figure 18: Fifth-year Total Cost of Ownership per km for Commercial Passenger Cars Purchased in 2030



Source: Authors' calculations.

Notes: CNG = compressed natural gas; EV = electric vehicle; GST = goods and services tax; MV = motor vehicle; TCO = total cost of ownership.

Figure 19: Two-wheeled Vehicle Registrations by Type of Fuel



Source: Authors' analysis based on Ministry of Road Transport and Highways (n.d.).

Note: Petrol two-wheeled vehicle sales share includes petrol and petrol/ethanol fuel types.

7. Dependence of Electric Two-wheeled Vehicles on Tax Incentives

7.1 Identifying Baseline Internal Combustion Engine Two-wheeled Vehicle

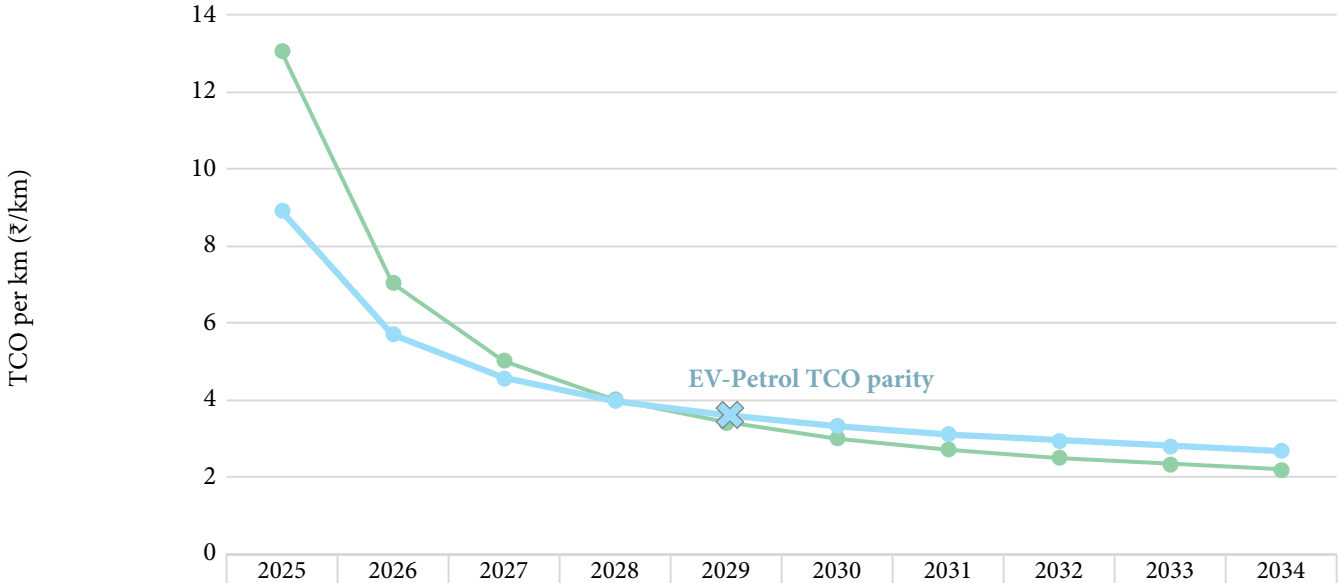
Electric two-wheeled vehicle registrations in India have been increasing consistently over the last six years (Figure 19). Starting from a 0.1% share in total two-wheeled vehicle registrations in FY 2019–20, their share increased to 6.1% in FY 2024–25. Petrol remains the dominant fuel choice in the two-wheeled vehicle segment, with petrol two-wheeled vehicles accounting for 97% of total registrations over the given period. Hence, a petrol two-wheeled vehicle is invariably the baseline vehicle type for TCO comparison.

7.2 Dependence on Tax Incentives Based on the Current Two-wheeled Vehicle Price

The analysis finds that in the first year of ownership, an electric two-wheeled vehicle has a higher per km TCO of ₹13.07 compared to ₹8.91 for the petrol variant, primarily due to the former's higher upfront cost (Figure 20). However, the TCO per km for the EV drops sharply over the next few years due to lower

operating costs (fuel, maintenance, and battery replacement). By the fourth year of ownership, TCO per km parity is achieved between electric and petrol variants. As shown in Figure 21, the electric option remains cost-competitive with the petrol version from the fifth year of ownership even if the demand incentive is completely phased out.

Figure 20: Total Cost of Ownership per km for Two-wheeled Vehicles (Including Demand Incentives for Electric Vehicles)

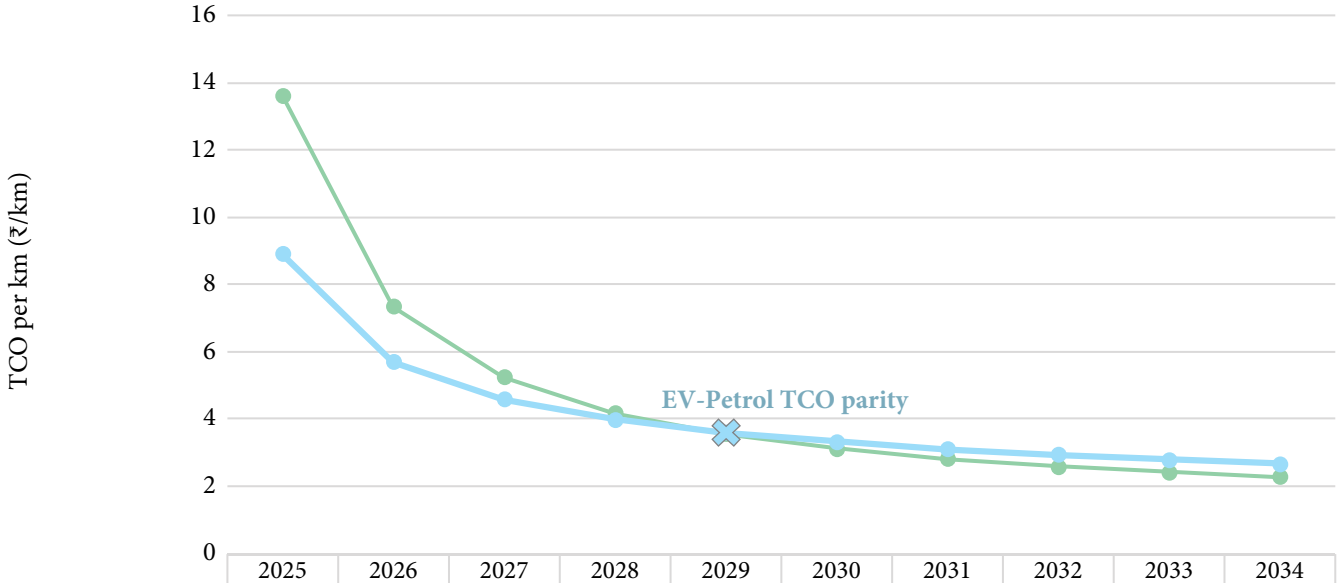


	2025 (Year 1)	2026 (Year 2)	2027 (Year 3)	2028 (Year 4)	2029 (Year 5)	2030 (Year 6)	2031 (Year 7)	2032 (Year 8)	2033 (Year 9)	2034 (Year 10)
Electric 2025	13.07	7.04	5.03	4.02	3.41	3.01	2.72	2.50	2.33	2.19
Petrol	8.91	5.70	4.58	3.98	**3.60**	3.32	3.11	2.94	2.80	2.68

Source: Authors' calculations.

Notes: TCO = total cost of ownership; EV = electric vehicle.

Figure 21: Total Cost of Ownership per km for Two-wheeled Vehicles (Excluding Demand Incentives)



	2025 (Year 1)	2026 (Year 2)	2027 (Year 3)	2028 (Year 4)	2029 (Year 5)	2030 (Year 6)	2031 (Year 7)	2032 (Year 8)	2033 (Year 9)	2034 (Year 10)
Electric 2025	13.63	7.34	5.24	4.18	3.55	3.13	2.82	2.60	2.42	2.28
Petrol	8.91	5.70	4.58	3.98	**3.60**	3.32	3.11	2.94	2.80	2.68

Source: Authors' calculations.

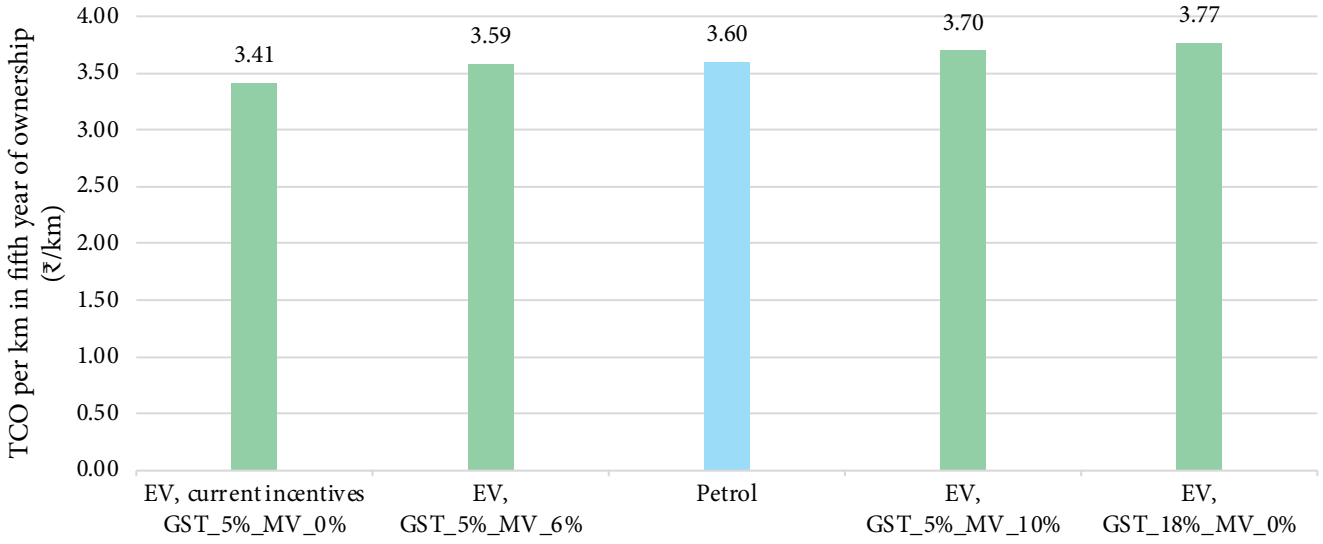
Notes: TCO = total cost of ownership; EV = electric vehicle.

With the current price of the electric two-wheeled vehicle, its TCO stays competitive with the petrol variant when MV tax increases to 6%, keeping the GST rate unchanged at 5% (Figure 22). However, moving to the GST slab of 18% (with 0% of MV tax) raises the TCO per km to ₹3.77 per km, which surpasses the TCO per km of a petrol two-wheeled vehicle in the fifth year of ownership and risks undermining the cost advantage of an electric two-wheeled vehicle.

7.3 Dependence on Tax Incentives Based on the 2030 Two-wheeled Vehicle Price

In 2030, the electric two-wheeled vehicle continues to have a higher TCO per km in the first year of ownership (₹12.50) compared to the petrol variant (₹8.91) (Figure 23), even after accounting for the decline in battery price. By the fourth year of ownership, the electric two-wheeled vehicle achieves TCO per km parity with the petrol variant. However, if the demand incentive is discontinued in 2030, EV is expected to achieve TCO parity with the petrol variant in the fifth year of ownership (Figure 24).

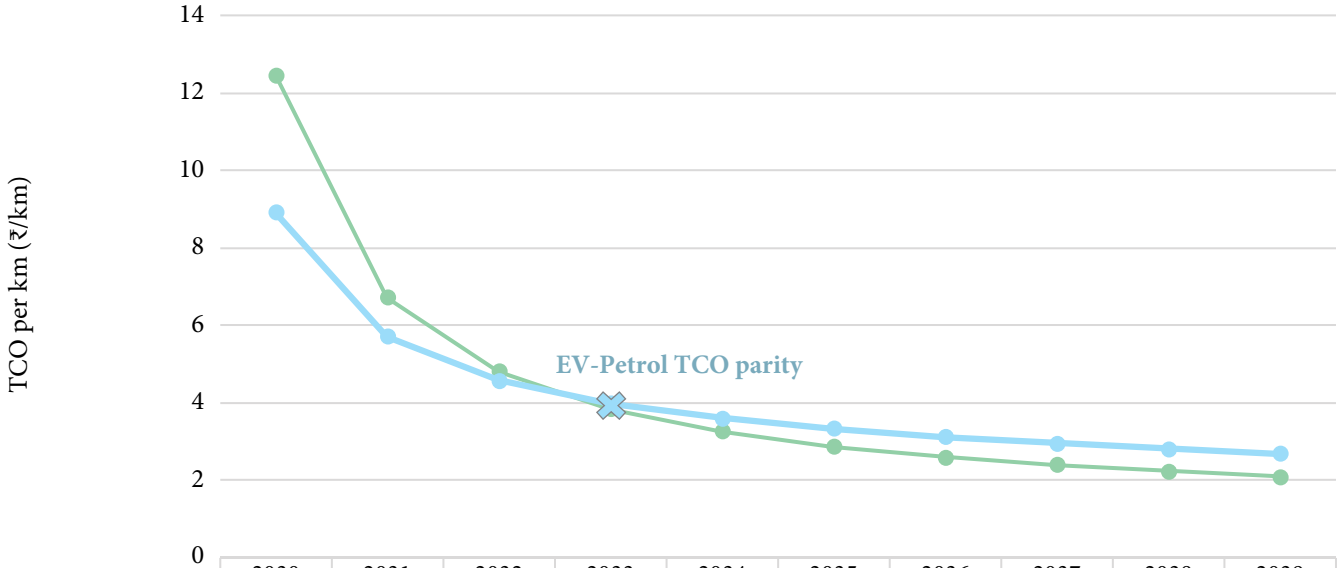
Figure 22: Fifth-year Total Cost of Ownership per km of Two-wheeled Vehicles Purchased in 2025



Source: Authors' calculations.

Notes: TCO = total cost of ownership; EV = electric vehicle; GST = goods and services tax.

Figure 23: Total Cost of Ownership per km for Two-wheeled Vehicles Purchased in 2030 (Including Demand Incentives for Electric Vehicles)

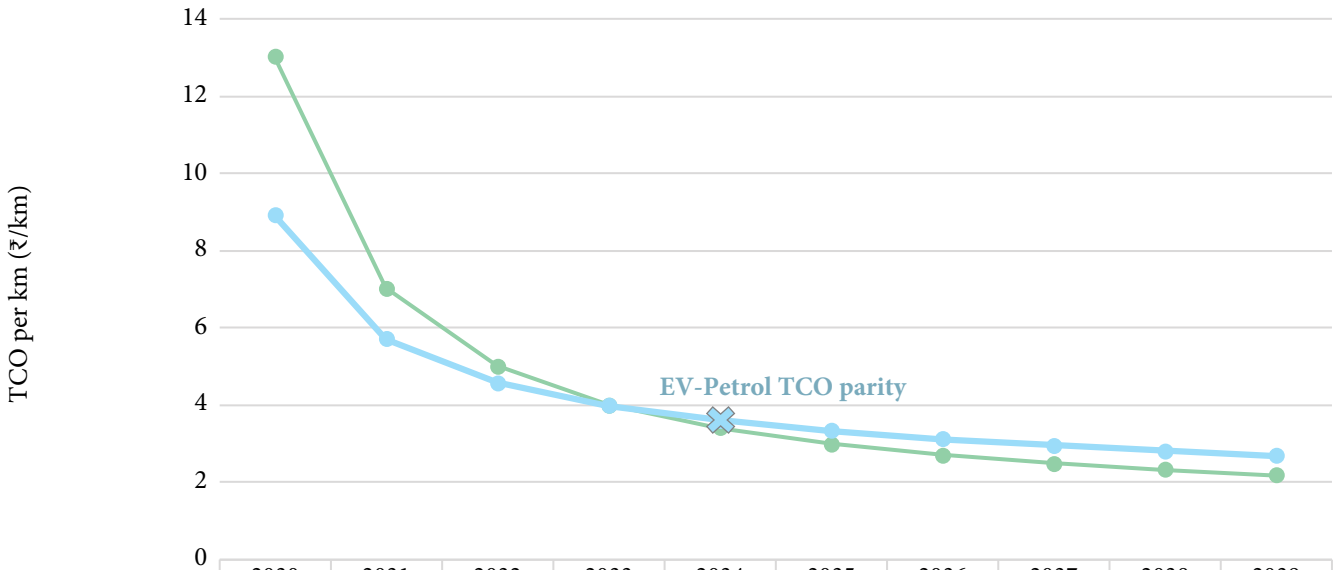


	2030 (Year 1)	2031 (Year 2)	2032 (Year 3)	2033 (Year 4)	2034 (Year 5)	2035 (Year 6)	2036 (Year 7)	2037 (Year 8)	2038 (Year 9)	2039 (Year 10)
Electric 2030	12.47	6.72	4.80	3.83	3.25	2.87	2.59	2.38	2.22	2.09
Petrol	8.91	5.70	4.58	**3.98**	3.60	3.32	3.11	2.94	2.80	2.68

Source: Authors' calculations.

Notes: TCO = total cost of ownership; EV = electric vehicle.

Figure 24: Total Cost of Ownership per km for Two-wheeled Vehicles Purchased in 2030 (Excluding Demand Incentive)



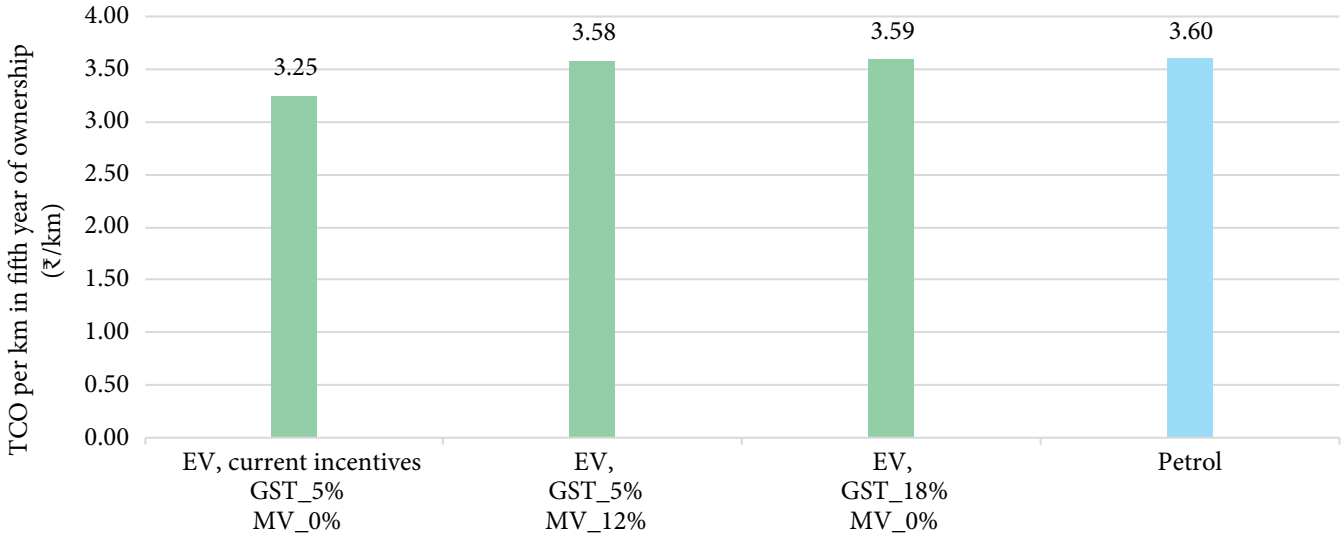
	2030 (Year 1)	2031 (Year 2)	2032 (Year 3)	2033 (Year 4)	2034 (Year 5)	2035 (Year 6)	2036 (Year 7)	2037 (Year 8)	2038 (Year 9)	2039 (Year 10)
Electric 2030	13.03	7.01	5.00	4.00	3.39	2.99	2.70	2.48	2.31	2.17
Petrol	8.91	5.70	4.58	3.98	**3.60**	3.32	3.11	2.94	2.80	2.68

Source: Authors' calculations.

The analysis finds that even at 18% GST (while keeping MV tax at 0%), electric two-wheeled vehicles maintain cost competitiveness with the petrol option (Figure 25).

However, if the government phases out demand incentives by 2030 and increases the GST on EVs to 18%, the TCO per km of electric two-wheeled vehicles would become non-competitive relative to the petrol model (Figure 26).

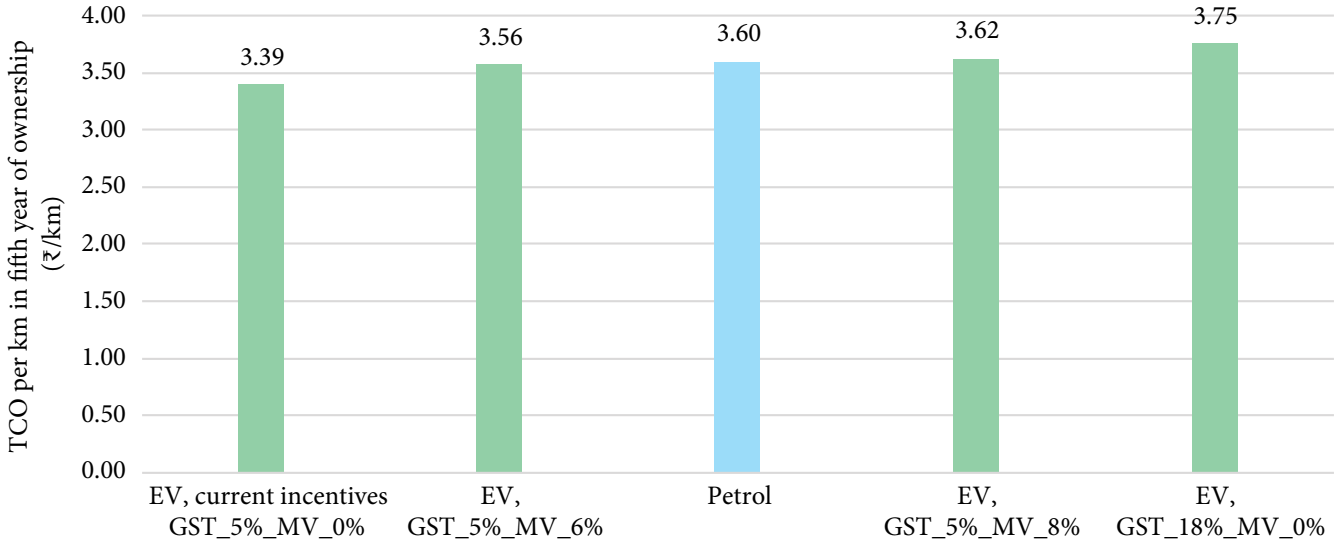
Figure 25: Fifth-year Total Cost of Ownership for Two-wheeled Vehicles Purchased in 2030 (Including Demand Incentives)



Source: Authors' calculations.

Notes: TCO = total cost of ownership; EV = electric vehicle; GST = goods and services tax; MV = motor vehicle.

Figure 26: Fifth-year Total Cost of Ownership for Two-wheeled Vehicles Bought in 2030 (Excluding Demand Incentives)



Source: Authors' calculations.

8. Conclusion: Possible Scope to Rationalise Electric Vehicle Tax Incentives

This study is a cost-comparison exercise and does not model actual consumer behaviour or adoption patterns. Using a TCO-based framework, the analysis explores possible tax scenarios to phase down or phase out some of the tax incentives offered to electric passenger cars and electric two-wheeled vehicles in India, considering their current and projected 2030 prices. The guiding principle is to strike a balance between promoting EV adoption by keeping EV TCO cost-competitive with ICE counterparts and reducing revenue losses to the government from EV tax incentives. Suggested changes in the tax rates on EVs are in accordance with the applicable tax structure.

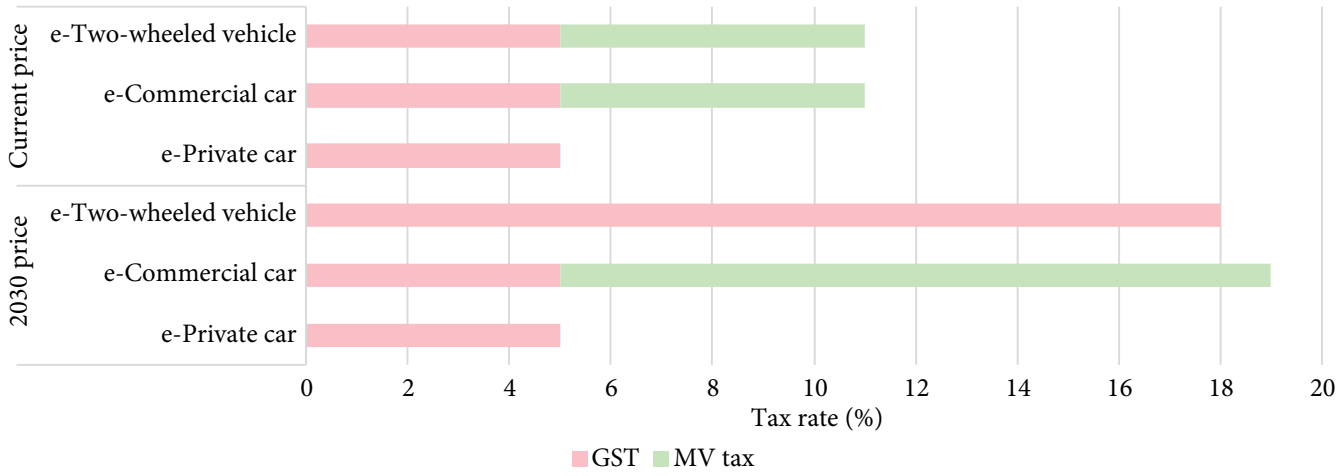
The following are the key recommendations based on the findings from the EV cost-competitiveness analysis.

- Continue the current tax incentives for electric private passenger car purchases until at least 2030, which includes a preferential GST rate of 5% on EV sales and exemption from MV tax. Maintaining the status quo is necessary until the costs of electric cars decrease further.
- Discontinue the MV tax waiver for electric commercial passenger cars while retaining the 5% GST rate, effective immediately. States can levy MV tax on this electric car segment up to the rate of 6%. From 2030 onwards, the MV tax rate can be further raised to 14% with GST maintained at 5%, without compromising the cost competitiveness of electric commercial cars. These tax hikes would enable States to reduce their tax revenue losses.
- Levy MV tax up to 6%, with continuance of the 5% GST rate on electric two-wheeled vehicles, considering their current prices. In this case, only States would be able to recover their tax revenue losses.
- Increase the GST rate to 18% on electric two-wheeled vehicles from 2030 onwards. However, this is conditional on the continued waiver of MV tax and continuation of current demand incentives.

Figure 27 summarises the possible tax scenarios based on the EV cost-competitiveness analysis.

While this study provides visibility on calibrating existing tax incentives for the purchase of electric passenger cars and electric two-wheeled vehicles, the findings must be viewed in light of certain limitations. The analysis is contingent on the consideration that consumers base their purchase decisions on TCO rather than the upfront vehicle cost. It is important to create awareness among consumers regarding the costs and benefits of EVs and how to assess the resulting financial merit. It is also worth noting that the presented results depend on certain underlying assumptions regarding vehicle models, average daily usage, fuel and electricity prices, and battery price forecasts, all of which are subject to some degree of uncertainty. These factors underscore the importance of revisiting the given recommendations in sync with future cost evolution in the EV and allied sectors.

Figure 27: Possible Tax Scenarios Based on Present and Future Electric Vehicle Prices



Source: Authors' calculations.

Notes: GST is applicable on the ex-factory price of a vehicle, whereas MV tax is levied on the ex-showroom price.

GST = goods and services tax; MV = motor vehicle.

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Appendices

Appendix A: Motor Vehicle Tax Rates for Internal Combustion Engine Cars and Two-wheeled Vehicles

Table A1: State Motor Vehicle Tax (%) for Petrol Cars and Share in National Car Sales

States	MV Tax Rate for Petrol Cars (%)	Private Petrol Car Registrations in FY 2024–25	States' Share in National Petrol Private Car Sales in FY 2024–25 (%)	Commercial Petrol Car Registrations in FY 2024–25	States' Share in National Petrol Commercial Car Sales in FY 2024–25 (%)
Maharashtra	12	2,20,383	10.3	2,090	4.3
Uttar Pradesh	11	2,53,075	11.9	1,214	2.5
Gujarat	6	1,41,355	6.6	759	1.6
Karnataka	19	1,99,669	9.4	7,306	15.1
Haryana	8	1,57,309	7.4	2,325	4.8
Tamil Nadu	18	1,88,907	8.9	9,037	18.7
Rajasthan	7	1,15,394	5.4	1,170	2.4
Kerala	11	1,74,683	8.2	1,843	3.8
Madhya Pradesh	10	1,07,282	5.0	620	1.3
Delhi	10	1,28,498	6.0	25	0.1

Source: Ministry of Road Transport and Highways (n.d.); Ministry of Road Transport and Highways (n.d.-a).

Notes: Petrol car sales include petrol, petrol/ethanol, petrol/hybrid, and strong hybrid cars.

Table A2: State Motor Vehicle Tax (%) for Diesel Cars and Share in National Car Sales

States	MV Tax Rate for Diesel Cars (%)	Private Diesel Car Registrations in FY 2024–25	States' Share in National Diesel Private Car Sales in FY 2024–25 (%)	Commercial Diesel Car Registrations in FY 2024–25	States' Share in National Diesel Commercial Car Sales in FY 2024–25 (%)
Maharashtra	14	95,819	14.8	3,788	13.6
Uttar Pradesh	11	84,874	13.2	1,997	7.2
Gujarat	6	74,266	11.5	2,620	9.4
Karnataka	19	51,239	7.9	1,085	3.9
Haryana	8	52,976	8.2	2,180	7.8
Tamil Nadu	18	37,858	5.9	1,296	4.7
Rajasthan	7	55,537	8.6	3,125	11.2
Kerala	11	16,374	2.5	269	1.0
Madhya Pradesh	12	44,259	6.9	2,262	8.1
Delhi	13	10,087	1.6	82	0.3

Source: Ministry of Road Transport and Highways (n.d.); Ministry of Road Transport and Highways (n.d.-a).

Note: Diesel car sales include diesel and diesel/hybrid cars.

Table A3: State Motor Vehicle Tax (%) for Compressed Natural Gas Cars and Share in National Car Sales

States	MV Tax Rate for CNG Cars (%)	Private CNG Car Registrations in FY 2024–25	States' Share in National CNG Private Car Sales in FY 2024–25 (%)	Commercial CNG Car Registrations in FY 2024–25	States' Share in National CNG Commercial Car Sales in FY 2024–25 (%)
Maharashtra	9	1,36,091	23	46,400	25
Uttar Pradesh	11	1,02,141	17	23,753	13
Gujarat	6	1,25,623	21	11,168	6
Karnataka	19	11,623	2	22,414	12
Haryana	6	61,403	10	26,787	14
Tamil Nadu	18	9,196	2	18,261	10
Rajasthan	7	37,522	6	6,641	4
Kerala	11	2,928	0	3,931	2
Madhya Pradesh	10	37,917	6	4,057	2
Delhi	10	42,717	7	3,772	2

Source: Ministry of Road Transport and Highways (n.d.); Ministry of Road Transport and Highways (n.d.-a).
Note: CNG car sales include CNG and petrol/CNG cars.

Table A4: State Motor Vehicle Tax Rates and Contribution to National Two-wheeled Vehicle Sales

States	MV Tax Rate for a Petrol Two-wheeled Vehicle (%)	Petrol Two-wheeled Vehicle Registrations in FY 2024–25	Share in National Petrol Two-wheeled Vehicle Sales in FY 2024–25 (%)
Uttar Pradesh	10	26,36,170	15.1
Maharashtra	10	17,98,638	10.5
Tamil Nadu	10	12,10,942	7.7
Karnataka	12	11,11,073	6.8
Gujarat	6	11,86,143	6.7
Madhya Pradesh	8	11,65,461	6.6
Rajasthan	8	10,61,987	6.1
Bihar	8	10,58,060	6.1
West Bengal	6	8,89,426	5.5
Andhra Pradesh	12	6,20,682	3.6

Source: Ministry of Road Transport and Highways (n.d.); Ministry of Road Transport and Highways (n.d.-a).
Note: Petrol two-wheeled vehicle sales include petrol and petrol/ethanol fuel types.

Appendix B: Parameters Considered in Total Cost of Ownership Analysis for Different Vehicle Segments

Table A5: Parameters Considered in Total Cost of Ownership Analysis of a Private Passenger Car

Parameter	Electric	Petrol	CNG	Diesel	Source
Cost of Acquisition					
Ex-showroom price (₹)	14 lakh (2025)	11.7 lakh	12 lakh	13.1 lakh	(Tata Motors, n.d.); (Cardekho, n.d.).
Ex-factory price (₹)	13.3 lakh (2025) 12.3 lakh (2030)	9.1 lakh	9.3 lakh	10 lakh	Authors' estimation using ex-showroom prices and prevailing GST rates. For EVs, the 2030 price is estimated using battery price projections.
GST paid (₹)	xxx	2.5 lakh	2.6 lakh	2.8 lakh	Authors' estimation using prevailing GST rates from (CBIC, n.d.).
Cess paid (₹)	0	9,070	9,302	30,000	Authors' estimation using prevailing Cess rates from (CBIC, n.d.).
MV Tax rate (%)	xxx	11.7	8.8	11.5	Authors' estimation using the weighted average MV tax rate for the top 10 States, accounting for ICE car sales for each fuel type based on Appendix A.
MV Tax (₹)	xxx	1.4 lakh	1.1 lakh	1.5 lakh	Authors' estimation using the MV tax rate and ex-showroom price.
Financial incentives (₹)	–	–	–	–	Not applicable (demand incentive is not available for electric cars at the Central level, and very few States have demand incentives for electric cars).
Insurance Cost (₹)	61,712	45,257	47,745	48,774	(Cardekho, n.d.).
Interest rate on financing (%)	10.7	10.8	10.8	10.8	Authors' estimation using prevailing car loan interest rates from (SBI, n.d.), (HDFC Bank, n.d.), and (Bajaj Finserv, n.d.).
Operational Cost					
Fuel cost	6.92 (₹/kWh)	101.5 (₹/l)	85.1 (₹/kg)	91.2 (₹/l)	Authors' estimation. For petrol, diesel, and CNG, fuel cost is derived based on the weighted average of State-wise fuel prices and corresponding fuel sales across States and Union Territories. For electricity, an Average Billing Rate (ABR) has been calculated for a reference public charging station with a sanctioned load of 126 kW and a 10% capacity utilisation across 20 States. The electricity cost is then calculated as a weighted average of this ABR and the state-wise electricity sales to public charging stations.
Annual maintenance costs (₹)	3,000	5,000	5,000	6,500	(Team BHP, 2024); (Cardekho, n.d. a); (All Service Cost, n.d.).
Battery replacement costs (₹)	–	–	–	–	Not applicable (battery warranty for unlimited kms offered by Original Equipment Manufacturer (OEM) for private car (Tata Motors, n.d.)).
Other Parameters					
Battery capacity (kWh)	45	–	–	–	(Tata Motors, n.d.).
Certified energy economy	10.87 (km/kWh)	17.2 (km/l)	17.44 (km/ kg)	23.23 (km/l)	(Cardekho, n.d.).
RV (%)	7	26	26	24	Authors' estimation using the Written Down Value method using depreciation rates from (Mint, 2024).
Daily VKM (km)	33	33	33	33	(International Transport Forum, 2023).

Notes: xxx indicates that those prices are subject to change due to different scenarios.

Table A6: Parameters Considered in Total Cost of Ownership Analysis of a Commercial Passenger Car

Parameter	Electric	Petrol	CNG	Diesel	Source
Cost of Acquisition					
Ex-showroom price (₹)	14 lakh (2025)	11.7 lakh	12 lakh	13.1 lakh	Same as private car in Table A5.
Ex-factory price (₹)	13.3 lakh (2025) 12.3 lakh (2030)	9.1 lakh	9.3 lakh	10 lakh	Same as private car in Table A5.
GST paid (₹)	xxx	2.5 lakh	2.6 lakh	2.8 lakh	Same as private car in Table A5.
Cess paid (₹)	0	9,070	9,302	30,000	Same as private car in Table A5.
MV Tax rate (%)	xxx	15	11	11	Authors' estimation using the weighted average MV tax rate for the top 10 States, accounting for ICE car sales for each fuel type based on Appendix A.
MV Tax (₹)	xxx	1.4 lakh	1.1 lakh	1.5 lakh	Authors' estimation using the MV tax rate and ex-showroom price.
Financial incentives (₹)	–	–	–	–	Not applicable (no demand incentive is available for electric cars at the Central level, and very few States have demand incentives for electric cars).
Insurance Cost (₹)	77,140	56,751	60,967	59,681	Authors' estimation for commercial cars based on (Policy Bazaar, n.d.).
Interest rate on financing (%)	10.7	10.8	10.8	10.8	Same as private car in Table A5.
Operational Cost					
Fuel cost	6.92 (₹/kWh)	101.5 (₹/l)	85.1 (₹/kg)	91.2 (₹/l)	Same as private car in Table A5.
Annual maintenance costs (₹)	3,900	6,500	6,500	8,450	Authors' estimation (maintenance costs of commercial cars are considered 30% higher than private cars).
Battery replacement cost (₹)	Battery replacement after five years of operation.	–	–	–	Authors' assumption (OEM offers a battery warranty of 1.6 lakh kilometres for private cars (Tata Motors, n.d.). This is expected to represent the minimum coverage; it is assumed that one battery replacement would be required over the lifetime of a commercial car).
Other Parameters					
Battery capacity (kWh)	45	–	–	–	(Tata Motors, n.d.).
Certified energy economy	10.87 (km/kWh)	17.2 (km/l)	17.44 (km/kg)	23.23 (km/l)	(Cardekho, n.d.).
RV (%)	7	26	26	24	Same as private car in Table A5.
Daily VKM (km)	132	132	132	132	(International Transport Forum, 2023).

Note: xxx indicates that those prices are subject to change due to different scenarios.

Table A7: Parameters Considered in Total Cost of Ownership Analysis of Two-wheeled Vehicles

Parameter	Electric	Petrol	Source
Cost of Acquisition			
Ex-showroom price (₹)	1,05,372 (2025)	81,090	(Bikewale, n.d.).
Ex-factory price (₹)	1,00,354 (2025) 95,492 (2030)	63,352	Authors' estimation using ex-showroom prices and prevailing GST rates. For EVs, the 2030 price is estimated using battery price projections.
GST paid (₹)	xxx	17,738	Authors' estimation using prevailing GST rates from (CBIC, n.d.).
MV Tax rate (%)	xxx	9	Authors' estimation using the weighted average MV tax rate for the top 10 States, accounting for ICE car sales for each fuel type based on Table A4 in Appendix A.
MV Tax (₹)	xxx	7,270	Authors' estimation using the MV tax rate and ex-showroom price.
Financial incentives (₹)	5,000		Authors' estimation (demand incentive of ₹2,500/kWh is available under the PM E-DRIVE scheme in FY 2025–26 (Ministry of Heavy Industries, 2024)).
Insurance cost (₹)	7,140	6,628	(Bikedekho, n.d.); (Bikewale, n.d.).
Interest rate on financing (%)	13%	13%	(Groww, n.d.).
Operational Cost			
Fuel cost	6.92 (₹/kWh)	101.5 (₹/l)	Same as private car in Table A5.
Annual maintenance costs (₹)	1,200	1,700	(Team BHP, 2022); (Bikedekho, n.d.).
Battery replacement costs (₹)	Battery replacement after five years of operation	–	Authors' assumption (OEM offers a battery warranty of 50,000 kilometres. Considering the VKM for an electric scooter, the battery is expected to be replaced after five years (TVS, n.d.)).
Other Parameters			
Battery capacity (kWh)	2.2	–	(Bikedekho, n.d.).
Certified energy economy	34.1 (km/ kWh)	50 (km/ l)	(Bikedekho, n.d.).
RV (%)	5	26	(ICCT, 2021).
Daily VKM	33	33	(Sati, Powell, & Tomar, 2021).

Notes: xxx indicates that those prices are subject to change due to different scenarios.

About the authors

Shyamasis Das, Fellow, CSEP, has over 16 years of experience in dealing with core and cross-cutting energy and climate change issues such as energy transition, electricity distribution, mobility, demand response, emissions mitigation stocktaking, and energy subsidies. He has devoted several years to understanding and decoding different aspects of electric mobility. He has led several data-analytics-based studies on EV transition and its inter-linkages with other sectors or issues like emissions and sustainability, electricity, government finance, etc. He has been instrumental in developing road-maps and implementation guidance documents for India and other developing countries like Vietnam. He has been invited by the Ministry of Finance, Government of India, to become a Member of the Technical Committee constituted to formulate the framework for India's first Climate Finance Taxonomy. He has also worked extensively on the subject of energy transition, particularly in the context of India's power sector.

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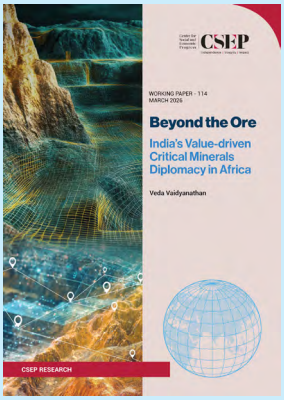
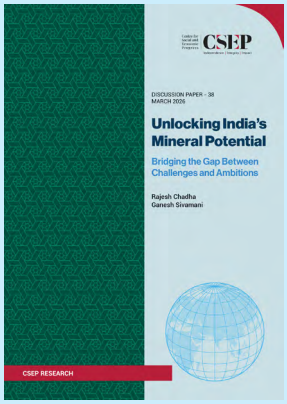
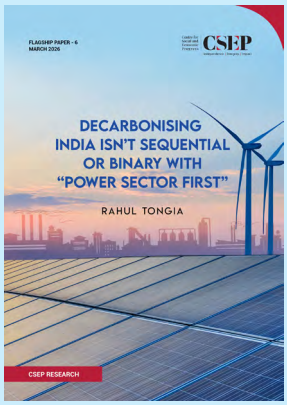
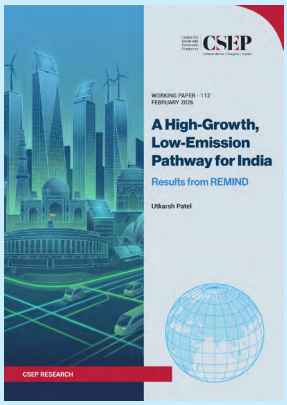
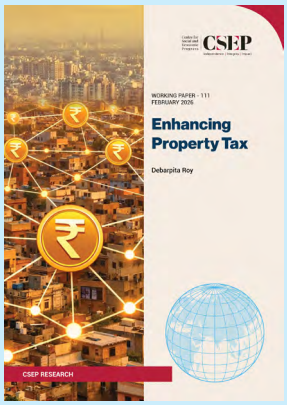
Other publications

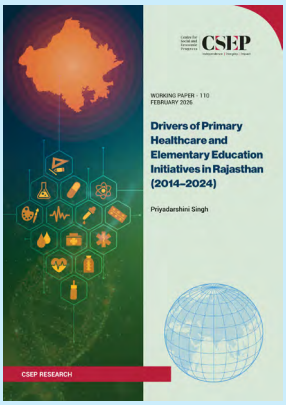


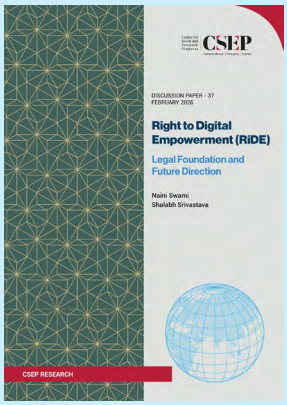


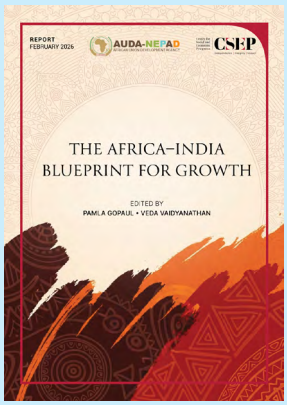


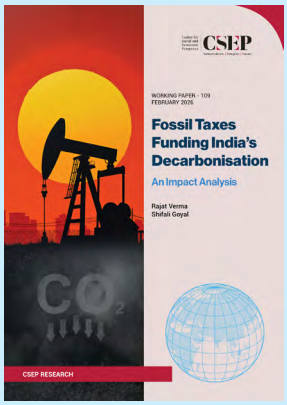


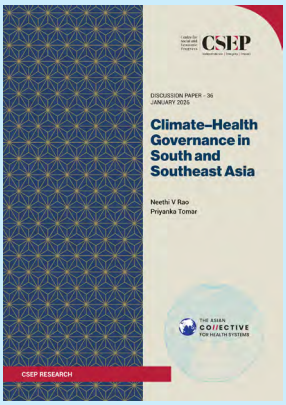


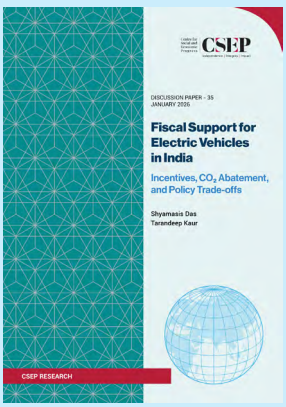


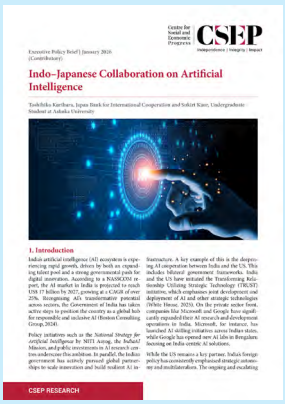












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