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Electric vehicle demand incentives in India

The FAME II scheme and considerations for a potential next phase

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EXECUTIVE SUMMARY

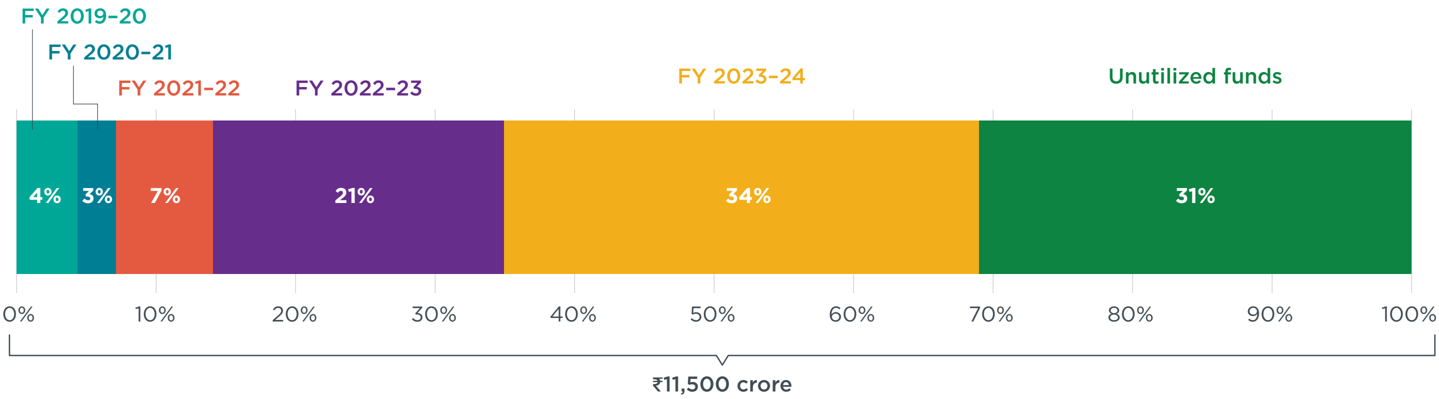
India's transport sector is a major contributor to the country's energy-related carbon dioxide (CO_2) emissions and is the fastest-growing source of carbon emissions in the country. For India to achieve its commitments under the Paris Agreement toward limiting global warming to below 2 °C, the phaseout of new internal combustion engine (ICE) vehicle sales by 2045 is imperative.

Electric vehicles (EVs) are the single most important technology for the decarbonization of the transport sector. India has been actively promoting the uptake of EVs, including through the flagship Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme, which aims to do this primarily through the provision of fiscal incentives to EV buyers. The scheme's second phase, FAME II, was launched in April 2019 with an initial budget outlay of ₹10,000 crore; that was later increased to ₹11,500 crore and the scheme concluded in March 2024. In this study, we offer insights into the FAME II scheme by examining the impact of FAME II purchase subsidies on the cost dynamics of EVs and exploring the opportunity of extending such subsidies to segments that are not yet covered under the scheme. Based on this analysis, we develop policy recommendations for a possible third phase of the program.

As presented in Figure ES1, 69% of the funds earmarked under FAME II were utilized over the duration of the program.

Figure ES1

Status of FAME II fund utilization from fiscal years 2019–20 to 2023–24



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Under the scheme's segment-specific targets regarding the number of vehicles to be supported, which were revised in February 2024, electric two-wheelers achieved 75% of the target (see Table ES1). Meanwhile, the three-wheeler segment achieved 84% of its target, the passenger car segment achieved 55%, and the bus segment achieved 66%.

Table ES1

Target number of vehicles to be incentivized under the FAME II scheme and target achievement

Vehicle segment	Target number of vehicles to be supported per original outlay	Target number of vehicles to be supported per revised outlay	Number of vehicles supported	Vehicles incentivized as a percentage of revised targets
Two-wheelers	1,000,000	1,550,225	1,170,241	75%
Three-wheelers	500,000	155,536	130,283	84%
Four-wheelers	55,000	30,461	16,631	55%
Bus	7,090	7,262	4,766	66%

Source: Ministry of Heavy Industries, Government of India (2024c)

We also examined the impact of the purchase subsidies offered under FAME II on the upfront cost and total cost of ownership (TCO) of EV models in the two-wheeler and passenger three-wheeler segments and compared this with the cost of ICE counterparts. Hypothetical incentives were also assessed for the private passenger car, private bus, and truck segments, which were not covered under FAME II. Based on this analysis, we found:

- **Two-wheeler segment:** In the absence of subsidies, the upfront cost of the electric two-wheeler is approximately twice that of the gasoline two-wheeler. On a TCO basis, the electric two-wheeler is already cheaper than the gasoline two-wheeler without subsidies. Purchase incentives for two-wheelers underwent several revisions under FAME II; the highest level of subsidy—₹15,000/kWh of battery capacity, capped at 40% of the ex-showroom price, which was offered from June 2021 to May 2023—made the upfront cost of the electric two-wheeler 1.5 times that of the gasoline two-wheeler. In general, Indian two-wheeler consumers are highly price-sensitive and place high importance on upfront cost. Subsidies, therefore, play a key role in facilitating the upfront cost competitiveness of electric two-wheelers.
- **Passenger three-wheeler segment:** Without subsidies, the on-road price of the electric passenger three-wheeler is about 1.4 times that of the conventional three-wheeler. The type of charging used (i.e., public versus residential charging) significantly impacts the TCO of the electric passenger three-wheeler: if a majority of charging is done through comparatively more expensive public charging, the TCO of the electric passenger three-wheeler is 1.1–1.5 times that of the ICE vehicles, depending on the type of fuel used (gasoline, diesel, or compressed natural gas [CNG]). The subsidy of ₹10,000/kWh of battery capacity, capped at 20% of the ex-showroom price, offered under FAME II can make EVs reasonably cost competitive with ICE counterparts on an upfront cost basis. The subsidy also bridges a considerable amount of the TCO gap between EV and ICE three-wheelers. More

broadly, scarce access to low-cost financing is a significant barrier to the uptake of EVs in this segment. In addition to purchase subsidies, therefore, measures such as interest subvention, longer repayment periods, and credit guarantees on loans could be considered under the potential next phase of FAME, to help overcome financing-related challenges faced by this segment.

» **Private passenger car segment:** Subsidies were not offered for private passenger cars under FAME II. The upfront cost of the representative EV in this segment is about 1–1.6 times that of conventional models, depending on the type of fuel used (gasoline, diesel, or CNG). On a TCO basis, the EV is cheaper than all conventional models, except the CNG model in the sedan sub-segment. With a hypothetical subsidy of ₹10,000/kWh of battery capacity, capped at 20% of ex-showroom price, the upfront cost of the EV becomes lower than that of the ICE models in the hatchback segment and is 1–1.3 times that of ICE models in the sedan and SUV segments. The subsidy also makes the electric sedan model cost-competitive with the CNG model on a TCO basis. The private passenger car market in India is highly price-sensitive and the upfront cost will significantly influence the market penetration of EVs.

» **Bus segment:** The FAME II scheme did not cover private buses, which account for 93% of the bus market in India and will play a key role in the electrification of the country's bus fleet. Private electric buses running on inter-city routes have the potential to offer an attractive TCO due to their high utilization rates. However, a lack of access to favorable financing is a crucial barrier to the uptake of EVs in this segment, among others. Looking ahead, measures such as interest subvention, longer loan tenures, and credit guarantees could help overcome financing-related challenges in this segment.

» **Truck segment:** A 100% transition to electric truck sales by 2045 is imperative for India to achieve its climate goals and its 2070 net-zero target. Subsidies were not extended to this segment under FAME II. The upfront cost of an electric truck is about 4 times that of the best-selling diesel truck, while the TCO of the electric truck is 1.2 times that the diesel truck. A hypothetical subsidy of ₹20,000/kWh of battery capacity, capped at 40% of the ex-showroom price, lowers the upfront cost to about 2.5 times that of the diesel truck and bridges 90% of the cost gap with the diesel truck on a TCO basis. Additional incentives such as waivers on toll and road taxes make the electric truck about 5% cheaper than the diesel truck.

In fiscal year 2023–24, EVs accounted for just 7% of vehicle sales in India. High upfront costs and an unfavorable financing environment remain among the major obstacles to the mass uptake of EVs, and this presents opportunities for continued targeted fiscal support to help accelerate the electric transition. If facilitating cost parity between EVs and conventional vehicles is a government objective, our findings support the following considerations for future policy:

Table ES2
Suggestions for the potential next phase of the FAME scheme

Segment	Policy considerations
Two-wheelers	Consider offering purchase subsidies for electric two-wheelers through 2025–2027, beginning with a higher subsidy of ₹15,000/kWh of battery capacity, capped at 40% of the ex-showroom price, and gradually phasing down the subsidy amount by type, in line with EV cost reduction trends.
Passenger three-wheelers	Consider offering purchase incentives of at least ₹10,000/kWh of battery capacity, capped at 20% of ex-showroom price, to enhance TCO and upfront cost competitiveness of electric passenger three-wheelers. To facilitate financing for a broader adoption of electric passenger three-wheelers, consider offering lower interest rates, longer payback periods and credit guarantees through notified agencies such as government banks and other financial institutions.
Four-wheelers	Consider offering subsidies for the purchase of private electric passenger cars of at least ₹10,000/kWh, capped at 20% of ex-showroom price.
Buses	Consider prioritizing the electrification of private inter-city buses by facilitating access to favorable financing through interventions such as interest subvention, longer loan tenures, and credit guarantees.
Trucks	Consider offering a purchase subsidy of ₹20,000/kWh of battery capacity, capped at 40% of ex-showroom price, for purchase of battery electric trucks. Targeted purchase subsidy programs, initially focusing on trucks deployed in government operations and eventually extended to private truck fleet operators, could help spur battery electric truck adoption.

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INTRODUCTION

The transport sector in India accounts for about 14% of the country's energy-related carbon dioxide (CO_2) emissions and is the fastest-growing source of carbon emissions in the country (Climate Analytics & New Climate Institute, 2020). Road transport is responsible for 90% of the sector's energy consumption (Climate Analytics & NewClimate Institute, 2020). In November 2021, India pledged to achieve net-zero greenhouse gas emissions by 2070 (Ministry of Environment, Forest and Climate Change, 2023). India is also a signatory to the Paris Agreement under the United Nations Framework Convention on Climate Change; past ICCT research has found that the country will have to phase out new sales of all internal combustion engine (ICE) vehicles by 2045 to achieve its commitments under the Paris Agreement toward limiting global warming to below 2 °C (Sen & Miller, 2023).

Electric vehicles have been found to be the single most important technology for decarbonizing road transport (International Council on Clean Transportation, 2020), and India has been actively promoting the transition to electric mobility. In fiscal year (FY) 2023–24, battery electric vehicles (EVs)—including two-wheelers, three-wheelers, passenger cars, buses, and goods vehicles—accounted for 7% of new vehicle sales in India (Ministry of Road Transport & Highways, 2024). The Faster Adoption and Manufacturing of Electric Vehicles (FAME) program is the Indian government's flagship EV promotion policy, and it seeks to spur demand for EVs through the provision of fiscal incentives to EV buyers. The second phase of the scheme, FAME II, was launched in April 2019 and concluded in March 2024 (Ministry of Heavy Industries, 2019c). Demand incentives account for the majority of funds allocated under FAME II and are the most significant policy lever under the scheme to accelerate the uptake of EVs. Media reports suggest that the government is considering implementing a third phase of the scheme, though there has been no official announcement from the government (Mukherjee, 2024).

In this context, the objectives of this study are:

1. To examine the progress of FAME II in terms of fund utilization, achievement of EV sales targets under the scheme, and the status of overall EV uptake in the country;
2. To examine the demand incentives offered under FAME II for the various vehicle segments and explore the opportunity of extending subsidies to additional segments; and
3. To develop policy considerations for a possible third phase of the scheme.

This study first provides background on FAME II, describing its components and purchase subsidies offered to each vehicle segment. The study then offers insights into the scheme in terms of fund utilization, EV sales target achievement, and the status of EV uptake in India. Further, the report assesses the impact of purchase subsidies offered under FAME II on the cost dynamics of EVs and explores the opportunity of extending incentives to segments not covered under the scheme. The study closes with considerations for future policy.

BACKGROUND

The first phase of FAME was launched in April 2015 and concluded in March 2019, with total earmarked funding of ₹895 crore and actual spending of ₹529 crore (Ministry of Heavy Industries, 2019a; Ministry of Heavy Industries & Public Enterprises, 2019b). FAME II was launched in April 2019 with initial earmarked funding of ₹10,000 crore (Ministry of Heavy Industries, 2019a). While the policy was initially approved to be implemented for a period of three years, in June 2021, its duration was extended to March 2024 with no change to its targets or fund allocation (Ministry of Heavy Industries, 2021). In February 2024, the budget outlay was increased to ₹11,500 crore and the target number of EVs to be incentivized was also revised (Ministry of Heavy Industries, 2024b; Ministry of Heavy Industries, 2024c).

Table 1 presents a summary of FAME II's components and the corresponding funds allocated to each component under the enhanced outlay. The majority of funding was allocated to demand incentives, at 61%, followed by grants for the creation of capital assets (i.e., electric buses and charging infrastructure) at 35%. The remaining funds were allocated for other miscellaneous expenditures. The ₹11,500 crore earmarked under FAME II is approximately 22 times the level of spending under FAME I.

Table 1

Components of FAME II and corresponding fund allocation

Component	Earmarked funds	Component fund share
Demand incentives (electric two-wheelers, electric three-wheelers, electric four-wheelers)	₹7,048 crore	61%
Grants for creation of capital assets (electric buses and charging infrastructure)	₹4,048 crore	35%
Other expenditure	₹404 crore	4%
Total funds	**₹11,500 crore**	**100%**

Note: Initial earmarked funding under FAME II was ₹10,000 crore, which was later raised to ₹11,500 crore in February 2024.

FAME II offered demand incentives to EVs in the two-wheeler, three-wheeler, passenger car, and bus segments. Demand incentives were made available to EV buyers at the point of sale in the form of a reduced upfront purchase price, which was later reimbursed to original equipment manufacturers by the central government. The scheme required EVs to be equipped with advanced batteries and meet segment-specific performance and efficiency criteria to be eligible for incentives.[1] For electric two-wheelers (E2Ws), both private and commercial-use vehicles were eligible for incentives. For electric three-wheelers (E3Ws), electric four-wheelers, and electric buses, only vehicles used for public transport or registered for commercial purposes were eligible.

The subsidy amount was indexed to the battery capacity of the vehicle and the maximum incentive was capped at a certain percentage of the price of the vehicle. Further, for the EV to be eligible for the subsidy, its ex-factory price was required to be below a certain price threshold. Per the International Energy Agency, the introduction of price caps for EV incentive eligibility might be partly responsible for declines in

1 Advanced batteries refer to new generation batteries such as lithium polymer, lithium iron phosphate, lithium cobalt oxide, lithium titanate, lithium nickel manganese cobalt, lithium manganese oxide, metal hydride, zinc air, sodium air, nickel zinc, lithium air, and other similar chemistries under development or currently in use. In addition, batteries should have a specific density of at least 70 Wh/kg and a cycle life of at least 1,000 cycles.

the prices of battery electric cars in China and plug-in hybrid cars in Europe in 2020 (International Energy Agency, 2021). FAME II also specified target numbers of vehicles to be incentivized in each segment.

Table 2 presents a summary of the incentives available for each vehicle segment, maximum incentive amount, the price threshold for vehicle eligibility, and target number of vehicles to be supported in each segment under FAME II. As noted above, segment incentivization targets were revised under the enhanced scheme outlay in February 2024; Table 2 presents the original and revised targets. The bus segment received the highest subsidy amount, at ₹20,000 per kWh of battery capacity. Maximum incentives were calculated as a percentage of the ex-showroom price except in the case of E2Ws, for which incentives underwent two revisions, the second of which was based on the ex-factory price.[2]

Table 2

Segment-specific incentive amounts per kWh of battery capacity, incentive amount cap, maximum ex-factory prices of EV, and target number of EVs to be supported under FAME II

Vehicle segment	Incentive amount per kWh of battery capacity	Maximum incentive as a percentage of vehicle price	Maximum ex-factory price of EV	Original target number of EVs to be supported under FAME II	Target number of EVs to be supported under FAME II revision
Two-wheelers	₹10,000	15% of ex-factory price	₹150,000	1,000,000	1,550,225
Three-wheelers	₹10,000	20% of ex-showroom price	₹500,000	500,000	155,536
Four-wheelers	₹10,000	20% of ex-showroom price	₹1,500,000	55,000	30,461
Bus	₹20,000	40% of ex-showroom price	₹20,000,000	7,090	7,262

Source: Ministry of Heavy industries, Government of India
Note: The incentive amount and maximum incentive for the electric two-wheeler segment was updated twice (see Footnote 2); the incentive amounts for electric two-wheelers presented in the table reflect the policy in effect at the end of the program.

There has been no official announcement by the government about the implementation of a third phase of the scheme. In March 2024, the government launched the Electric Mobility Promotion Scheme (EMPS) 2024, wherein purchase subsidies are offered for electric two-wheelers and electric three-wheelers from April to July 2024 (Ministry of Heavy Industries, 2024a). With a funding outlay of ₹500 crore, the scheme offers a purchase subsidy of ₹5,000 per kWh of battery capacity to EV buyers, with the maximum incentive amount per vehicle capped at either ₹10,000 per EV or 15% of the ex-factory price, whichever is lower. The subsidy amount offered under the EMPS is lower than was offered under FAME II.

2 Incentives for E2Ws were initially set at ₹10,000 per kWh of battery capacity, with the maximum incentive amount set at 20% of the ex-showroom price of the vehicle. However, in June 2021, the incentive was increased to ₹15,000 per kWh and the incentive cap was raised to 40% of the ex-showroom price. In June 2023, the incentive amount for E2Ws was reduced to the initial level of ₹10,000 per kWh of battery capacity and the cap was lowered to 15% of the ex-factory price of the vehicle (Ministry of Heavy Industries, 2023).

FAME II FUND UTILIZATION AND ELECTRIC VEHICLE UPTAKE

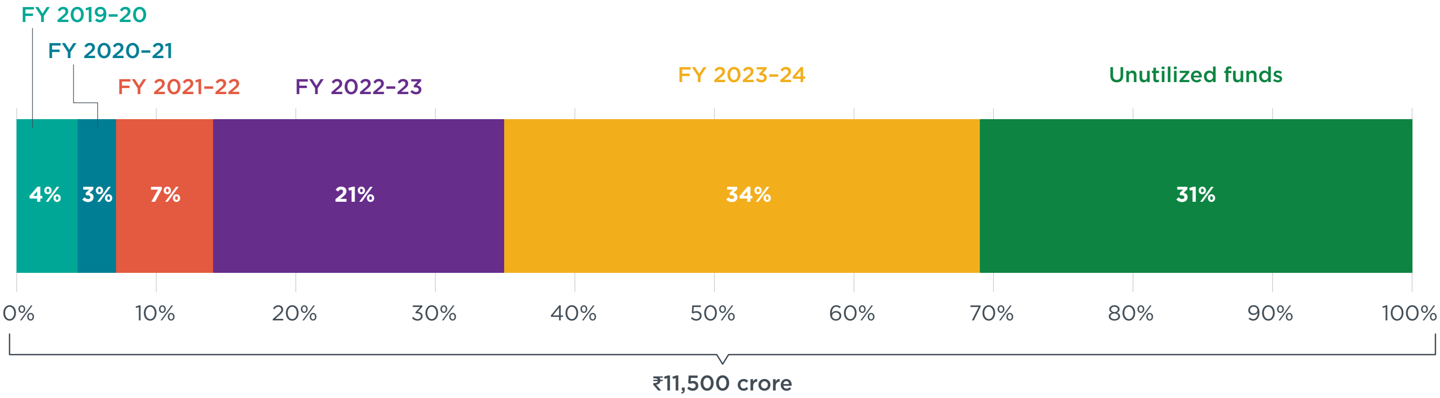
Table 3 and Figure 1 present the annual fund utilization under FAME II. Approximately 4% of total funding for the scheme was utilized in the first year, 3% in the second year, 7% in the third year, 21% in the fourth year, and 34% in the fifth year (Ministry of Heavy Industries, 2024c). On a cumulative basis, 69% of the ₹11,500 crore earmarked under the scheme was utilized. In comparison, of the ₹895 crore earmarked under Fame I, a total of ₹529 crore was utilized across the program's duration, a fund utilization rate of 59% (Ministry of Heavy Industries, 2019a; Ministry of Heavy Industries & Public Enterprises, 2019b).

Table 3
FAME II fund utilization breakdown from FY 2019–20 to FY 2023–24

Year of operation	Fiscal year	Funds utilized	Percentage of earmarked funds
Year 1	FY 2019–20	₹500 crore	4%
Year 2	FY 2020–21	₹318 crore	3%
Year 3	FY 2021–22	₹800 crore	7%
Year 4	FY 2022–23	₹2,401 crore	21%
Year 5	FY 2023–24	₹3,921 crore	34%
Total funds utilized		**₹7,940 crore**	**69%**
Unutilized funds		**₹3,560 crore**	**31%**
Total funds earmarked under FAME II		**₹11,500 crore**	**100%**

Source: Ministry of Heavy Industries, Government of India

Figure 1
FAME II fund utilization breakdown from FY 2019–20 to FY 2023–24



Source: Ministry of Heavy Industries, Government of India (2024c)

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Table 4 presents the number of EVs targeted for incentives under FAME II under the original outlay and under the revised outlay in the two-wheeler, three-wheeler, passenger car, and bus segments, and the percentage of each target achieved per the revised outlay (Ministry of Heavy Industries, 2024c). The two-wheeler segment saw a target achievement of 75%. The three-wheeler segment achieved 84% of its target, the passenger car segment achieved 55%, and the bus segment achieved 66% (Ministry of Heavy Industries, 2024c).

Table 4

Target number of vehicles to be incentivized under the FAME II scheme and target achievement

Vehicle segment	Target number of vehicles to be supported per original outlay	Target number of vehicles to be supported per revised outlay	Number of vehicles supported	Vehicles incentivized as a percentage of revised targets
Two-wheelers	1,000,000	1,550,225	1,170,241	75%
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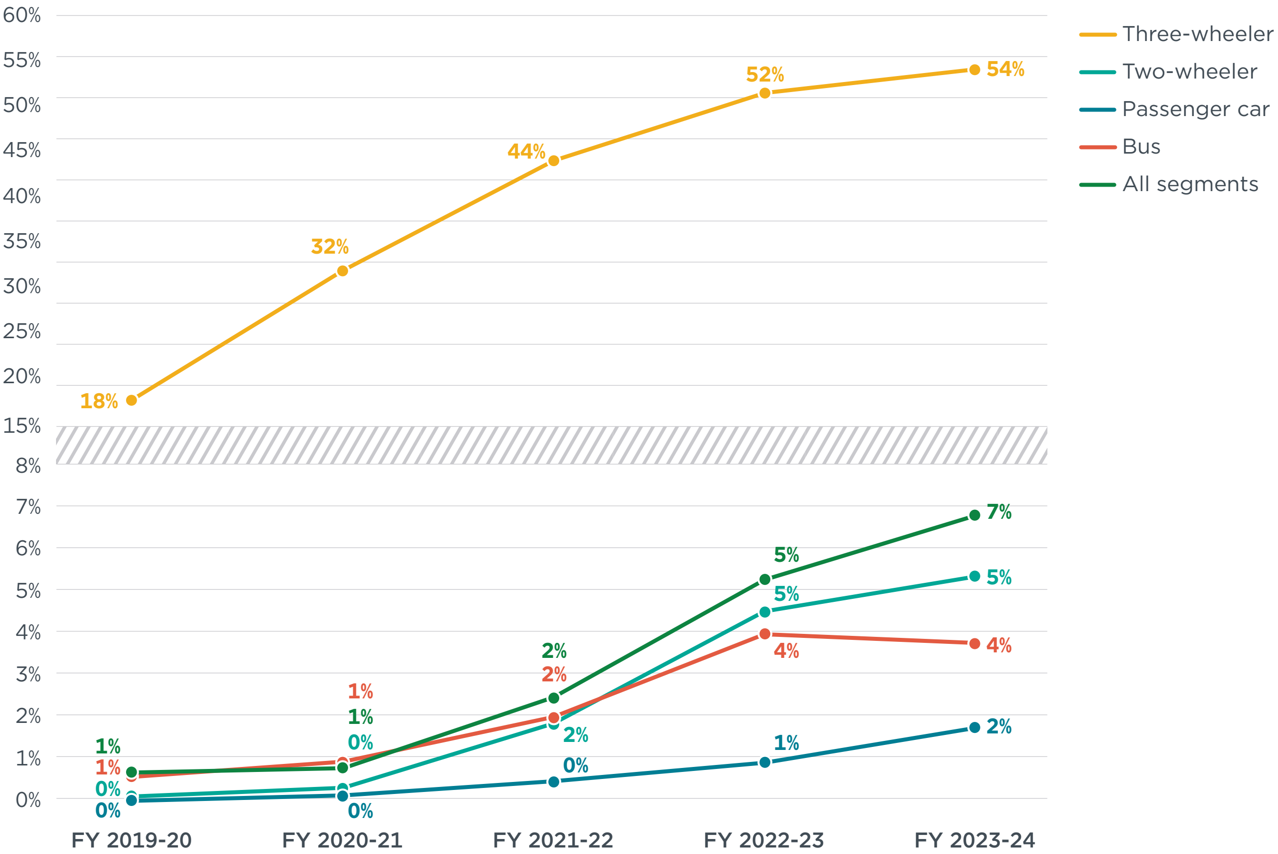
Source: Ministry of Heavy Industries, Government of India (2024c)

The rate of target achievement may have been influenced by multiple factors, such as the availability of vehicle models and charging infrastructure, access to financing, and consumer perceptions (Dash et al., 2021; Nimesh et al., 2023; CESL, 2022). The scope of this study is limited to examining the impact of the subsidies on cost parity dynamics.

Figure 2 traces the EV registration percentage in India from FY 2019–20 (the launch of FAME II) to FY 2023–24, by segment (Ministry of Road Transport & Highways, 2024). While the EV uptake rate in the two-wheeler segment was less than 1% in FY 2019–20, it rose to 5% in FY 2023–24. The three-wheeler segment displayed the highest electrification rate, rising from 18% in FY 2019–20 to 54% in FY 2023–24. Uptake of EVs in the passenger car segment was almost entirely absent in FY 2019–20, but rose to approximately 2% in FY 2023–24. In the bus segment, EV uptake rose from 1% in FY 2019–20 to 4% in FY 2023–24. On a cumulative basis, EV penetration rose from 1% in FY 2019–20 to 7% in FY 2023–24.

Figure 2
Annual EV uptake in new vehicle sales from FY 2019–20 to FY 2023–24



Source: Ministry of Road Transport and Highways (2024)

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DEMAND INCENTIVES ANALYSIS AND RECOMMENDATIONS

We next study the impact of the purchase subsidies offered under FAME II on the upfront cost and the total cost of ownership (TCO) of EVs and examine the effectiveness of demand incentives in bringing about cost parity with conventional vehicles. We also explore the opportunity of extending incentives to segments that were not covered under the scheme's benefits. For the analysis, we studied representative models in each vehicle category. For upfront cost, we undertook an on-road cost analysis.[3] For the TCO analysis, the first-use ownership duration of the respective vehicle segment was considered; assumptions regarding the duration of first-use ownership vary between segments. Details on vehicle models, cost drivers, and assumptions used in the analysis are presented in the appendix. This analysis is then used to develop policy recommendations for future demand incentives.

TWO-WHEELER SEGMENT

The market for on-road vehicles in India is dominated by two-wheelers, which accounted for approximately 75% of the vehicle sales in the country in FY 2022–23 (Society of Indian Automobile Manufacturers, 2023). The segment is responsible for about 60% of India's gasoline consumption, and tailpipe CO_2 emissions from the segment have been estimated to be nearly 38 megatonnes annually (Anup & Deo, 2021). Rapid electrification of two-wheelers could significantly advance the pursuit of India's energy security, climate mitigation, and vehicle electrification goals. Further, two-wheeler manufacturing capacity far exceeds that of any other vehicle segment in India and has the potential to more than double, to 50.6 million units annually, by 2026 (MarkLines, 2019). There is thus high potential to develop local EV manufacturing capacity at scale, contributing to lowering EV battery and component costs.

As mentioned above, purchase subsidies for E2Ws underwent two revisions during FAME II. Figure 3 presents the monthly sales share of E2Ws in the two-wheeler market from April 2019, when the scheme came into force, until February 2024, highlighting the prevailing incentive policy during the corresponding time period (Ministry of Road Transport & Highways, 2024). Monthly EV uptake remained below 1% for all months during the first incentive policy period. During the second incentive policy period, monthly EV uptake rose from 0.4% in June 2021 to 7.1% in May 2023. According to the 2021 Year-End Review of the Ministry of Heavy Industries, the sale of E2Ws increased from 700 per week to over 5,000 per week after the subsidy restructuring (Ministry of Heavy Industries, 2021). Sales of E2Ws in FY 2021–22 were six times that of sales in the previous year.

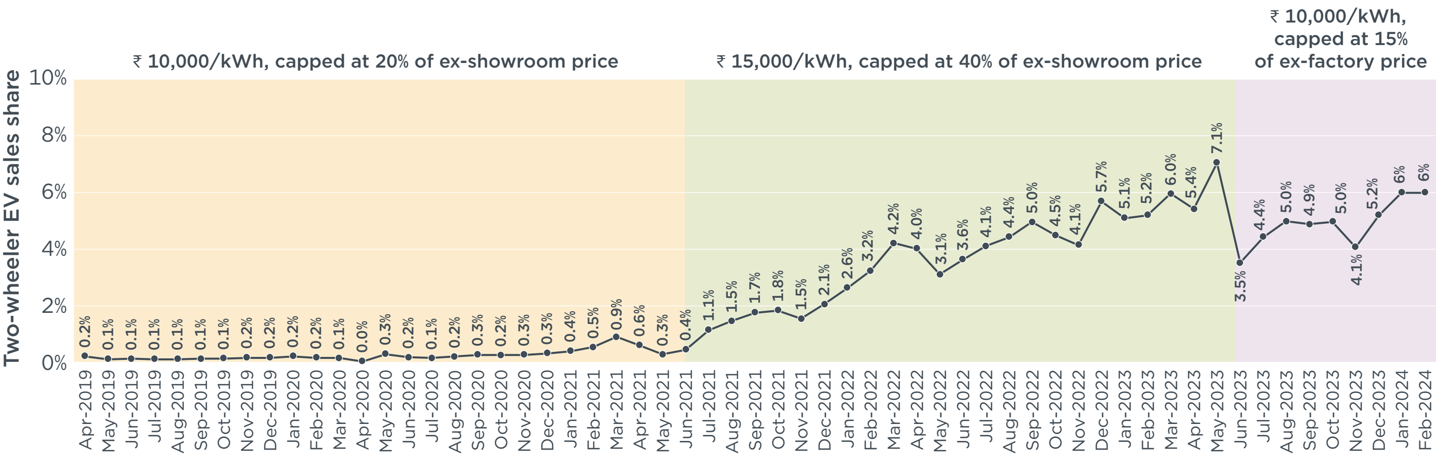
In response to an ensuing subsidy reduction in June 2023, E2W manufacturers either partially or fully passed on the amount of subsidy markdown to the consumer by raising the prices of their vehicles, which caused E2W sales to slow considerably (Luthra, 2023). In the first month under the new subsidy, the EV uptake rate fell to 3.5% and E2W sales witnessed a month-on-month drop of 57%, falling to their lowest point in a year. The E2W market subsequently grew, but at a reduced pace: the uptake rate rose to 5.2% in December 2023 and 6% in February 2024. E2W sales grew at a monthly average of 9% in the 6 months preceding June 2023, but an average of just 3% in the 6 months following the subsidy reduction. Further, during this period, some E2W models covered under FAME II were made ineligible for incentives under the scheme in light of

3 On-road price refers to the ex-showroom price plus registration fee, tax collected at source, road tax and other vehicular state taxes and fees. Ex-showroom prices of vehicle models were sourced from the respective manufacturer websites.

alleged violations of the vehicle localization and ex-factory price norms of the scheme (Kumar, 2023).

Figure 3

Monthly sales share of electric two-wheelers in the two-wheeler market, April 2019 to February 2024



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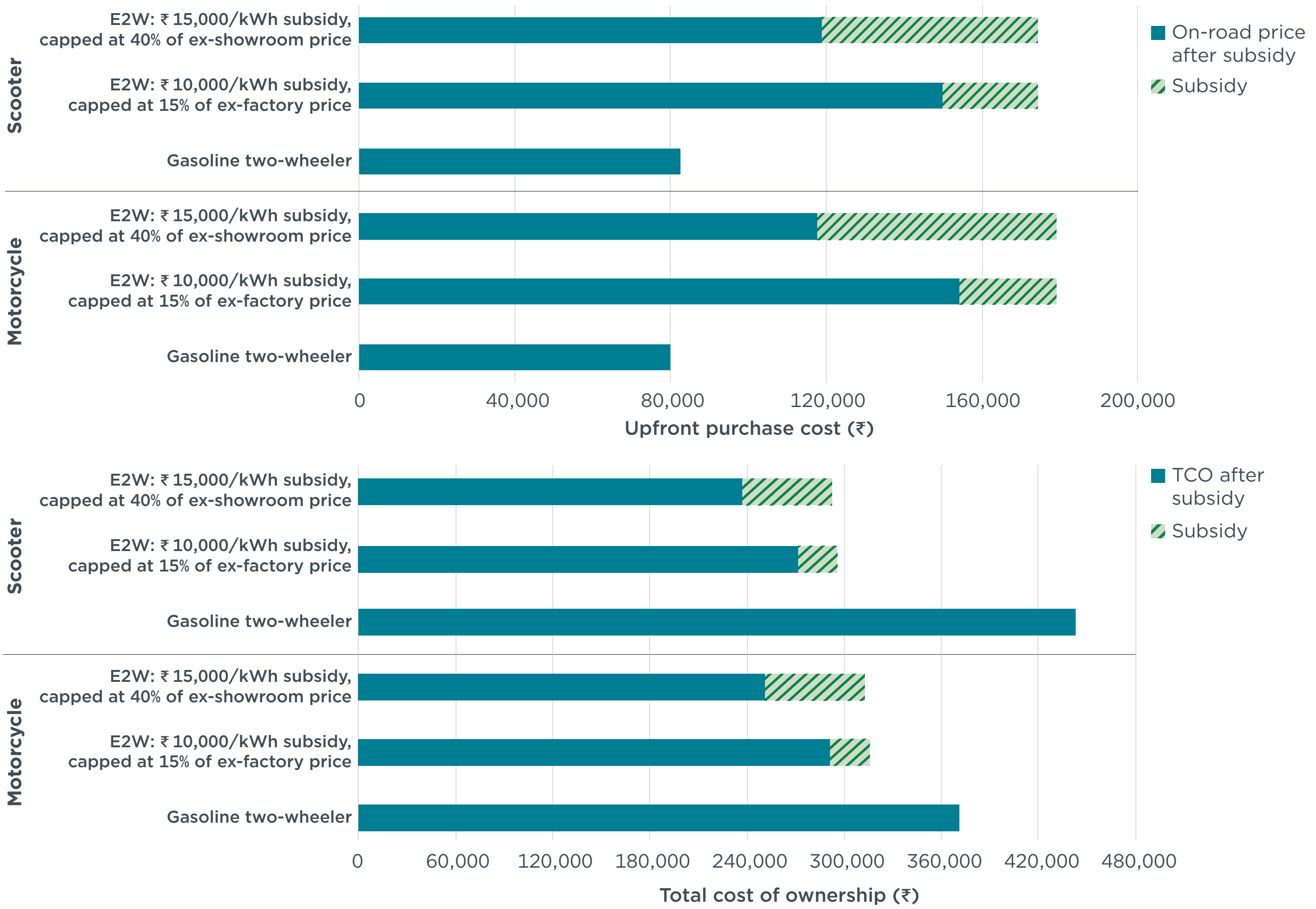
As the impact of the first E2W subsidy policy on upfront cost and TCO was analyzed in a previous ICCT publication (Rokadiya et al., 2021), this paper assesses the impact of the second and third subsidy regimes on the cost competitiveness of representative E2Ws with gasoline two-wheelers by comparing the upfront cost and the 5-year TCO in the scooter and motorcycle segment.[4] The top chart of Figure 5 presents the on-road price of E2Ws under these two subsidy scenarios and compares this to the on-road price of the gasoline two-wheeler. The on-road price of the E2W is approximately twice the price of the gasoline model, absent subsidies. The ₹15,000 subsidy scenario bridges 61%–62% of the on-road price gap, making the assessed E2Ws more expensive than conventional two-wheelers by about ₹37,000. However, under the ₹10,000 subsidy scenario, about 25%–27% of the price gap is bridged and E2Ws are considerably more expensive than conventional models, by approximately ₹70,000.

The bottom chart of Figure 4 presents the 5-year TCO analysis of E2Ws under the two subsidy scenarios and compares this to the TCO of the gasoline two-wheeler. Even without subsidies, the E2Ws are already cheaper than gasoline models; subsidies help in enhancing the cost advantage.

4 Refer to Table A1 in the appendix for details on cost drivers, assumptions, and vehicle models considered.

Figure 4

Comparative analysis of upfront cost and 5-year total cost of ownership for electric two-wheelers and gasoline two-wheelers under the second and third subsidy scenarios



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Research published previously by the ICCT found that under the ₹15,000 per kWh subsidy scenario, upfront cost parity for short- and mid-range E2Ws would be expected to emerge in 2025–27 (Rokadiya, 2021), while under a ₹10,000 per kWh subsidy scenario, the attainment of upfront cost parity would be delayed by 4 to 5 years (Rokadiya et al., 2021). Purchasers of E2Ws in India are generally highly price-sensitive and accord high importance to upfront cost when making purchase decisions. Further, access to low-cost finance is a major challenge for this segment (Abidi, 2021). Therefore, although some E2Ws have already attained TCO parity with gasoline models, the upfront cost is likely to largely dictate market penetration.

If achieving cost parity with conventional two-wheelers is a government objective, a purchase subsidy of ₹15,000/kWh of battery capacity, capped at 40% of the ex-showroom price, could be offered initially and gradually reduced in accordance with EV cost reduction trends. A policy providing for the gradual phasedown of subsidies could also help motivate consumers to purchase E2Ws earlier, when the subsidy is higher.

Recommendation: To facilitate cost parity between E2Ws and conventional two-wheelers, consider offering purchase subsidies to electric two-wheelers 2025–27, beginning with a higher subsidy of ₹15,000/kWh of battery capacity, capped at 40%

of the ex-showroom price, and gradually phasing down the subsidy amount by type, in line with EV cost reduction trends.

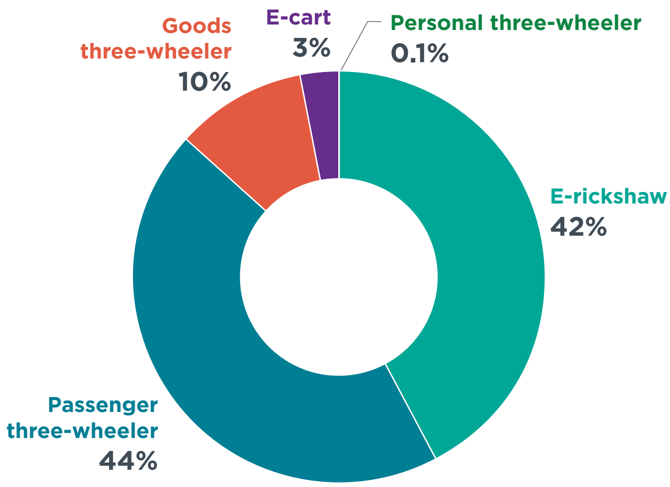
More broadly, subsidies for this vehicle segment have undergone frequent and unanticipated revisions. As discussed in greater detail below, rapidly changing policies create uncertainty in the EV ecosystem and make it challenging for stakeholders like manufacturers, investors, and consumers to undertake long-term planning, which risks slowing down the transition (Dinakar, 2023). Continued and stable long-term policy support could help to enhance the affordability of E2Ws and boost demand for E2Ws in the country.

THREE-WHEELER SEGMENT

The E3W segment has emerged as the frontrunner in India's electric mobility transition. Uptake of EVs in the three-wheeler segment stood at 54% in FY 2023–24, the highest across all vehicle segments. The segment is further divided into five sub-segments: e-rickshaws,[5] e-carts,[6] goods three-wheelers,[7] passenger three-wheelers (also known as "autorickshaws"),[8] and personal three-wheelers (The Motor Vehicles Act, 1988). Figure 5 presents the share of each sub-segment among three-wheeler sales in 2023–24, which totaled 11.7 lakh (Ministry of Road Transport & Highways, 2024). Passenger three-wheelers accounted for the majority of sales in the three-wheeler segment, at 44%. This was closely followed by e-rickshaws, which do not have any direct ICE counterpart, at 42%.[9] Goods three-wheelers accounted for 10% of sales, while e-carts and personal three-wheelers accounted for 3% and 0.1%, respectively.

Figure 5

Three-wheeler sales by sub-segment, FY 2023–24



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5 As per Central Motor Vehicles Rules, 1989, "e-rickshaw" means a special purpose battery operated vehicle having three wheels and intended to provide last mile connectivity for transport of passengers for hire or reward, provided, - (i) Such vehicle is constructed or adapted to carry not more than four passengers, excluding the driver, the not more than 40 kilograms luggage in total; (ii) The net power of its motor is not more than 2000 W; (iii) The maximum speed of the vehicle is not more than 25 kilometers per hour;

6 As per Central Motor Vehicles Rules, 1989, "e-cart" means a special purpose battery operated vehicle having three wheels and intended to provide last mile connectivity for carrying goods for hire or reward, provided, - (i) Such vehicle is constructed or adapted for carrying goods by providing a separate load body or compartment with a maximum weight of 310 kilograms in addition to driver; (ii) The net power of its motor is not more than 2000 W; (iii) The maximum speed of the vehicle is not more than 25 kilometers per hour;

7 L5N category under Central Motor Vehicles Rules, 1989 defined as a three-wheeler on account of its technical features intended to carry goods.

8 L5M vehicle category under Central Motor Vehicles Rules, 1989, defined as a three-wheeler on account of its technical features intended to carry passengers.

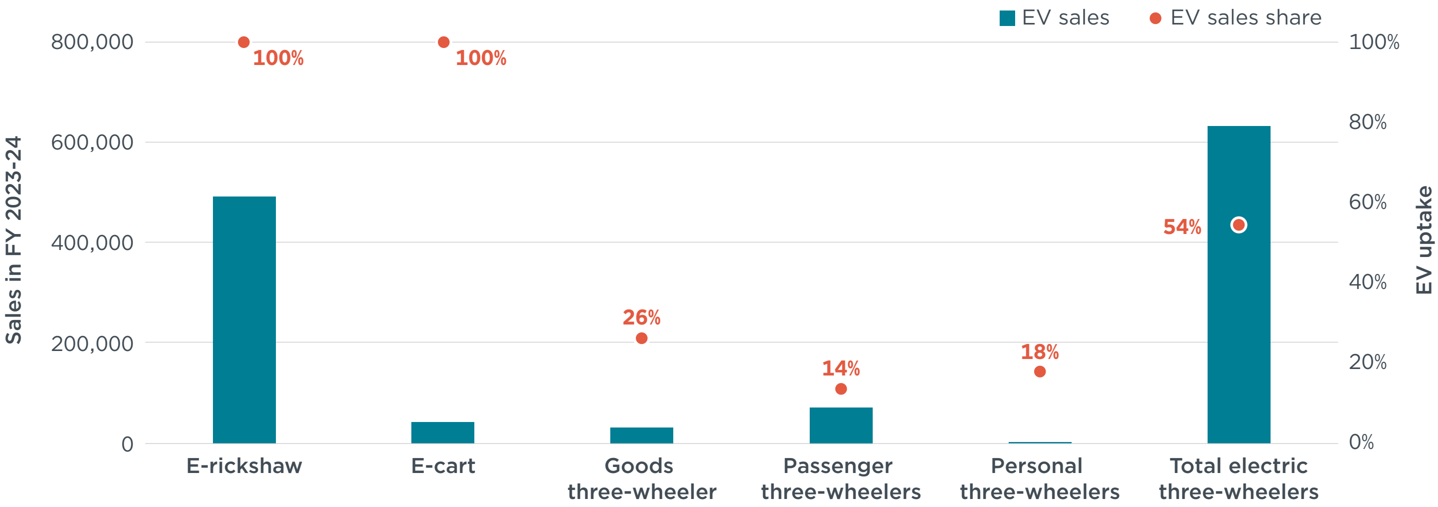
9 Conventional rickshaws are non-electric three-wheelers that are manually pedaled.

Figure 6 presents the sales of EVs and the EV uptake rate in each of these sub-segments in FY 2023–24. The high electrification rate among three-wheelers is primarily driven by e-rickshaws, which accounted for 78% of total E3W sales. High e-rickshaw sales can be attributed, in part, to their low upfront cost, linked to the fact that most e-rickshaws are powered by comparatively inexpensive lead-acid batteries (Nimesh et al., 2023; Philip, 2019). The e-rickshaw and e-cart sub-segments have 100% electrification rates because neither has an ICE equivalent; among E3Ws with an ICE counterpart, goods three-wheelers had the highest uptake rate, at 26%. The EV uptake rate was 18% for personal three-wheelers and 14% for passenger three-wheelers.

As noted above, the passenger three-wheeler segment has recently accounted for the majority of three-wheeler sales. If achieving electrification of the three-wheeler segment is a government objective, accelerating EV uptake in the passenger three-wheelers will be critical. Thus, the cost analysis focuses on the passenger three-wheeler segment.

Figure 6

Three-wheeler sales by type and EV sales share, FY 2023–24



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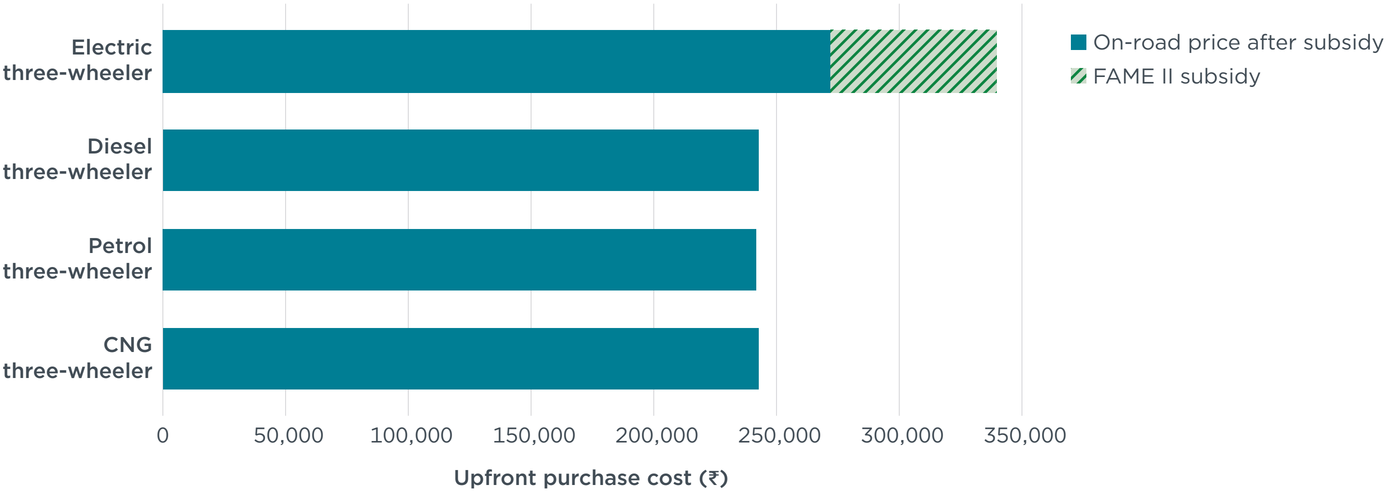
The subsidy for passenger E3Ws under FAME II was ₹10,000/kWh of battery capacity, capped at 20% of the ex-showroom price. To examine the impact of the subsidy, we analyze the upfront cost and TCO of representative passenger E3Ws and compare them with those of selected petrol, diesel, and compressed natural gas (CNG) passenger three-wheelers.[10] As presented in Figure 7, without subsidies, the on-road price of passenger E3Ws is 1.4 times that of the conventional models. The ₹10,000/kWh subsidy, capped at 20% of ex-showroom price, is able to bridge approximately 70% of the gap in the on-road price between E3Ws and conventional models, leaving E3Ws more expensive by about ₹30,000. ICCT consultations with three-wheeler manufacturers indicated that buyers of passenger three-wheelers give high importance to the upfront cost when making purchase decisions.[11] Studies have found that the majority of passenger three-wheelers are operated not as part of large commercial fleets, but by individual owner-drivers who generally have limited access to financial resources (Roychowdhury & Roy, 2022; Nimesh et al., 2023). When passenger E3Ws are purchased with loans, which is common, the high upfront cost translates into a high down payment amount for the owners.

10 Refer to Table A2 in the appendix for details on cost drivers, assumptions, and vehicle models considered.
11 ICCT interactions with passenger electric three-wheeler manufacturers at stakeholder forums.

Figure 7
Comparative upfront purchase price analysis of electric passenger three-wheelers with conventional passenger three-wheelers



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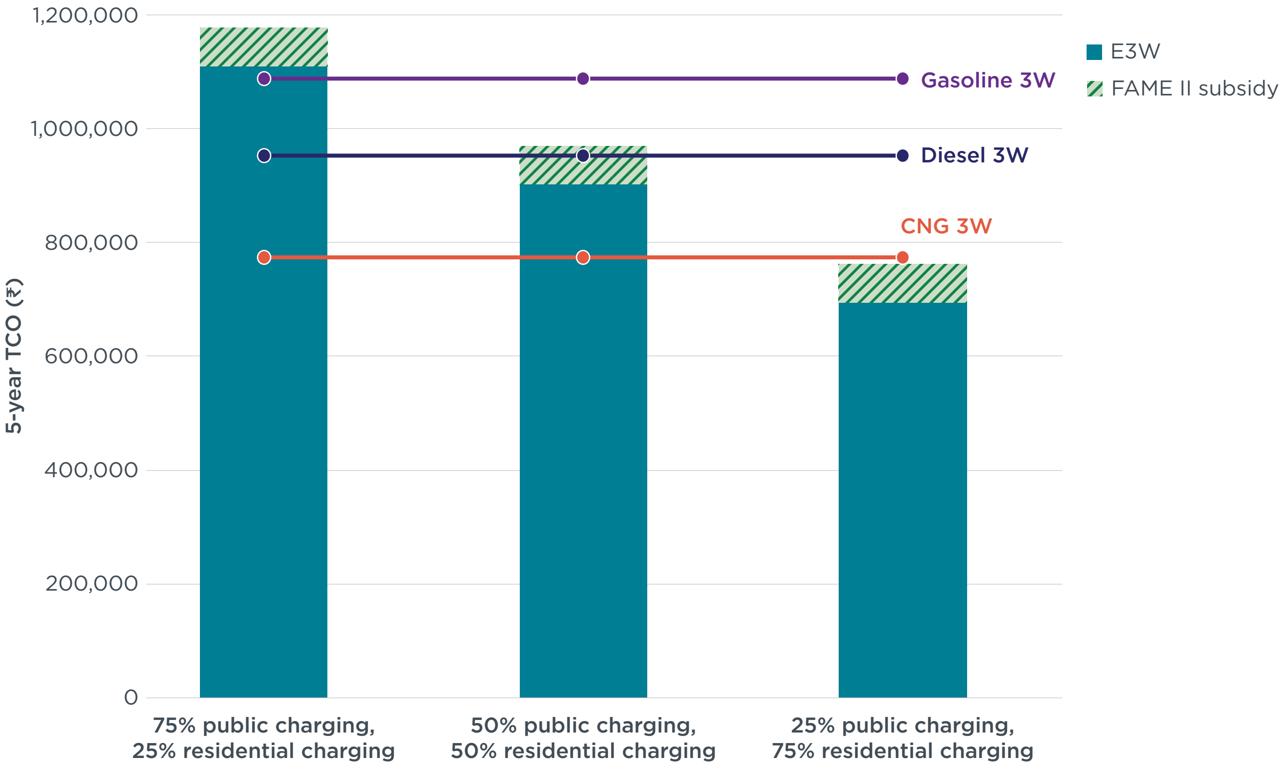
For the TCO analysis, a duration of 5 years is considered. The TCO of passenger E3Ws is heavily influenced by the type of charging used (public versus residential charging) Reliance on public charging—which is generally more expensive—varies geographically depending upon the availability of adequate charging infrastructure. To explore the impacts of charging arrangements on E3W TCO, we consider three charging scenarios: (a) 75% public charging and 25% residential charging, (b) 50% public charging and 50% residential charging, and (c) 25% public charging and 75% residential charging (public and residential charging rate assumptions are presented in the appendix). As shown in Figure 8, with 75% public charging and 25% residential charging, the TCO of the E3W is 2% higher than that of the gasoline model but 17% more expensive than the diesel vehicle and 44% more expensive than the CNG vehicle. In the case of 50% public charging and 50% residential charging, the E3W is cheaper than the gasoline model by 17% and is cost competitive with the diesel three-wheeler, but continues to be more expensive than the CNG three-wheeler by 17%. Under the scenario of 25% public charging and 75% residential charging, the E3W is cheaper than all conventional three-wheelers.

Figure 8

Total cost of ownership over 5 years of conventional passenger three-wheelers and electric passenger three-wheelers under three charging scenarios



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Of all new passenger three-wheeler sales in FY 2023–24, 63% were fueled by CNG. Without subsidies, the TCO of the passenger E3W is either equal to or more than the CNG model, depending upon the share of public charging and residential charging used by the E3W. The E3W becomes more expensive than the diesel three-wheeler when a majority of charging is performed with public chargers.

Studies have shown that for a vast share of passenger three-wheeler drivers, access to residential charging is a challenge due to a lack of dedicated parking spaces, causing them to park their vehicles on roads or in other public places (Roychowdhury & Roy, 2022; Roychowdhury et al., 2023). Further, drivers who have access to residential parking may not have the required electricity connections, electric equipment, and other infrastructure required for setting up residential charging, increasing reliance on public charging. If cost parity with conventional three-wheelers is a policy objective, purchase subsidies to lower the upfront cost and TCO of passenger E3Ws could be offered alongside policies to facilitate the development of both public and residential charging infrastructure.[12]

Recommendation: Consider offering purchase incentives of at least ₹10,000/kWh of battery capacity, capped at 20% of ex-showroom price, to enhance TCO and upfront cost competitiveness of electric passenger three-wheelers.

As noted above, owners of passenger three-wheelers generally require loans to purchase the vehicle. Surveys have found that 60%–80% of passenger three-wheeler owners in certain Indian cities, including Delhi, Lucknow and Bangalore, purchase their vehicles with loan financing (Nimesh et al., 2023). While almost all conventional

12 The scope of this paper is limited to the analysis of demand incentives under the FAME II scheme and, hence, charging infrastructure policies are not discussed here.

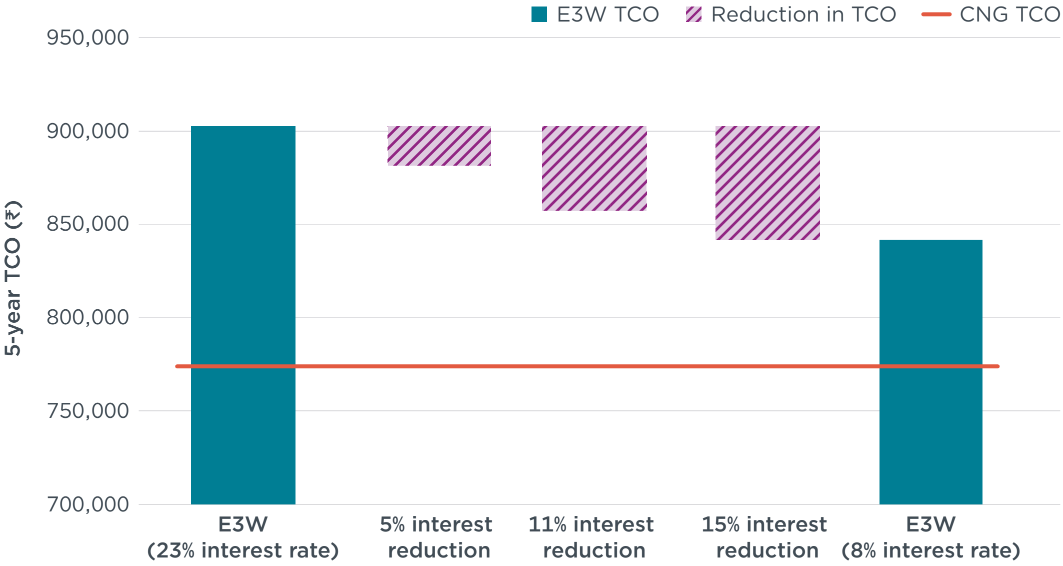
financial institutions offer loans to purchase passenger ICE three-wheelers, financing for passenger E3Ws is limited. The lack of a track record on E3W performance creates uncertainty of investment returns for financiers, which has caused them to display caution in offering financial products for this segment to date.

Certain start-ups and financial technology companies have emerged to fill the gap for E3W financing, though they generally charge interest rates considerably higher than those for ICE three-wheelers; while interest rates for ICE three-wheelers range between 7% and 17.5%, E3Ws are often financed at rates ranging from 20% to 25% (Bajaj Finance Ltd, n.d.; Roychowdhury & Roy, 2022; Roychowdhury et al., 2023).[13] Vehicle technology uncertainty, lack of creditworthiness of owner-operators, unknown resale value of E3Ws, and low demand are some of the factors contributing to high interest rates for E3Ws (Roychowdhury et al., 2023). Additionally, the loan payback period for passenger E3W financing is generally considerably shorter than that for ICE three-wheelers. The payback period for ICE three-wheeler loans offered by banks is often 4–5 years, while non-banking financial companies typically offer a payback period of up to 3 years. In contrast, the payback period for E3Ws is usually 2 years (Roychowdhury & Roy, 2022; Roychowdhury et al., 2023). All of these factors raise challenges for the mass uptake of passenger E3Ws in India.

Figure 9 presents the TCO of a passenger E3W financed with a loan of 3 years at an interest rate of 23% per annum and examines the impacts of interest rate reductions of 5%, 11%, and 15%.[14] The TCO of the passenger E3W under the three scenarios is also compared with the TCO of the CNG passenger three-wheeler, which is considered to be financed at an interest rate of 12%. With a 5% interest rate reduction, the effective interest rate becomes 18% and the policy bridges 16% of the TCO gap between the E3W and the CNG 3W. The 11% interest rate reduction policy brings the effective interest rate to 12% (i.e., equivalent to the interest rate for the CNG 3W), bridging 35% of the TCO gap. The 15% interest rate reduction policy brings the effective interest rate to 8%, bridging 47% of the TCO gap.

Figure 9

Total cost of ownership over 5 years of a passenger E3W under various interest rate scenarios compared with a CNG passenger three-wheeler



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13 These interest rates have been considered in the E3W TCO analysis undertaken above.

14 For the analysis, 50% public charging and 50% residential charging scenario is considered.

Supplementing interest subvention policies with longer payback periods could potentially yield additional benefits both in terms of lower interest burdens and lower instalment amount burdens. For instance, as compared to the baseline scenario of a 3-year loan with 23% per annum interest rate, an interest subvention of 11% combined with a longer payback period of 5 years could reduce the monthly instalment amount by 43% and the overall interest burden by 15%.

If easing financial constraints on E3W purchases were of interest to policymakers, government banks and certain other financial institutions could be required or encouraged to provide passenger E3W loans with favorable financing terms. Credit guarantees could be offered to the notified agencies to mitigate the investment risk of financiers. Further, interest subvention for E3W loans could be offered, wherein funds could be used to compensate the notified agencies for the interest amounts foregone. For instance, under the EV policy of Delhi, an interest subvention of 5% was offered for E3Ws loans from notified agencies (Transport Department, Government of National Capital Territory of Delhi, 2020; “Delhi Cabinet gives nod,” 2024). The interest amount foregone on approved loans could be directly disbursed to the notified agencies so that consumers could directly benefit from the lower interest cost. This mechanism would be similar to the purchase subsidy disbursal mechanism adopted under FAME II, wherein the subsidy amount was disbursed to original equipment manufacturers and the consumer received a lower upfront cost.

Recommendation: If addressing financial barriers to passenger E3W uptake is of interest to policymakers, consider measures to facilitate lower interest rates, longer payback periods, and credit guarantees through notified agencies such as government banks and other financial institutions.

PASSENGER CAR SEGMENT

Domestic passenger car (PC) sales in India grew from 3.1 million units in FY 2021–22 to 3.9 million units in FY 2022–23, a year-on-year increase of 27% (Society of Indian Automobile Manufacturers, 2023). With rising living standards and a desire for enhanced travel safety among Indian consumers, one analysis has projected demand for PCs to grow at a compounded annual growth rate of 8.5% between FY 2021–22 and FY 2026–27 (“Plugging into the future,” 2022). This outlook suggests an opportunity to electrify new PCs entering the country’s vehicle fleet in the coming years.

Under FAME II, subsidies were only made available for commercial PCs, which constituted around 7% of all PC sales in India in FY 2023–24 (Ministry of Road Transport & Highways, 2024). Consequently, while PCs accounted for 17% of vehicle sales in the country in FY 2023–24 (Society of Indian Automobile Manufacturers, 2024b), they made up a comparatively smaller percentage—around 4% under the original outlay and 2% under the revised target—of vehicles targeted under the program. In FY 2022–23, the share of EVs in new sales of commercial PCs was 5%, whereas the share of EVs in new sales of private PCs was just 1% (Ministry of Road Transport & Highways, 2024). Previous research by the ICCT analyzed the impact of the subsidy on the 5-year TCO of commercial PCs (Dash et al., 2021).

In addition to its direct impacts on fleet-wide electrification, greater uptake of electric PCs can also have positive externalities for the EV ecosystem by spurring greater battery production and thereby encouraging EV battery price reductions. Previous ICCT research found that the sale of 10,00,000 E2Ws would create a demand of 2.3 GWh of battery cells, while an equivalent demand could be created by the sale of just 55,000–115,000 electric cars, because they have batteries 10–20 times larger (Gode et al., 2021). Other ICCT research projected that E2Ws and electric cars would together account for 66% of the cumulative battery capacity requirement in India in 2035 under an ambitious

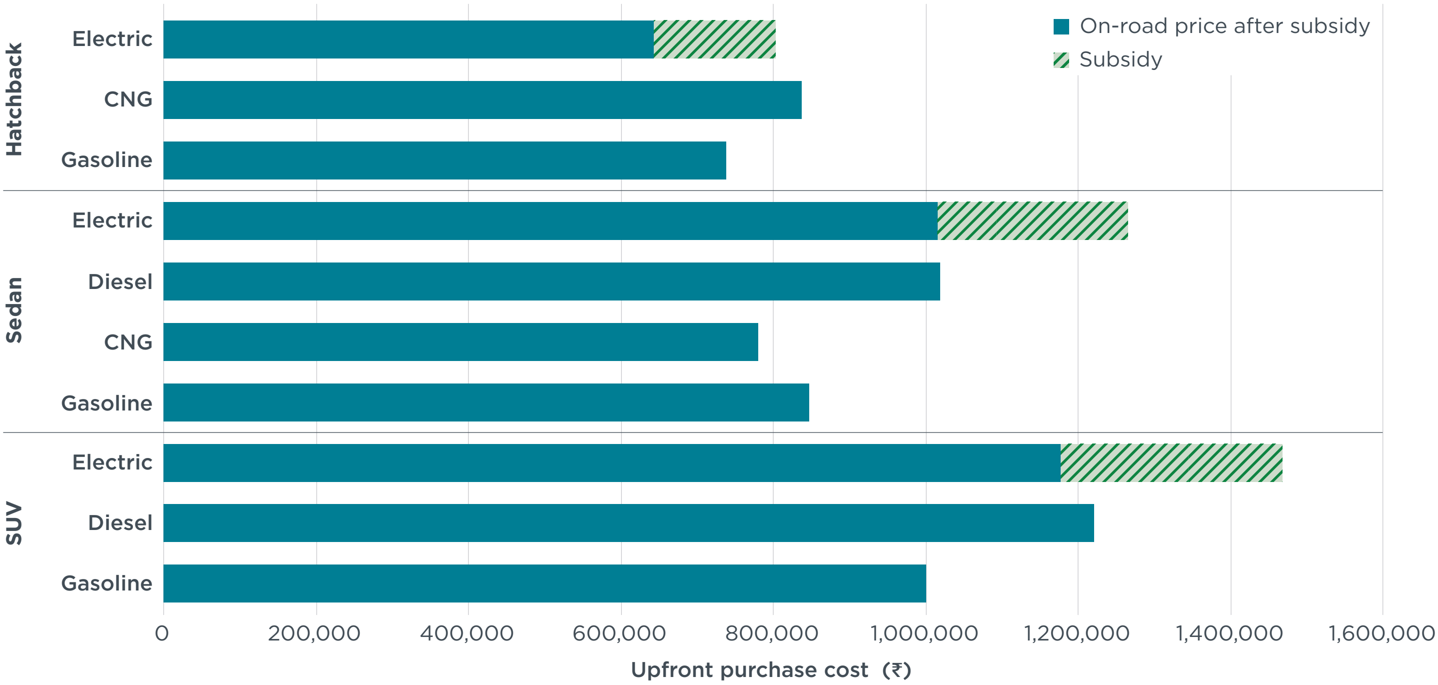
EV uptake scenario (Gode et al., 2021). By promoting the uptake of private electric PCs, a larger demand for battery cells can be generated in a shorter span of time, thereby accelerating the pace of reduction in the price of battery packs in the country.

As an exploratory exercise, we assessed the impact of a hypothetical subsidy for private electric PCs equivalent to the amount offered to commercial electric PCs under FAME II—that is, ₹10,000/kWh, capped at 20% of the ex-showroom price. The analysis considers representative PC models in the hatchback, sedan, and SUV segments[15]; results presented here pertain only to these representative models.[16] For conventional PCs, gasoline and CNG models are considered in the hatchback segment; gasoline, diesel, and CNG models are considered in the sedan segment; and diesel and gasoline models are considered in the SUV segment.

Figure 10 presents a comparative analysis of the on-road price of representative electric and conventional PCs. Without subsidies, the on-road price of the electric hatchback is slightly more expensive than the gasoline model and slightly less expensive than the CNG model. Meanwhile, in the sedan segment, the on-road price of the electric model is approximately 1.3–1.6 times that of conventional models, while in the SUV segment, the electric model is 1.2–1.5 times that of ICE counterparts. When the subsidy is included, the electric hatchback is 13% cheaper than the gasoline model and 23% cheaper than the CNG model. In the sedan segment, the subsidy bridges 60% and 52% of the price gap with the gasoline and the CNG models, respectively, and closes the full price gap with the diesel model. Meanwhile, the subsidy bridges 62% of the on-road price gap between the electric and gasoline SUV, and bridges the complete price gap with the diesel SUV. On average, after the subsidy, the electric models in the sedan and SUV segment are 1–1.2 times the price of conventional models.

Figure 10

On-road price of electric and conventional passenger cars in the hatchback, sedan, and SUV sub-segments



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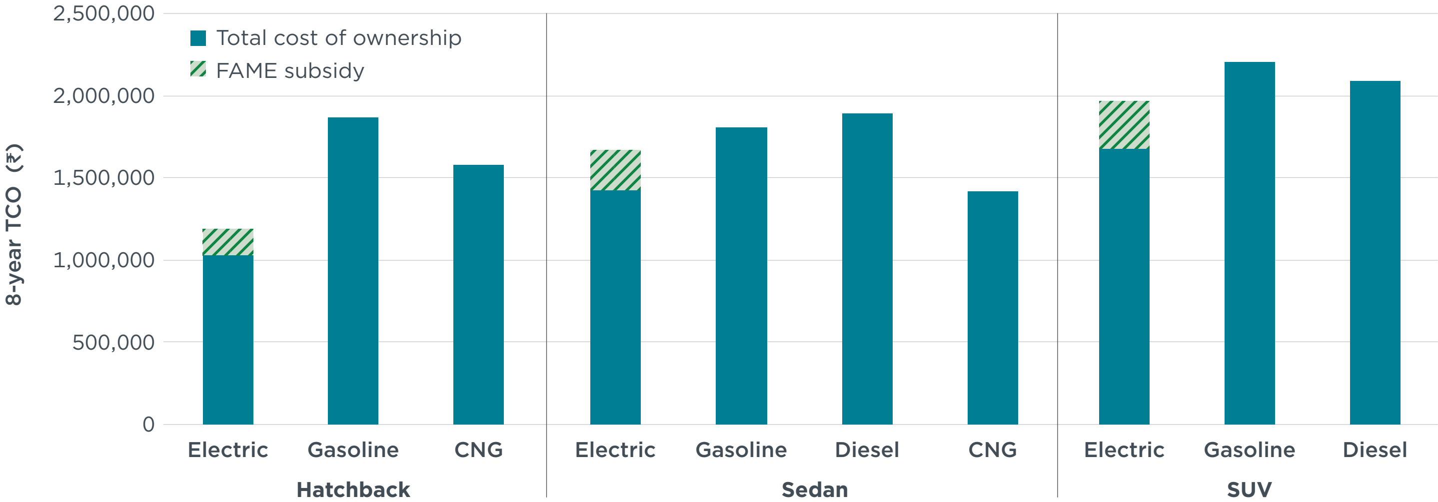
15 Compact SUVs have been considered for the analysis since the FAME II scheme offered incentives to compact SUVs and not conventional SUVs. This is because conventional SUVs exceeded the price threshold specified under the scheme for incentive eligibility.

16 Refer to Table A3 in the Appendix for details on costs, assumptions and vehicle models considered.

Figure 11 presents the comparative 8-year TCO analysis of the electric and the conventional models. In the hatchback segment, even without the subsidy, the electric model is already cheaper than the gasoline model by 36% and the CNG model by 25%. The subsidy enhances this cost advantage, making the electric hatchback 45% and 35% cheaper than the gasoline and CNG models, respectively. In the sedan segment, without subsidies, the electric model is cheaper than the gasoline model by 8% and the diesel model by 12%, though the CNG sedan is the cheapest, with a TCO that is 15% lower than that of the electric sedan. With the subsidy, the TCO of the electric sedan becomes 21% lower than that of the gasoline model, 25% lower than that of the diesel model, and approximately equal to that of the CNG model. In the SUV segment, without subsidies, the electric model is about 8% cheaper than the gasoline model and diesel models. With the subsidy of ₹10,000/kWh, the electric SUV model becomes about 22% cheaper than the conventional SUV.

Figure 11

Comparative 8-year total cost of ownership for private electric passenger cars and private conventional cars in the SUV and sedan segments



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Cities in India suffer from chronic congestion, and private vehicle ownership is witnessing continuous growth (Viegas, 2021). While purchase subsidies could encourage the uptake of electric PCs by lowering the upfront cost of vehicles for a consumer class that is highly price-sensitive, complementary measures such as scrappage policies, congestion charges, vehicle taxes, and the augmentation of public transport infrastructure could help to address the impacts of increased EV ownership on road congestion and related issues. In 2021, the Ministry of Road Transport and Highways notified the Vehicle Scrappage Policy, which offers incentives for scrapping old vehicles and for purchasing new ones, including by providing scrap value equivalent to 4%–6% of the ex-showroom price of the new vehicles and by encouraging original equipment manufacturers to provide an additional 5% discount on the purchase of a new vehicle against the scrappage of an old one (Ministry of Road Transport & Highways, n.d.). The incentives under the vehicle scrappage policy, coupled with the hypothetical subsidy of ₹10,000/kWh, could cumulatively result in cost savings of approximately ₹300,000–₹400,000 on the purchase of a new private electric PC, which has the potential to bridge at least 70% of the cost gap with conventional models and significantly enhance the economic attractiveness of electric PCs.

Recommendation: Consider offering a subsidy for the purchase of private electric passenger cars of at least ₹10,000/kWh, capped at 20% of ex-showroom price, to enhance the cost parity of private electric and conventional passenger cars.

BUS SEGMENT

Electric buses received the highest level of financial support on a per-kWh battery capacity basis under FAME II, of ₹20,000 per kWh, with a cap of 20% of the ex-showroom price of the vehicle. Only electric buses deployed for public transport by the government or municipal corporations were eligible for incentives under the scheme. Public transport buses are characterized by fixed routes, availability of dedicated parking spaces in depots, and long stops after completion of their daily schedule, all of which make them a strong candidate for electrification.

FAME II mandated the adoption of the gross cost contract (GCC) model for the deployment of electric buses. Under the GCC model, the government transit authority manages the transit system while a contracted private entity owns, operates, and maintains the buses, for which the transit authority makes periodic payments to the private entity across the life of the contract on a per kilometer basis. While traditionally the outright purchase model has been used for procurement of buses in India, the higher purchase cost of electric buses, which is 2–4 times that of conventional buses, is a major challenge for this system (CESL, 2022). The GCC model allows for a more even distribution of cash flows across the life of the electric bus contract, which facilitates better matching of revenue and expenses. Further, the GCC model facilitates the distribution of risk associated with the deployment of electric buses between the government transit authority and the private operator.

In April 2022, the bidding process was concluded for 5,450 electric buses for public transport under the government's "Grand Challenge" initiative to aggregate demand for buses across cities and homogenize procurement specifications. The per-kilometer price determined through the Grand Challenge procurement was 23%–27% lower than the prevailing cost of conventional buses in the corresponding cities; when accounting for the FAME subsidy, these prices were 31%–35% lower (CESL, 2022).

Presently, the market for electric buses in India is driven largely by demand from government undertakings for public transport, which accounts for just 7% of the approximately 2 million buses registered in India (Ministry of Road Transport & Highways, 2023). Addressing barriers to the electrification of private sector buses is therefore critical to wider electric bus adoption in India. The limited availability of financing is one key hurdle in the uptake of electric buses by the private sector. Higher perceived risk-return profiles, higher cost, and low perceived resale value of electric buses as collateral make financing a challenge for this segment (International Energy Agency, 2024). Further, studies have found that although electric buses in intercity operations could offer average profits that are higher than those of diesel buses over the service life of the vehicle, under the current financing landscape, EV bus operators could face substantially more losses than diesel buses during the loan tenure (Khanna et al., 2024).

Private inter-city bus operators have expressed their willingness to invest in electric buses to offset rising fuel costs (Dhingra & Wadhwa, 2021). Such buses account for 57% of daily bus ridership in India and 64% of total bus kilometers travelled in the country (Gadepalli et al., 2024). Further, about 40% of all inter-city bus travel in India is in the range of 250–300 km (Dhingra & Wadhwa, 2021). The Indian market already offers electric bus models that meet such range requirements (GO EC, 2023; Singh, 2022). If promoting the adoption of electric bus uptake by private operators were an aim of the government, policymakers could consider various measures, including interest subvention and longer tenures on loans for private inter-city buses, to facilitate lower interest burdens and installment amounts. To mitigate the investment risk for financiers, credit guarantees could also be offered. Such financing interventions could be rolled out through government banks and other notified financial institutions.

Recommendation: If expanding electric bus adoption is an objective of government policy, consider prioritizing the electrification of private inter-city buses by facilitating access to favorable financing through interventions such as interest subvention, longer loan tenures, and credit guarantees.

TRUCK SEGMENT

The medium- and heavy-duty truck (MHDT) segment accounts for just 3% of the on-road vehicle fleet in India but is responsible for 44% of the CO_2 emissions from road transport in the country (Kumar et al., 2022).[17] Diesel trucks accounted for 44% of the oil consumed by the road transport sector in 2020 (Kumar et al., 2022). Studies suggest that heavy-duty truck activity could witness an approximately four-fold increase by 2050, amounting to 400 billion kilometers per year (Kumar, 2021).

Recent ICCT research found that India must achieve 100% zero-emission truck sales no later than 2045 to meet its commitments under the Paris Agreement toward limiting global warming to below 2 °C (Sen & Miller, 2023). Further, the ICCT has found that for India to meet its net zero target by 2070, a 100% zero-emission truck sales share will have to be achieved by no later than 2050 (Singh & Yadav, 2024). Among existing ZET powertrain technologies, battery electric trucks (BETs) are spearheading the transition in leading EV markets globally, accounting for 94% and 97% of the ZET technology share in 2022 in China and Europe, respectively (Mulholland & Rodríguez, 2023; Shen & Mao, 2023; Buysse, 2022). Hydrogen fuel cell technology is still at a nascent stage and faces challenges in real-world applications, largely owing to the high cost of fuel cell trucks and hydrogen fuel (Xie et al., 2023).

The transition to zero-emission trucks is gaining pace in other markets. In China, ZET sales in the rigid truck and tractor-trailer truck segment stood at 7% each in 2022 (Shen & Mao, 2023). In Europe, the sales share for zero-emission trucks was at 3% in the light and medium trucks segment in 2022 (Mulholland & Rodríguez, 2023). Governments across the globe are forging ahead in undertaking policy interventions, including offering purchase subsidies, to accelerate the transition to electric ZETs (see Table 5).

17 Medium trucks are defined as those trucks with the GVW between 3.5 tonnes to 12 tonnes (N2 vehicle category as per Central Motor Vehicles Rules, 1989, of India), and heavy-duty trucks are defined as trucks with GVW of 12 tonnes and above (N3 vehicle category as per Central Motor Vehicles Rules, 1989, of India).

Table 5

Targets and purchase incentives for electric bus deployment in certain global EV markets

Government	Incentive policy
California	**Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) -** The base vehicle incentive varies depending upon the vehicle class. Under the most recent iteration of the scheme, the maximum base vehicle incentive is up to $120,000, with additional modifiers. (California Air Resources Board, 2022)
China	**A Notice on Optimizing Fiscal Subsidies for Promoting New Energy Vehicles (April 2020) -** The notice outlined the subsidy policy applicable from the end of 2020 to the end of 2022. A grant of ¥315 per kWh of battery capacity was offered to BEV trucks, subject to a subsidy ceiling depending upon the gross vehicle weight of the BEV. (International Council on Clean Transportation, 2020)
France	**Ecological Bonus 2022 -** Purchase incentives were offered to HDVs that use electricity, hydrogen, or a combination of both as an exclusive source of energy. The amount of subsidy was calculated as 40% of the acquisition cost including all taxes, up to a maximum of €50,000. (Ministry of Ecological Transition, 2022)
Germany	**Directive on the promotion of light and heavy commercial vehicles with alternative, climate-friendly drives and associated refuelling and charging infrastructure for electrically powered commercial vehicles -** Commercial vehicles with electric drives are offered grants of up to 80% of the price difference between the zero-emission HDV and their Euro VI diesel equivalent model. The policy is effective as of August 2021 and is valid until December 2024. (Federal Ministry of Transport and Digital Infrastructure, 2021)
Canada	**Medium- and Heavy- Duty Zero-Emission Vehicles Program -** Launched in 2022, with a funding corpus of $550 million, the quantum of the incentive is approximately 50% of the price difference between the EV and the conventional counterpart. The program has a duration of four years. (Government of Canada, 2022)
Netherlands	**AanZET -** The grant amount is determined based on the type of the truck, the purchase price and the type of organization intending to purchase the truck. The maximum incentive available under the scheme is €131,900 per vehicle. The scheme is due to expire in May 2027. (Ministry of Infrastructure and Water Management, Government of Netherlands, 2022)
Finland	**Act on purchase and conversion subsidies for low-emission vehicles -** Depending on the size of the vehicle, purchase incentive of €6,000 to €50,000 has been made available for electric trucks from 2022 to 2025. Both private persons and companies are eligible to avail the incentives. (Ministry of Transport and Communications, 2021)

In India, the electrification of the truck segment is at a nascent stage. A lack of availability of electric MHDT models, the relatively high price of the electric models, inadequate charging infrastructure, and general skepticism regarding technological feasibility are major barriers stalling the initiation of electrification of the segment. As of mid-2024, few models were commercially available in the market; to date, deployment of electric trucks in India has been limited to pilot projects (Dalmia Cement, 2021; Tata Steel, 2021; UltraTech Cement, 2024; Bhalla, 2019; World Business Council for Sustainable Development, 2023; Yadav, 2023).

Here, we analyze the impacts on BET upfront cost and TCO of a purchase subsidy of ₹20,000/kWh of battery capacity, capped at 40% of the ex-showroom price—equivalent to that offered to electric buses under FAME II. The analysis in this section is based on a forthcoming ICCT analysis on the TCO of trucks in India (Kaur et al., in press), which considers a 16-tonne truck with a 250-km range and a 295-kWh lithium iron phosphate (LFP) battery, a commonly used battery chemistry for EVs in the Indian market.

Figure 12 presents the upfront cost analysis of the 16-tonne BET and compares this to the upfront cost of a comparable diesel truck. Without incentives, the upfront cost of the BET is approximately 4 times that of the diesel truck. The ₹20,000/kWh subsidy bridges 48% of the price gap between the BET and the diesel truck. The subsidized upfront cost of the BET is approximately 2.6 times the cost of the diesel truck.

Figure 12

Upfront cost of 16-tonne battery electric truck with subsidy and a 16-tonne diesel truck

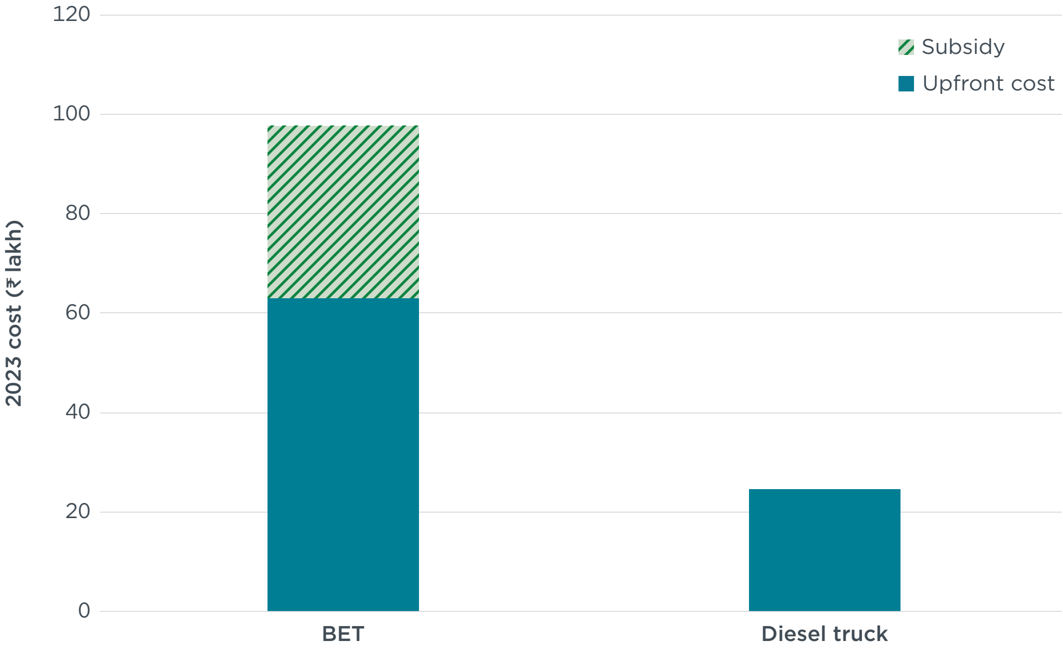

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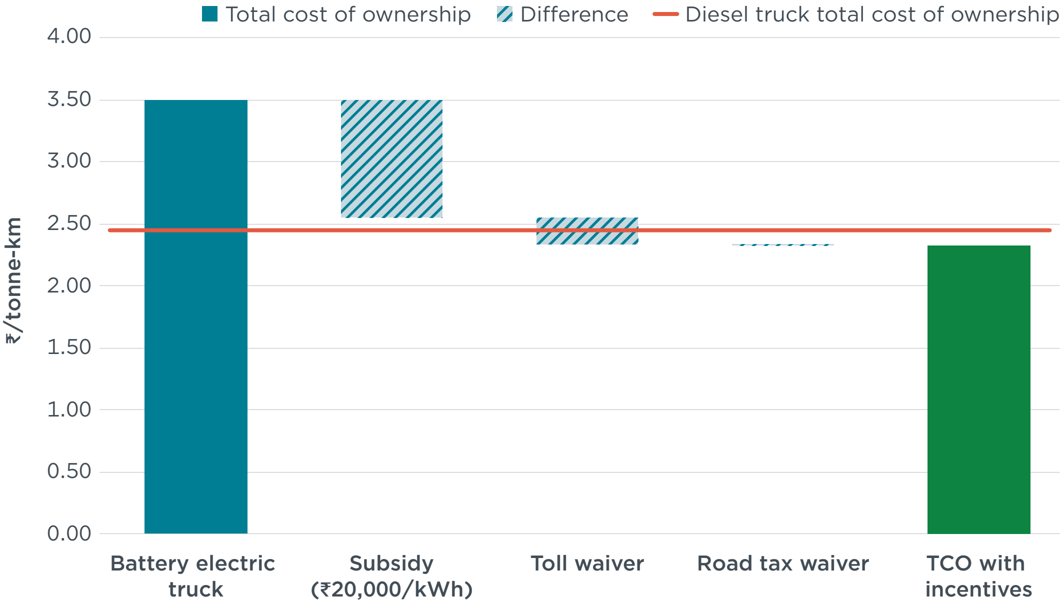
Figure 13 presents the 7-year per tonne-km TCO analysis of a 16-tonne BET and compares it to the TCO of an equivalent diesel truck. Without incentives, the TCO of the BET is approximately 1.4 times that of the comparable diesel truck. With the ₹20,000/kWh purchase subsidy, capped at 40% of the ex-showroom price, 90% of the cost gap between the BET and the diesel truck is bridged. Supplementing this purchase subsidy with additional incentives such as waivers on toll tax and road tax could further enhance the TCO attractiveness of the BET, making the BET about 5% cheaper than the diesel truck.[18]

18 We study the impact of road tax waivers because this measure has been implemented by several states in India for EVs in other vehicle segments. Toll waivers, meanwhile, have been introduced as an operations subsidy in other countries, such as Germany.

Figure 13

Comparative 7-year total cost of ownership analysis for 16-tonne battery electric truck under various policy scenarios and 16-tonne diesel truck



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Trucks with fixed routes, uniform daily ranges, predicable payloads, and regular idle time between operations may be particularly well-suited to electrification in this early stage of BET uptake. These notably include certain vehicles that are owned, operated, or leased by the government, such as garbage trucks, water tankers, and anti-smog gun trucks. If expanding the uptake of electric trucks is in the interest of the government, subsidies could initially target certain trucks employed in government operations, which could serve as a demonstration of BET performance and instill public confidence in such technologies.

Trucks with similar characteristics and use patterns in private commercial applications, such as drayage trucks, trucks used in cement industries, horticulture trucks, and trucks carrying essentials such as dairy products, fruits, and vegetables, also could potentially be more easily electrified. Gradually extending subsidies beyond government applications to reach private operators could help accelerate the transition to zero-emission trucks. Small operators owning up to 10 trucks make up an estimated 80% of India's trucking sector (The Energy and Resources Institute, 2015). For these operators, the upfront price is typically the most significant consideration associated with purchasing new vehicles. Generally, small fleet operators face limitations in terms of capital availability and are unable or reluctant to invest in new truck technologies. By contrast, large fleet operators are generally more inclined and able to invest in new truck technologies that have proven benefits (The Energy and Resources Institute, 2015). Uptake of battery electric trucks in the private sector is thus likely to be pioneered by large operators; indeed, initial BET deployment in India, albeit limited to pilot projects, has been undertaken by large and well-established companies (Hampel, 2023; Dalmia Cement, 2021; Tata Steel, 2021; UltraTech Cement, 2024). If expanding uptake beyond large operators is a government objective, a portion of such a subsidy could then be earmarked for smaller companies.

Subsidy support can send signals to manufacturers about the government's intention to support and accelerate the electrification of a segment, as has been seen in the case of electric buses. While hardly any electric bus models were available in the market before FAME I, there are now around 10 electric bus manufacturers operating in India, offering at least 15 electric bus models. Extending subsidies to BETs can thus not only help overcome barriers related to high upfront cost and TCO, but can also potentially lead to truck manufacturers introducing more electric models in the market.

Recommendation: To accelerate BET uptake, consider offering a purchase subsidy of ₹20,000 per kWh of battery capacity, capped at 40% of ex-showroom price, for purchases of battery electric trucks.

Recommendation: Targeted purchase subsidy programs, initially focusing on trucks deployed in government operations and eventually extended to private truck fleet operators, could help kickstart BET adoption.

POLICY OUTLOOK

FAME I was extended four times, each on a short-term basis. As noted above, FAME II was characterized by unforeseen changes in the subsidy amount for E2Ws. Since FAME II lapsed in March 2024, there has been no official announcement from the government regarding a possible next phase of the program, though subsidies for E2Ws and E3Ws continue to be offered under its short-term Electric Mobility Promotion Scheme (EMPS), due to conclude in July 2024.

Unforeseen policy revisions and an unclear policy outlook create uncertainty in the EV ecosystem, undermining the effectiveness of policy interventions and sending mixed signals to stakeholders about the government's support for EV technology. Media reports and stakeholder consultations by the ICCT have highlighted concerns over policy uncertainty and emphasized the need for greater certainty, stability, and visibility in the policy landscape (Dinakar, 2023).

A stable and long-term policy landscape can create benefits both on the demand side as well as the supply side of the EV ecosystem. On the demand side, sustained support from the government for a new technology helps alleviate skepticism associated with its uptake. Policy longevity and clarity can help resolve uncertainty around the availability and amount of incentives, enabling consumers to plan their purchases accurately and commercial operators to organize their timelines and budgets for transitioning their fleets to EVs with greater certainty. A stable policy environment can also spur demand creation, potentially leading to economies of scale in production and contributing to a reduction in the prices of EVs over the long term.

On the supply side, policy longevity and consistency encourage greater private-sector participation. Investors and manufacturers are able to undertake informed investment decisions, robust strategic business planning, and accurate financial budgeting. Investment risk is also reduced when investors are assured of a stable policy landscape. Manufacturers can more accurately forecast the demand for EVs, components, and batteries, facilitating the development of domestic supply chains and creation of employment opportunities. A higher number of private sector participants can potentially reduce dependency on subsidies and other forms of government support in the long run.

Countries leading in the EV transition have implemented long-term incentive policies and provided visibility into the policy outlook. For instance, China's comprehensive New Energy Vehicle program, launched in 2009, spanned more than a decade. In 2016, when the government announced a gradual phase-down of incentives, it also specified the subsidy reductions applicable until 2020 (Cui, 2017). In the United States, the Inflation Reduction Act of 2022 offers tax credits on the purchase of clean vehicles until 2032. The policy also provides visibility in terms of the localization requirements for critical minerals and battery components to be eligible for incentives and specifies the exact percentage of localization required in each year of the policy duration (U.S. Department of Energy, n.d.). The Netherlands, meanwhile, passed a regulation in 2020 making purchase subsidies available for new and used electric passenger cars until 2025. The regulation also provides for the progressive lowering of the subsidy for new electric passenger cars and specifies the exact amount of subsidy that will be made available each year throughout the policy term. Such long-term policy visibility and stability can create certainty in the EV ecosystem, helping to accelerate the EV transition.

SUMMARY

This report examined the FAME II EV promotion scheme in India, assessing the extent to which segment-specific incentivization targets were achieved and the impact of purchase subsidies offered under the program. Table 6 presents key observations regarding the status of fund utilization and the achievement of segment EV incentivization targets under the scheme. The uptake of EVs in the Indian market in FY 2023–24 by segment is presented in the rightmost column. As indicated in the table, EVs accounted for just 7% of vehicle sales in India in FY 2023–24. High upfront cost and a lack of access to financing continue to pose major challenges for the uptake of EVs in the country.

Table 6
Fund utilization and segment target achievement under FAME II

Status of funds				
	Earmarked funds		Total funds utilized	Percentage of total funds utilized
Details of funds	₹11,500 crore		₹7,940 crore	69%
Details of vehicle segment-wise incentivization targets				
	Original target number of EVs to be supported under FAME II	Target number of EVs to be supported under FAME II per revised outlay	Percentage of target achieved under FAME II per revised targets	Segment-wise market EV uptake in FY 2023–24
Two-wheelers	1,000,000	1,550,225	75%	5%
Three-wheelers	500,000	155,536	84%	54% (passenger 3W – 14% goods 3W – 26% e-rickshaws – 100% e-carts – 100%)
Passenger cars	55,000	30,461	55%	2%
Buses	7,090	7,262	66%	4%
All segments	1,562,090	1,743,484	76%	7%

FAME II prioritized the electrification of the two-wheeler and three-wheeler segments, which together accounted for 98% of vehicles targeted for incentives under the scheme. These two segments dominate the market for on-road vehicles in India . As policymakers weigh a possible third phase of FAME, they may consider enhancing efforts to incentivize EV uptake in other vehicle segments, including the private passenger car segment, private bus segment, and truck segment, which are collectively responsible for an overwhelming majority of well-to-wheel CO_2 emissions in the country. Promoting the uptake of EVs in these segments could also help spur domestic demand for EV batteries in a short span of time, owing to their relatively larger battery size, and potentially facilitate a rapid reduction in EV battery prices.

If the government seeks to build on the achievements of FAME I and II, continued fiscal support aimed at overcoming these barriers could be part of an effective policy toolkit to help accelerate the EV adoption across a diverse range of consumers. The analysis above supports the following policy recommendations:

Table 7

Suggestions for the potential next phase of the FAME scheme

Segment	Policy considerations
Two-wheelers	To facilitate cost parity between E2Ws and conventional two-wheelers, consider offering purchase subsidies to electric two-wheelers through 2025–2027, beginning with a higher subsidy of ₹15,000/kWh of battery capacity, capped at 40% of the ex-showroom price, and gradually phase down the subsidy amount by type, in line with EV cost reduction trends.
Passenger three-wheelers	Consider continuing purchase incentives of at least ₹10,000/kWh of battery capacity, capped at 20% of ex-showroom price, to enhance TCO and upfront cost competitiveness of electric passenger three-wheelers. To facilitate financing for electric passenger three-wheelers, consider offering lower interest rates, longer payback periods, and credit guarantees through notified agencies such as government banks and other financial institutions.
Four-wheelers	Consider offering subsidies of at least ₹10,000/kWh, capped at 20% of ex-showroom price, for the purchase of private electric passenger cars.
Buses	Consider prioritizing the electrification of private inter-city buses by facilitating access to favorable financing through interventions such as interest subvention, longer loan tenures, and credit guarantees.
Trucks	To accelerate BET uptake, consider offering a purchase subsidy of ₹20,000/kWh of battery capacity, capped at 40% of ex-showroom price, for purchase of battery electric trucks. Consider kickstarting BET adoption through targeted purchase subsidy programs, initially focusing on trucks deployed in government operations and eventually extended to private truck fleet operators.

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APPENDIX

Table A1

Electric and conventional two-wheeler costs

TCO factors		Motorcycle		Scooter		Notes and sources
		Electric	Gasoline	Electric	Gasoline	
		Kabira Mobility KM 3000	Hero Splendor+	Ather 450x	Honda Activa 6G	
Taxes and fees	Goods and Services Tax rate	5%	28%	5%	28%	Ministry of Finance (2019)
	Registration fee	₹0	₹1,000	₹0	₹1,000	Several states in India have waived the registration fee for EVs. For conventional two-wheelers, the registration fee has been assumed to be ₹1,000.
	Road tax	0%	10%	0%	10%	Several states in India have waived the road tax for EVs. For conventional two-wheelers, road tax varies across states from 6% to 14% of the base price. The median value of 10% has been considered for conventional two-wheelers.
	Other state taxes	2% of base price	2% of base price	2% of base price	2% of base price	Includes municipal tax and parking fee.
Vehicle utilization	Vehicle life	10 years	10 years	10 years	10 years	
	Vehicle first ownership period	5 years	5 years	5 years	5 years	"Droom digital platform sees growing usage" (2021)
	Annual vehicle kilometers traveled	10,000 km	10,000 km	10,000 km	10,000 km	Rokadiya et al. (2021)
Fueling costs	Price of gasoline		₹96.7/L		₹96.7/L	Price of petrol is the 6 month average as of September 2023 in Delhi (MyPetrolPrice, 2023).
	Annual escalation in gasoline price		5%		5%	Rokadiya et al. (2021)
	Residential electricity rate	₹6.5/kWh		₹6.5/kWh		Energy consumption slab of 401–800 units has been considered for the state of Delhi (Delhi Capital, 2023).
	Annual escalation in residential electricity rate	5%		5%		Rokadiya et al. (2021)
	Real world energy consumption adjustment factor	25%	25%	25%	25%	It is assumed that real world range/mileage is 25% lower than the certified value.
Maintenance and repair cost	Maintenance and repair cost (first year)	₹1,000	₹6,000	₹1,000	₹6,000	Mallick and Gopal (2021)
	Annual maintenance and repair cost escalation	10%	10%	10%	10%	Rokadiya et al. (2021)
	Battery replacement year	6th year of ownership		6th year of ownership		Since TCO analysis is for 5 years, battery replacement cost has not been considered.
Insurance cost	Insurance cost	₹1,600 annually	₹1,060 annually	₹1,600 annually	₹1,060 annually	Rokadiya et al. (2021)
Financing cost	Interest rate	11% per annum	11% per annum	11% per annum	11% per annum	Rokadiya et al. (2021)
	Repayment period	3 years	3 years	3 years	3 years	Rokadiya et al. (2021)
	Financed amount	85%	85%	85%	85%	Rokadiya et al. (2021)
Depreciation	Depreciation	55%	50%	55%	50%	Values are as of 5th year of ownership (Rokadiya et al., 2021).

Note: Gasoline models considered are the best-selling models in India in FY 2022-23. Representative electric models have specifications comparable to the conventional models.

Table A2

Conventional and electric passenger three-wheeler costs

TCO factors		Passenger three-wheelers: Electric — Piaggio Ape E-city 8 kWh	CNG — Bajaj RE	Gasoline — Bajaj RE	Diesel — Bajaj RE	Notes and sources
Taxes and fees	Goods and Services Tax rate	5%	28%	28%	28%	EVs enjoy a preferential GST rate of 5%, as against the 28% applicable on conventional vehicles (Ministry of Finance, 2019).
	Registration fee		₹1,000		₹1,000	Several states in India have waived the registration fee for EVs.
	Road tax		₹305 per annum	₹305 per annum	₹305 per annum	Several states in India have waived the road tax for EVs. For conventional passenger three-wheelers, a road tax of ₹305 per year is considered (Transport Department, Government of NCT of Delhi, 2023).
	Permit fee	0	₹2,000 for 5 years	₹2,000 for 5 years	₹2,000 for 5 years	Several states in India have waived the permit fee for EVs (Acko, 2024).
	Other state taxes	₹2,000	₹2,000	₹2,000	₹2,000	Includes municipal tax and parking fee.
Vehicle utilization	Vehicle life	10 years	10 years	10 years	10 years	WRI India (n.d.)
	Vehicle first ownership period	5 years	5 years	5 years	5 years	Conservative assumption based on varying literature and stakeholder consultations.
	Daily vehicle kilometers traveled	141 km	141 km	141 km	141 km	Nimesh et al. (2023)
	Annual operational days	313 days	313 days	313 days	313 days	Assumes one non-operational day per week.
Fueling costs	Price of corresponding fuel		₹74/kg	₹97/L	₹90/L	Price of petrol is 6 month average as of September 2023 in Delhi (MyPetrolPrice, 2023).
	Annual escalation in fuel price		4%	5%	8%	Last 10 years' compounded annual growth rate.
	Residential electricity rate	₹6.5/kWh				Energy consumption slab of 401-800 units has been considered for the state of Delhi (Delhi Capital, 2023).
	Annual escalation in residential electricity rate	5%				Rokadiya et al. (2021)
	Public charging rate	₹15/kWh				Switch Delhi (2024)
	Annual escalation on public charging rate	5%				Assumed to be same as that of residential electricity rate.
	Real world energy consumption adjustment factor	25%	25%	25%	25%	Assumed that real world range/mileage is 25% lower than the certified value.
Earnings	Earnings per hour	₹99	₹99	₹99	₹99	Nimesh et al. (2023)
Maintenance and repair cost	Maintenance and repair cost (in first year)	₹10,500	₹17,500	₹17,500 of ownership	₹17,500	Maintenance and repair cost of E3W has been assumed to be 40% lower than that of conventional three-wheeler (Roychowdhury & Roy, 2022).
	Annual maintenance and repair cost escalation	10%	10%	10%	10%	Assumed to be same as that of two-wheelers (Rokadiya et al., 2021).
Insurance cost	Insurance cost	₹7,924 annually	₹7,924 annually	₹7,924 annually	₹7,924 annually	Nimesh et al., (2023)
Financing cost	Interest rate	23% per annum	12% per annum	12% per annum	12% per annum	Roychowdhury & Roy (2022)
	Repayment period	3 years	3 years	3 years	3 years	Roychowdhury & Roy (2022)
	Financed amount	85%	85%	85%	85%	Assumed to be same as that of two-wheelers (Rokadiya et al., 2021).
Depreciation	Depreciation by year 5	70%	50%	50%	50%	Assumed to be same as that for two-wheelers (Rokadiya et al., 2021).

Note: Conventional models considered are the best-selling models in India in FY 2022–23. Representative electric models have specifications comparable to the conventional models.

Table A3

Cost drivers considered for total cost of ownership analysis for electric and conventional private passenger cars

TCO factors		SUV			Sedan				Hatchback			Notes and sources
		Electric	Gasoline	Diesel	Electric	Gasoline	Diesel	CNG	Electric	Gasoline	CNG	
		Tata Nexon EV XM	Tata Nexon XMA	Tata Nexon XMA S	Tigor EV XM	Maruti Suzuki Dzire VXI	Hyundai Aura SX Plus	Maruti Suzuki Tour S	BEV Tiago XE MR	Gasoline Tiago XE	CNG Tiago	
Taxes and fees	Goods and Services Tax rate	5%	28%	28%	5%	28%	28%	28%	5%	28%	28%	EVs enjoy a preferential GST rate of 5%, as against the 28% applicable on conventional vehicles (Ministry of Finance, 2019).
	Compensation cess	0%	1%	3%	0%	1%	3%	1%	0%	1%	1%	Society of Indian Automobile Manufacturers (2024a)
	Tax collected at source	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	Kohli et al. (2023)
	Registration fee		₹600	₹600		₹600	₹600	₹600		₹600	₹600	The central government has encouraged states to waive the registration fee and several states have implemented this exemption.
	Road tax	0%	7%	8.75%	0%	7%	8.75%	7%	0%	7%	7%	Several states in India have waived the road tax for EVs (Delhi Motor Vehicles Taxation Act, 1962, As Amended).
Vehicle life	Vehicle life	10 years	10 years	10 years	10 years	10 years	10 years	10 years	10 years	10 years	10 years	WRI India (n.d.)
	Vehicle first ownership period	8 years	8 years	8 years	8 years	8 years	8 years	8 years	8 years	8 years	8 years	Average ownership duration of cars in India is 6 years. BEVs considered in the analysis offer a battery warranty of 8 years, hence, an ideal time to sell the BEV would be after 8 years ("Droom digital platform sees growing usage", 2021).
	Annual vehicle kilometers traveled	15,000 km	15,000 km	15,000 km	15,000 km	15,000 km	15,000 km	15,000 km	15,000 km	15,000 km	15,000 km	Assuming 317 working days in a year and daily travel distance of 50 km.
Fueling costs	Price of relevant fuel (per L or kg)		₹97	₹90		₹97	₹90	₹76		₹97	₹76	Price of relevant fuel is 6-month average as of September 2023 in Delhi (Good Returns, 2024).
	Annual escalation in fuel price		5%	8%		5%	8%	4%		5%	4%	Rokadiya et al. (2021)
	Residential electricity rate (per kWh)	₹6.5			₹6.5				₹6.5			It is estimated that 80% of the daily charging needs of the BEV will be met through residential electricity.
	Annual escalation in residential electricity rate	5%			5%				5%			Rokadiya et al. (2021)
	Public charging electricity rate (per kWh)	₹19			₹19				₹19			It is estimated that 20% of the daily charging needs of the BEV will be met through public charging (Fortum, 2022).
	Annual escalation in public charging electricity rate	5%			5%				5%			Assumed to be same as that of residential electricity rate.
	Real world energy consumption adjustment factor	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	It is assumed that real world range/mileage is 25% lower than the ARAI certified value.
Maintenance and repair cost	Annual maintenance cost (in first year)	₹2,347	₹3,912	₹4,447	₹2,128	₹3,546	₹3,744	₹3,546	₹2,128	₹3,546	₹3,546	CarDekho (2023a; 2023b; 2023c)
	Annual increment in maintenance cost	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	
	Battery replacement year											Models considered in the analysis offer battery warranty through the holding period considered for the analysis.
Insurance cost	Insurance cost (first year)	₹28,200	₹16,982	₹16,422	₹21,869	₹18,630	₹19,900	₹18,876	₹21,869	₹18,630	₹18,876	InsuranceDekho (2023)
	Annual increment in insurance cost	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	Conservative assumption.
Financing cost	Interest rate (per annum)	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	State Bank of India (2024)
	Repayment period	5 years	5 years	5 years	5 years	5 years	5 years	5 years	5 years	5 years	5 years	
	Financed amount	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	
Depreciation	Depreciation by year 8	85%	65%	65%	85%	65%	65%	65%	85%	65%	65%	
EV loan income tax benefit	Annual income	₹1,500,000	₹1,500,000	₹1500,000	₹1,500,000	₹1,500,000	₹1,500,000	₹1,500,000	₹1,500,000	₹1,500,000	₹1,500,000	
	Annual increment in income	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	Cleartax (2024)

Note: Electric models considered are the best-selling models in their respective vehicle segments. Representative conventional models have specifications comparable to the electric models.

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