



# Industry Report on Indian Electric 2-Wheeler Market

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Warivo Electric Mobility Limited

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# Table of Contents

|                                                                                                                             |           |
|-----------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Executive Summary: Electric Vehicles (EVs) and E2W Industry in India.....</b>                                            | <b>5</b>  |
| <b>Overview- Electric Vehicles (EV).....</b>                                                                                | <b>7</b>  |
| Introduction to Electric Vehicles (EV).....                                                                                 | 7         |
| Key Characteristics of Electric Vehicles .....                                                                              | 8         |
| Types of Electric Vehicles.....                                                                                             | 9         |
| <b>Overview: E2W and E3W Industry in India.....</b>                                                                         | <b>10</b> |
| E2W Landscape in India .....                                                                                                | 10        |
| Brief insight into key indicators like speed/distance or range / tentative cost of ownership.....                           | 11        |
| <b>Electric Vehicle (EV) Market Scenario in India .....</b>                                                                 | <b>13</b> |
| <b>EV Market Segmentation in India.....</b>                                                                                 | <b>15</b> |
| Market segmentation: by vehicle category (2W / 3W / 4W/ Others): Share of vehicle category .....                            | 15        |
| Market size of the electric 2-Wheeler (E2W) industry in India.....                                                          | 17        |
| E2W Segment in India: Market segmentation (High speed v/s low speed variants) .....                                         | 18        |
| E2W Segments in India: Based on use case (delivery vehicle v/s passenger use).....                                          | 20        |
| Impact of United States (US)–Iran Conflict on E2W Industry in India .....                                                   | 21        |
| <b>EV Penetration in India: E2W Scenario .....</b>                                                                          | <b>22</b> |
| Estimated share of electric vehicles in Indian two-wheeler market.....                                                      | 22        |
| Brief insight on adoption trend of E2W among smaller towns & cities in India .....                                          | 23        |
| <b>Ecosystem in Indian E2W market .....</b>                                                                                 | <b>25</b> |
| <b>Business Model in Indian E2W Space .....</b>                                                                             | <b>29</b> |
| Traditional channels: OEM selling vehicles directly to customers through own dealerships and multi vehicle dealerships..... | 30        |
| New channels: .....                                                                                                         | 31        |
| <b>Technology &amp; Innovation in Indian E2W market .....</b>                                                               | <b>33</b> |
| Insight on emerging technology & innovations in Indian E2W space.....                                                       | 33        |
| <b>Regulatory Landscape (Focusing on EV as a whole and Especially E2W space).....</b>                                       | <b>37</b> |
| Insight on National-Level Policy Framework Driving E2W Growth in India.....                                                 | 39        |

|                                                                                                |           |
|------------------------------------------------------------------------------------------------|-----------|
| <b>Key Advantages of EV over conventional vehicles.....</b>                                    | <b>41</b> |
| <b>Key Demand Drivers.....</b>                                                                 | <b>42</b> |
| <b>Total Cost of Ownership Analysis .....</b>                                                  | <b>45</b> |
| <b>Mapping the supply scenario in Indian EV market: Focusing on E2W and E3W market .....</b>   | <b>46</b> |
| <b>Threats &amp; Challenges.....</b>                                                           | <b>48</b> |
| Insight on the major threats & challenges faced by the EV Industry.....                        | 48        |
| <b>Key Opportunities.....</b>                                                                  | <b>49</b> |
| Mapping the emerging opportunities in the Indian E2W market.....                               | 49        |
| <b>EV Financing Models .....</b>                                                               | <b>51</b> |
| Brief insight on the financing models in E2W space in India.....                               | 51        |
| Specialized lenders: Specialized fintech lenders like Revfin / Ecofy and their solutions ..... | 52        |
| Leasing models .....                                                                           | 52        |
| Buyback / Resale programs .....                                                                | 53        |
| Battery-as-a-Service / Battery Swapping models.....                                            | 54        |
| <b>Competitive Landscape .....</b>                                                             | <b>55</b> |
| Insight on Competitive Landscape in India.....                                                 | 55        |
| <b>Company Profiling: Warivo Electric Mobility Limited .....</b>                               | <b>58</b> |
| <b>Peers Profile:.....</b>                                                                     | <b>61</b> |
| <b>Financial KPI .....</b>                                                                     | <b>62</b> |

## Executive Summary: Electric Vehicles (EVs) and E2W Industry in India

Electric Vehicles (EVs) are transforming the automotive industry by replacing conventional internal combustion engines with electric motors powered by rechargeable batteries. EVs offer several advantages, including lower operating costs, improved energy efficiency, reduced emissions, and quieter operation. Advancements in battery technology, charging infrastructure, battery management systems (BMS), and power electronics have further strengthened the viability of electric mobility solutions across various transportation applications.

Within India's EV ecosystem, electric two-wheelers (E2Ws) have emerged as the largest and most dynamic segment, driven by their affordability, suitability for daily commuting, and lower total cost of ownership compared to conventional two-wheelers. Rising fuel prices, increasing environmental awareness, supportive government policies, and improvements in charging infrastructure have accelerated E2W adoption across urban, semi-urban, and rural markets.

The Indian EV market has witnessed significant growth in recent years, with market value increasing from approximately INR 25,402 crore in FY2023 to INR 1,27,453 crore in FY 2026, reflecting a CAGR of around 71%. The growth has been supported by favourable government policies, increasing consumer acceptance, rising fuel prices, and improvements in charging infrastructure. Looking ahead, the EV market is projected to grow at a CAGR of approximately 29% between FY 2026E and FY 2031F, reaching around INR 4,53,863 crore by FY 2031F. Within this ecosystem, electric two-wheelers (E2Ws) continue to be the dominant vehicle category by volume, accounting for approximately 40.3% of total EV volumes in FY 2021, increasing to around 59.9% in FY 2026E and further to approximately 61.0% by FY 2031F. The E2W market value increased from approximately INR 9,358 crore in FY2023 to INR 19,735 crore in FY 2026E, registering a CAGR of around 28.2%, and is further projected to reach approximately INR 67,062 crore by FY 2031F, reflecting a CAGR of around 27.7%. The segment continues to benefit from growing demand for affordable personal mobility, increasing penetration across urban and semi-urban markets, and rising adoption for commercial applications such as last-mile delivery and logistics.

Technological advancements continue to play a critical role in the evolution of the E2W segment. Modern electric two-wheelers are increasingly equipped with connected vehicle features, telematics integration, improved battery systems, and enhanced performance capabilities. The market comprises both high-speed and low-speed variants, enabling manufacturers to cater to diverse consumer requirements across urban and rural markets. The development of battery-swapping infrastructure and charging networks is further supporting convenience and operational efficiency for E2W users.

The Government of India has played a significant role in promoting electric mobility through initiatives such as the National Electric Mobility Mission Plan (NEMMP), FAME schemes, and the PM E-DRIVE programme. These initiatives provide financial incentives, support charging infrastructure development, and encourage domestic manufacturing. Complementary measures such as the Production Linked Incentive (PLI) Scheme,

Phased Manufacturing Programme (PMP), reduced GST rates, and state-level EV policies have further strengthened the E2W ecosystem and encouraged investment across the value chain.

Safety and quality standards, including AIS-156 and relevant Bureau of Indian Standards (BIS) regulations, continue to support product reliability and consumer confidence. Together with ongoing investments in technology, manufacturing capabilities, and infrastructure development, these measures are expected to support sustained growth of the E2W industry.

Overall, the Indian E2W market is well-positioned for long-term expansion, supported by favourable economics, improving technology, expanding infrastructure, and strong policy backing. With increasing adoption across both personal and commercial mobility applications, electric two-wheelers are expected to remain the primary driver of EV growth and penetration in India over the coming years.

## Overview- Electric Vehicles (EV)

### Introduction to Electric Vehicles (EV)

Electric Vehicles (EVs) are automobiles that use **electric motors powered by electrical energy stored in rechargeable batteries or other energy storage systems**, instead of relying solely on internal combustion engines (ICE) that run on fossil fuels such as petrol or diesel. EVs convert electrical energy into mechanical energy through electric motors, enabling propulsion with significantly lower tailpipe emissions. The adoption of EVs is being driven globally by the need to reduce greenhouse gas emissions, improve air quality, and decrease dependence on fossil fuels.

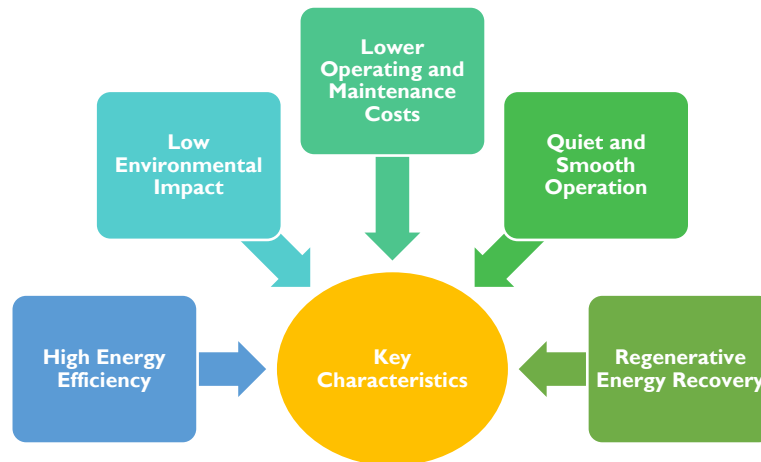
Advancements in battery technologies, charging infrastructure, and power electronics have significantly improved the performance and practicality of EVs in recent years. Lithium-ion batteries, which offer higher energy density and longer life cycles, are widely used in modern EVs. Governments across several countries are also promoting EV adoption through regulatory policies, subsidies, tax incentives, and investments in charging infrastructure, supporting the transition toward sustainable mobility.

EVs are used across multiple vehicle segments, including **two-wheelers, three-wheelers, passenger vehicles, buses, and commercial vehicles**. In markets such as India, electric two-wheelers and three-wheelers have emerged as key drivers of EV adoption due to their affordability, lower operating costs, and suitability for urban commuting and last-mile delivery applications.

### Technology Used

- **Electric Motor:** Converts electrical energy from the battery into mechanical energy to drive the vehicle.
- **Battery Pack:** Typically, lithium-ion batteries that store electrical energy used to power the vehicle.
- **Battery Management System (BMS):** Monitors battery performance, temperature, voltage, and ensures safe and efficient operation.
- **Power Electronics Controller:** Regulates the flow of electrical energy between the battery and the motor.
- **Charging System:** Includes onboard chargers and external charging infrastructure used to recharge the vehicle's battery.
- **Regenerative Braking System:** Recovers kinetic energy during braking and converts it into electrical energy to recharge the battery.
- **Electric Drive System / Inverter:** Converts Direct Current (DC) power from the battery to Alternating Current (AC) power required by the motor and manages motor speed and torque.

## Key Characteristics of Electric Vehicles



- **High Energy Efficiency:** Electric vehicles convert a larger proportion of stored energy into usable power compared to internal combustion engine vehicles. Electric motors typically achieve efficiency levels above 85-90%, whereas traditional engines operate at significantly lower efficiency levels. This higher efficiency contributes to reduced energy consumption and lower operational costs.
- **Low Environmental Impact:** EVs produce zero tailpipe emissions during operation, which helps reduce air pollution in urban environments. When powered by electricity generated from renewable sources such as solar or wind energy, EVs can significantly reduce overall greenhouse gas emissions throughout their lifecycle.
- **Lower Operating and Maintenance Costs:** Electric vehicles generally have fewer moving components compared to conventional vehicles, which reduces wear and tear and lowers maintenance requirements. In addition, electricity as a fuel source is typically cheaper than petrol or diesel, contributing to lower running costs over the vehicle's lifetime.
- **Quiet and Smooth Operation:** Electric motors operate with minimal noise and vibration compared with internal combustion engines. This results in smoother acceleration and a quieter driving experience, which also contributes to reduced noise pollution in urban areas.
- **Regenerative Energy Recovery:** Many EVs are equipped with regenerative braking systems that capture kinetic energy generated during braking and convert it back into electrical energy stored in the battery. This feature improves energy efficiency and helps extend the vehicle's driving range.

## Types of Electric Vehicles



- **Battery Electric Vehicles (BEV):** BEVs are also known as All-Electric Vehicles (AEV). These vehicles operate entirely on electricity stored in rechargeable battery packs and do not use any internal combustion engine. These vehicles rely solely on electric motors for propulsion and must be charged through external charging infrastructure. BEVs are widely used in electric scooters, motorcycles, and passenger cars due to their zero tailpipe emissions and relatively simple drivetrain architecture.
- **Plug-in Hybrid Electric Vehicles (PHEV):** Plug-in Hybrid Electric Vehicles combine an internal combustion engine with an electric motor and a rechargeable battery that can be charged externally. These vehicles can operate in both electric mode and hybrid mode, providing flexibility for longer driving ranges. The electric motor typically supports short-distance travel while the combustion engine provides backup power when the battery is depleted.
- **Fuel Cell Electric Vehicles (FCEV):** Fuel Cell Electric Vehicles generate electricity through a chemical reaction between hydrogen and oxygen in a fuel cell stack. The electricity produced powers an electric motor, while the only byproduct emitted is water vapor. FCEVs offer longer driving ranges and faster refueling compared to battery-based EVs but require specialized hydrogen refueling infrastructure.
- **Hybrid Electric Vehicles (HEV):** Hybrid Electric Vehicles combine an internal combustion engine with an electric motor but typically do not rely on external charging. The battery is charged through regenerative braking and the engine itself. HEVs improve fuel efficiency and reduce emissions compared to conventional vehicles, although they still rely partially on fossil fuels.

## Overview: E2W and E3W Industry in India

### E2W Landscape in India

#### Overview: Electric Two-Wheeler (E2W) Industry in India

Electric two-wheelers (E2Ws) refer to battery-powered two-wheeled vehicles, including electric scooters, motorcycles, and mopeds, designed for personal and commercial mobility applications. The segment is broadly classified into high-speed variants ( $\geq 25$  km/h), which are primarily used for mainstream commuting and require vehicle registration and a driving license, and low-speed variants ( $< 25$  km/h), which are exempt from registration and licensing requirements under the prevailing regulatory framework. E2Ws are widely deployed across passenger mobility, neighbourhood transportation, and last-mile logistics applications, making them a versatile mobility solution for both individual users and fleet operators.

Electric two-wheelers (E2Ws) represent the largest and fastest-evolving segment within India's electric mobility ecosystem, supported by favourable government initiatives, advancements in battery technology, expanding charging infrastructure, and increasing availability of products across multiple vehicle categories. Growing consumer acceptance of electric mobility and continuous product innovation have further accelerated adoption across personal as well as commercial applications. Overall EV registrations in India increased significantly from **1.41 lakh units in FY2021** to **26.50 lakh units in FY2026**, while registrations stood at approximately **7.70 lakh units as of 24 June 2026** for FY2027, reflecting the continued expansion of India's electric mobility ecosystem.

| Financial Year                                   | Registered EVs (Lakh Units) |
|--------------------------------------------------|-----------------------------|
| <b>FY 2021</b>                                   | 1.41                        |
| <b>FY 2022</b>                                   | 4.56                        |
| <b>FY 2023</b>                                   | 11.74                       |
| <b>FY 2024</b>                                   | 16.72                       |
| <b>FY 2025</b>                                   | 20.41                       |
| <b>FY 2026</b>                                   | 26.50                       |
| <b>FY 2027 (As of 24<sup>th</sup> June 2026)</b> | 7.70                        |

Source: Vahan Portal (For FY 2021-FY 2025, data was extracted on 17 March 2026, For FY 2026, and FY 2027 data was extracted on 24<sup>th</sup> June 2026)

**Note:** The registration data presented above is based on vehicle registrations reported through the Vahan Portal and primarily reflects registered electric vehicles, including high-speed electric two-wheelers falling under the applicable L-category vehicle classifications (such as L1 and L2 categories) that require registration under the Central Motor Vehicles Rules (CMVR). Low-speed electric two-wheelers with a maximum design speed below 25 km/h are generally exempt from registration requirements and may therefore not be fully captured in the registration statistics.

## Overview: Electric Three-Wheeler (E3W) Industry in India

Electric three-wheelers (E3Ws)<sup>1</sup> constitute a **well-established and rapidly scaling segment** within India's EV ecosystem, primarily driven by their strong economics in commercial applications such as passenger transport (e-rickshaws) and cargo logistics. The segment has demonstrated consistent adoption due to **lower operating costs, favorable total cost of ownership (TCO), and suitability for last-mile connectivity**.

E3W industry continue to gain strong traction driven by increasing demand from fleet operators, small businesses, and logistics providers. The segment has seen widespread adoption across Tier II and Tier III cities, where three-wheelers play a critical role in urban and semi-urban transportation networks.

Compared to E2Ws, the E3W segment is relatively **more commercially oriented and less fragmented**, with demand closely linked to income generation opportunities. Growth in e-commerce, last-mile delivery requirements, and urban mobility needs is expected to continue supporting the expansion of the E3W market.

### Brief insight into key indicators like speed/distance or range / tentative cost of ownership

Electric two-wheelers (E2Ws) in India are designed to cater to a wide range of personal and commercial mobility applications, including daily commuting, neighbourhood travel, and last-mile connectivity. Driving range and performance vary depending on the battery capacity, motor configuration, and vehicle category, with high-speed models generally offering higher speeds and longer driving ranges than low-speed variants. The average driving range of electric two-wheelers is around 50 km per charge, which is generally sufficient to meet daily intra-city travel needs. Electric drivetrains provide instant torque, smoother acceleration, and lower noise levels, enhancing the overall riding experience across diverse operating conditions. In addition, electric two-wheelers offer a lower total cost of ownership than conventional petrol-powered two-wheelers, supported by lower running costs and comparatively lower maintenance requirements, making them an increasingly attractive mobility solution for a broad consumer base.

From a structural standpoint, the E2W market is segmented into high-speed and low-speed variants, which differ in performance, regulatory requirements, and target applications:

- **High-Speed Electric Two-Wheelers ( $\geq 25$  km/h):** These vehicles are designed for mainstream urban commuting, offering speeds typically ranging between 70–90 km/h along with higher battery capacities and extended range. They require registration, driving licenses, and compliance with regulatory standards. The segment has witnessed increasing adoption, supported by policy incentives and expanding product offerings from established Original Equipment Manufacturer (OEMs) and new entrants.

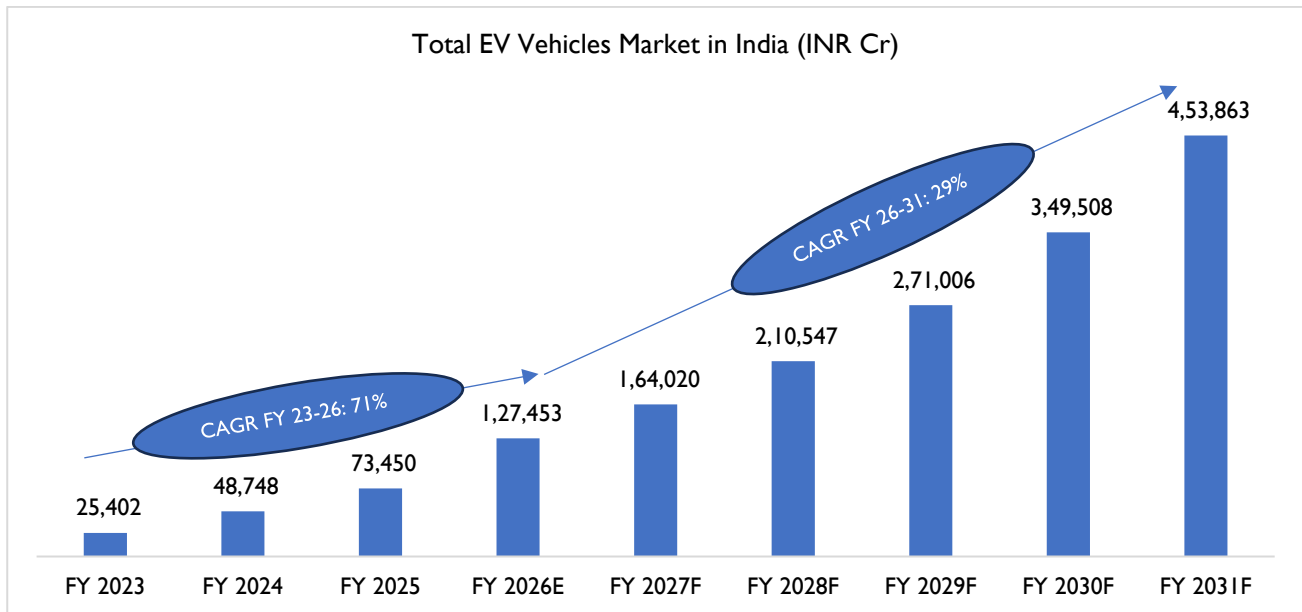
<sup>1</sup> E3W refers to Electric Three-Wheeler, a battery-operated three-wheeled vehicle used for passenger transportation or goods delivery, mainly for last-mile mobility

- **Low-Speed Electric Two-Wheelers (<25 km/h):** These vehicles are exempt from registration and driving licence requirements under the prevailing regulatory framework. They are widely used across neighbourhood mobility, personal transportation, and selected commercial applications, particularly in semi-urban and rural markets. Their simplified regulatory requirements and ease of operation support their adoption across a diverse range of users.

From an economic perspective, electric mobility solutions offer a cost advantage over conventional internal combustion engine (ICE) vehicles. Industry estimates indicate that electric two-wheelers have a total cost of ownership (TCO) of approximately INR 2.10 per kilometer, compared to around INR 3.65 per kilometer for petrol-powered counterparts. This cost efficiency is largely driven by lower energy costs and reduced maintenance requirements, as electric vehicles have fewer moving parts and do not require complex mechanical systems such as multi-gear transmissions or internal combustion engines. The combination of lower operating costs, adequate range, and differentiated product segmentation (high-speed vs low-speed) continues to support the growing adoption of electric two-wheelers and three-wheelers across both personal and commercial use cases.

## Electric Vehicle (EV) Market Scenario in India

The electric vehicle (EV) market in India has witnessed a significant transformation over the past few years, evolving from a nascent stage to a rapidly expanding segment within the automotive industry. This growth has been driven by a combination of supportive government policies, increasing environmental awareness, and advancements in EV technology. The market has demonstrated strong momentum, transitioning from a low base to a more structured and scalable ecosystem, with increasing participation from both domestic and global manufacturers.



Source: D&B Research Estimates \*E= Estimated and F= Forecasted

### Analysis of Historical Growth (FY 2023-26E)

During FY 2023–FY 2026E, the EV market witnessed exceptional growth, expanding at a CAGR of approximately **71%**, with the market increasing from around **INR 25,402 crore** in FY 2023 to approximately **INR 1,27,453 crore** by FY 2026E. This sharp expansion reflects the accelerating adoption of electric mobility across India, particularly in electric two-wheelers and three-wheelers, which continue to account for a substantial share of overall EV volumes due to their affordability and suitability for urban and last-mile transportation requirements.

The growth during this period was supported by favourable government initiatives, including demand incentives, state-level subsidies, and investments in charging infrastructure. Rising fuel prices and the lower total cost of ownership (TCO) of EVs further encouraged adoption among both individual consumers and commercial fleet operators. As per D&B India's TCO assessment for two-wheelers, the total cost of ownership of an electric two-wheeler is estimated to be approximately 42% lower than that of a comparable internal combustion engine (ICE) two-wheeler under the stated assumptions. In addition, improvements in battery performance, enhanced vehicle offerings across multiple price segments, and increasing financing availability contributed to broader consumer acceptance and market penetration.

## Future Outlook

Looking ahead, the Indian EV market is expected to maintain strong growth momentum, although at a relatively moderated pace compared to the rapid expansion witnessed during the early adoption phase. The market is projected to grow at a CAGR of approximately **29%** between FY 2026E and FY 2031F, increasing from around **INR 1,27,453 crore** to approximately **INR 4,53,863 crore** by FY 2031F.

Future growth is expected to be driven by rising EV penetration across urban, semi-urban, and rural markets, supported by expanding charging infrastructure and continued improvements in battery technology. Declining battery costs, increasing localization of manufacturing, and strengthening domestic supply chains are expected to improve affordability and enhance the competitiveness of EVs across vehicle categories. The adoption of electric passenger vehicles, commercial vehicles, and premium electric two-wheelers is also expected to contribute meaningfully to market expansion.

Furthermore, the EV ecosystem is anticipated to evolve into a more integrated mobility landscape encompassing vehicle manufacturing, charging infrastructure, battery-swapping networks, energy management solutions, and digital mobility platforms. Increasing electrification of commercial fleets, logistics operations, and shared mobility services is expected to create additional demand opportunities. As technology matures and infrastructure becomes more widespread, EVs are expected to emerge as a mainstream transportation solution in India, supported by sustained policy support and growing consumer acceptance.

## EV Market Segmentation in India

Market segmentation: by vehicle category (2W / 3W / 4W/ Others): Share of vehicle category

### Electric Two-Wheelers (E2W)

The E2W segment accounted for approximately 40.3% of total EV volumes in FY 2021, making it the second-largest vehicle category during the period. Driven by increasing adoption of electric scooters and motorcycles for personal mobility, daily commuting, and last-mile transportation, the segment's share is estimated to increase significantly to 59.9% by FY 2026E. The share is further projected to strengthen to approximately 61.0% by FY 2031F, supported by affordability advantages, wider product availability, improving battery technology, and rising acceptance among both individual consumers and commercial fleet operators. The segment is expected to remain the dominant contributor to overall EV volumes in India through the forecast period.

### Electric Three-Wheelers (E3W)

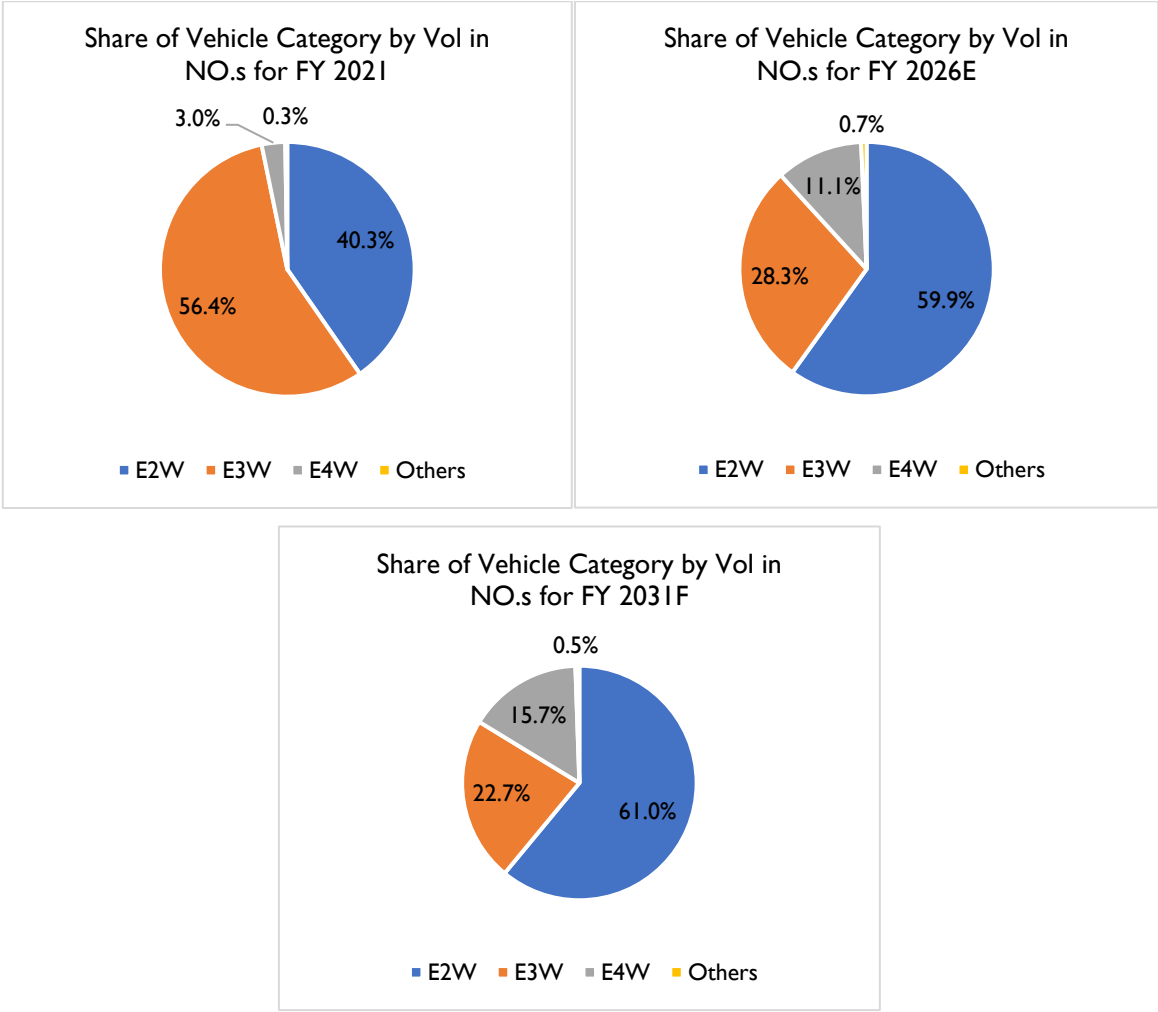
The E3W segment represented the largest share of EV volumes in FY 2021 at approximately 56.4%, supported by widespread deployment in passenger mobility, e-rickshaw operations, and last-mile logistics. However, its relative share is expected to decline to 28.3% in FY 2026E and further to 22.7% by FY 2031F as electric two-wheelers witness faster adoption across a broader consumer base. Nevertheless, the segment is expected to continue recording healthy growth in absolute volumes, supported by favourable operating economics and sustained demand from commercial transportation, passenger mobility, and last-mile logistics applications.

### Electric Four-Wheelers (E4W / Passenger Vehicles)

The E4W segment accounted for a relatively small 3.0% share of EV volumes in FY 2021, reflecting the early stage of electric passenger vehicle adoption in India. The segment is projected to expand considerably, reaching 11.1% of total EV volumes by FY 2026E and approximately 15.7% by FY 2031F. Growth is expected to be driven by increasing consumer acceptance of electric cars, expansion in model availability across price points, improvements in battery technology, higher driving ranges, and the continued development of charging infrastructure across urban and inter-city networks.

### Others (Electric Buses, Goods Vehicles and Emerging EV Categories)

The "Others" category, comprising electric buses, light commercial vehicles, goods carriers, and other emerging electric mobility solutions, accounted for approximately 0.3% of total EV volumes in FY 2021. The share is expected to increase to around 0.7% by FY 2026E and subsequently moderate to approximately 0.5% by FY 2031F. While the segment contributes a relatively small proportion of overall EV volumes, growth is expected to be supported by increasing electrification of public transportation fleets, commercial logistics operations, and specialized mobility applications across industrial and urban sectors.



Source: D&B Research Estimates \*E= Estimated and F= Forecasted

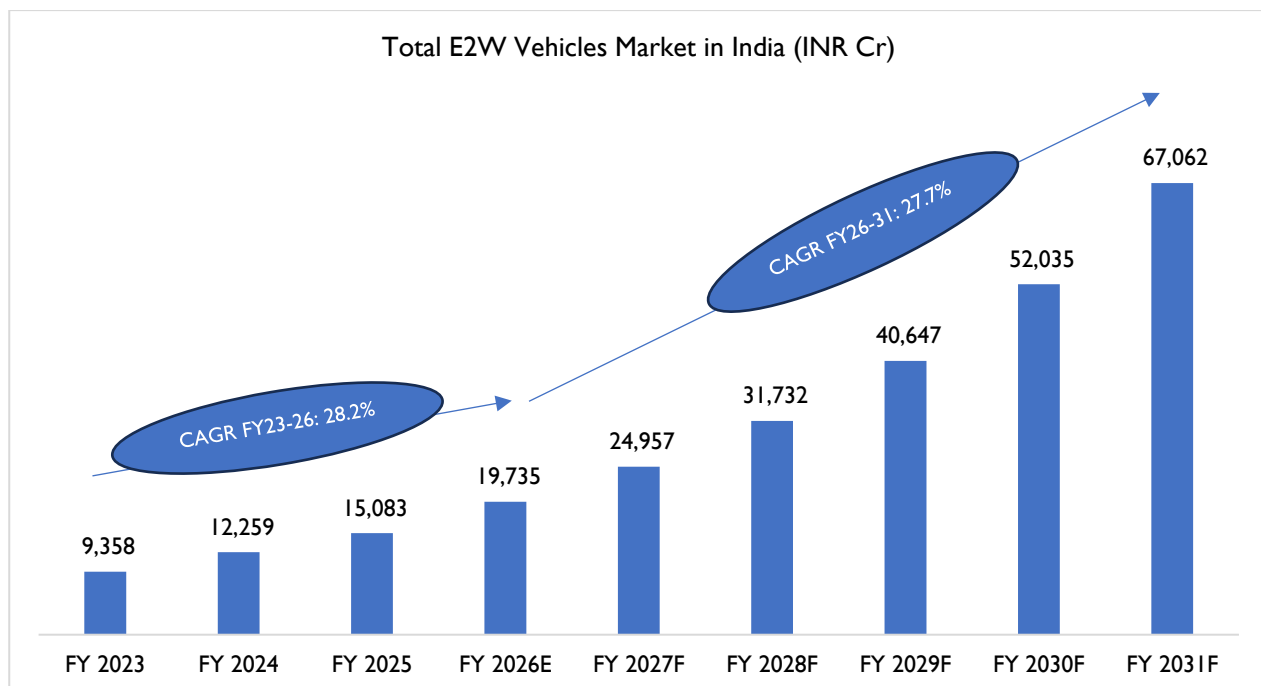
## Market size of the electric 2-Wheeler (E2W) industry in India

The electric two-wheeler (E2W) market in India has emerged as the **largest and most dynamic segment within the EV ecosystem**, driven by strong demand for cost-efficient and sustainable urban mobility solutions. The market has expanded rapidly from a relatively small base to a sizeable industry, supported by favorable economics, increasing consumer awareness, and policy incentives. With rising adoption across both personal and commercial use cases, E2Ws are playing a central role in India's electrification journey.

### Historical Analysis (FY 2023-26E)

Between FY 2023 and FY 2026E, the E2W market expanded from approximately **INR 9,358 crore** to **INR 19,735 crore**, registering a CAGR of around **28.2%**. The strong growth during this period reflects increasing penetration of electric scooters and motorcycles across urban and semi-urban markets. Growing consumer awareness regarding fuel cost savings, lower maintenance requirements, and environmental benefits contributed significantly to the adoption of electric two-wheelers.

The market growth was further supported by government incentive schemes, expansion of charging infrastructure, improvements in battery performance, and increasing availability of models across multiple price segments. In addition, the rapid growth of electronic commerce (e-commerce), food delivery, and last-mile logistics sectors created strong demand for electric two-wheelers, further accelerating market expansion. The period also witnessed greater participation from established automotive manufacturers and emerging EV-focused companies, resulting in enhanced product quality and wider market reach.



Source: D&B Research Estimates \*E= Estimated and F= Forecasted

*Note: The Electric Two-Wheeler (E2W) market size has been estimated using a combination of registered and unregistered electric two-wheeler volumes in India. Registration data for high-speed electric two-wheelers has been sourced from the VAHAN Portal maintained by the Ministry of Road Transport and Highways (MoRTH), which captures vehicle registrations across states and union territories. In addition, estimates for low-speed electric two-wheelers, which are generally exempt from registration requirements subject to applicable regulatory provisions, have been incorporated based on industry interactions, primary interviews, secondary research, manufacturer disclosures, and market estimates. The overall market size has*

been derived by aggregating both registered and estimated unregistered E2W volumes and applying corresponding average selling price assumptions to arrive at market value estimates. Accordingly, the market size represents the combined demand for high-speed and low-speed electric two-wheelers in India and may differ from registration-based estimates presented by government sources

## Future Market Outlook (FY 2026E to FY 2031F)

The E2W market is expected to maintain a robust growth trajectory over the forecast period, growing from approximately **INR 19,735 crore** in FY 2026E to around **INR 67,062 crore** by FY 2031F, reflecting a CAGR of approximately **27.7%**. Although the growth rate is expected to moderate compared to the initial adoption phase, the market is projected to continue expanding significantly as EV adoption becomes increasingly mainstream.

Future growth is expected to be driven by deeper penetration into Tier II and Tier III cities, continued improvements in battery technology, declining battery costs, and expansion of charging and battery-swapping infrastructure. Furthermore, increasing localization of EV components and battery manufacturing is expected to improve cost competitiveness and support wider adoption. The segment is also likely to benefit from rising consumer confidence in electric mobility, enhanced vehicle performance, and broader financing options.

While conventional internal combustion engine (ICE) two-wheelers are expected to remain a significant part of the overall two-wheeler market, the long-term growth momentum is increasingly shifting towards electric alternatives. The favorable total cost of ownership, improving ecosystem support, and continued technological advancements are expected to position electric two-wheelers as a key driver of growth within India's broader mobility landscape over the coming years

### E2W Segment in India: Market segmentation (High speed v/s low speed variants)

The electric two-wheeler (E2W) market in India is broadly segmented into **high-speed and low-speed variants**, primarily based on vehicle speed, motor capacity, and regulatory classification. This segmentation plays a critical role in defining product positioning, target customer segments, pricing strategies, and usage patterns. While both categories contribute to the overall electrification of mobility, they cater to distinct consumer needs.

The distinction is largely governed by regulatory norms set by authorities such as the Ministry of Road Transport and Highways (MoRTH), which determine whether a vehicle is classified as a motorised vehicle or a non-motorised vehicle (NMV). As a result, high-speed and low-speed E2Ws differ not only in performance and application but also in compliance requirements, ownership costs, and accessibility, thereby creating two parallel sub-markets within the broader E2W ecosystem.

## E2W Market Segmentation: High-Speed vs Low-Speed Electric Two-Wheelers:

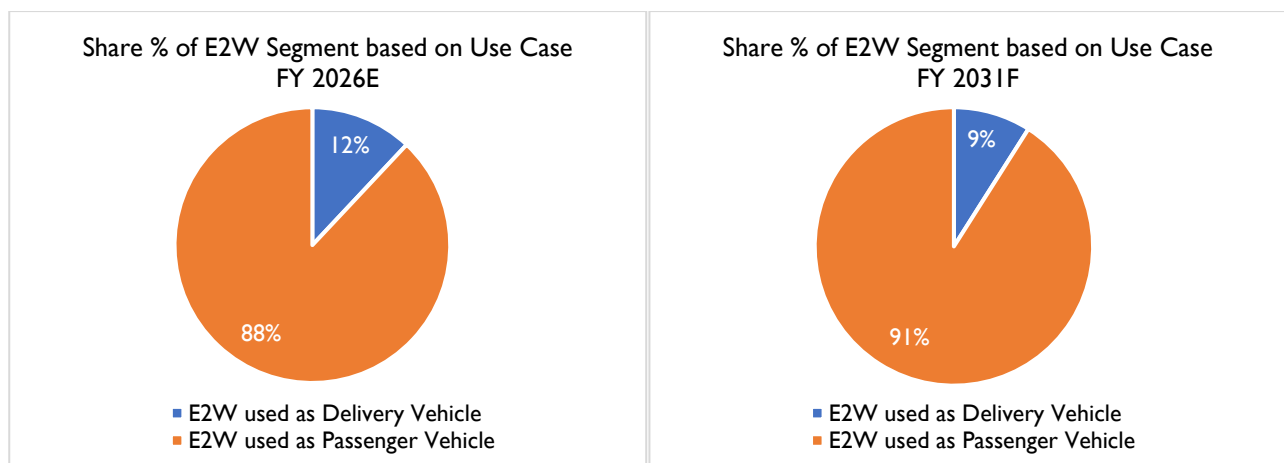
| Parameter                                           | High-Speed Electric Two-Wheelers (>25 km/h)                                                                                       | Low-Speed Electric Two-Wheelers ( $\leq 25$ km/h – NMV Category)                                                                                                                                                                                                                                                |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Regulatory Classification &amp; Requirements</b> | Classified as motor vehicles; requires registration, driving licence, insurance, and compliance with safety norms                 | Classified under non-motor vehicle category; benefits from simplified regulatory requirements with no need for registration, driving license, or insurance                                                                                                                                                      |
| <b>Speed, Motor &amp; Performance</b>               | Higher motor capacity; speeds above 25 km/h with strong acceleration, extended range, and enhanced performance for urban mobility | Optimised for efficiency and practicality; speeds up to 25 km/h with adequate range for personal and commercial transportation and intra-city travel                                                                                                                                                            |
| <b>Target Users &amp; Applications</b>              | Mainstream users for daily commuting and longer-distance urban mobility; suitable as an alternative to petrol vehicles            | Primarily adopted for convenient mobility, institutional campuses, gated communities, local retail movement, and everyday utility-based transportation requirements. The segment also finds adoption among users seeking simplified ownership and operational convenience under the non-motor vehicle category. |
| <b>Features &amp; Technology</b>                    | Equipped with advanced features such as connected technologies, improved battery systems, and enhanced ride experience            | Focused on ease of use, reliability, and cost efficiency, with simplified design and user-friendly operation                                                                                                                                                                                                    |
| <b>Cost &amp; Market Positioning</b>                | Higher upfront cost with improving cost competitiveness; dominant and rapidly growing segment                                     | Cost-effective mobility solution with lower upfront investment, supporting wider accessibility and mass adoption potential                                                                                                                                                                                      |
| <b>Illustrative Example</b>                         | High-speed electric scooters and motorcycles across premium and mid segments                                                      | Ampere Reo 80 ( $\leq 25$ km/h; no licence/registration required)                                                                                                                                                                                                                                               |

## E2W Segments in India: Based on use case (delivery vehicle v/s passenger use)

The adoption of Electric Two-Wheelers (E2Ws) in India can be broadly categorized into two primary use cases: passenger mobility and delivery applications. Passenger mobility constitutes the dominant segment, driven by the growing preference for cost-effective and environmentally sustainable transportation solutions for daily commuting. Factors such as rising fuel prices, improving charging infrastructure, expanding model availability, and favourable government initiatives have supported the adoption of E2Ws among individual users across urban, semi-urban, and rural markets.

The delivery segment comprises electric two-wheelers deployed for e-commerce, food delivery, quick-commerce, and last-mile logistics operations. The segment benefits from lower operating costs, reduced maintenance requirements, and higher vehicle utilization rates, making E2Ws an attractive option for fleet operators and delivery service providers. Growth in online commerce and hyperlocal delivery services continues to support demand for electric two-wheelers in commercial applications.

Low-speed electric two-wheelers ( $\leq 25$  km/h) play a complementary role across both passenger and delivery segments, serving a wide range of personal and commercial mobility applications. In the passenger segment, these vehicles are used for neighbourhood mobility, routine commuting, and first-time EV adoption, while in the delivery segment they support hyperlocal logistics and last-mile delivery operations. Their simplified regulatory framework, ease of operation, and suitability across diverse usage scenarios make them a practical mobility solution for a broad range of users across urban, semi-urban, and rural markets.



Source: D&B Research Estimates \*E= Estimated and F= Forecasted

Passenger mobility remains the primary use case for electric two-wheelers in India, accounting for approximately **88%** of total E2W volumes in FY2026E. The segment is expected to strengthen further, reaching around **91%** of total E2W volumes during the forecast period, supported by increasing consumer adoption for daily commuting and personal transportation requirements.

The delivery segment accounts for an estimated **12%** of E2W volumes in FY2026E and is projected to moderate to approximately **9%** during the forecast period. While its share is expected to decline as passenger

adoption expands more rapidly, the segment is anticipated to continue growing in absolute terms, supported by sustained demand from e-commerce, food delivery, and last-mile logistics applications.

#### Impact of United States (US)–Iran Conflict on E2W Industry in India

Geopolitical tensions such as the United States (US)- Iran conflict have a direct and positive impact on the electric two-wheeler (E2W) industry in India by driving a noticeable increase in demand. Such conflicts disrupt global crude oil supply, leading to higher and more volatile fuel prices. This significantly enhances the cost competitiveness of electric two-wheelers compared to petrol-powered alternatives, making them a more attractive option for cost-conscious consumers. As fuel prices rise, consumers increasingly shift towards E2Ws to reduce their daily commuting expenses, particularly in high-usage segments such as delivery, ride-sharing, and urban commuting. The total cost of ownership advantage becomes more pronounced during such periods, accelerating purchase decisions across both urban and semi-urban markets. This demand push is largely driven by the need for predictable and lower operating costs amid fuel price uncertainty.

The impact is comparatively more visible across utility-oriented and economically driven E2W categories, where lower operating expenses and energy cost efficiency significantly influence purchasing decisions. These vehicles, known for their affordability and lower running costs, witness faster adoption during periods of fuel price escalation. Tier 2 and Tier 3 markets, where consumers are more sensitive to fluctuations in fuel expenses, emerge as key demand centers during such periods. Overall, geopolitical conflicts that result in sustained increases in fuel prices act as a strong demand catalyst for the E2W industry in India. By reinforcing the economic advantages of electric mobility, such events accelerate the transition towards E2Ws and support the long-term growth trajectory of the segment.

## EV Penetration in India: E2W Scenario

### Estimated share of electric vehicles in Indian two-wheeler market

Electric vehicles are steadily increasing their presence in India's two-wheeler market, driven by supportive government policies, lower operating costs, and growing environmental awareness. Adoption has been particularly strong in urban and semi-urban areas where short-distance mobility needs align well with EV capabilities. Electric two-wheelers are gaining popularity among individual commuters as charging infrastructure improves and more affordable models become available. Factors such as rising fuel prices, increasing consumer awareness, and advancements in battery technology are further supporting the adoption of electric two-wheelers across the country. With continued policy support and technological advancements, the share of electric vehicles in the two-wheeler segment is expected to increase steadily over the coming years.

| E2W Penetration in Total 2-Wheeler Segment |         |         |         |         |          |
|--------------------------------------------|---------|---------|---------|---------|----------|
| Category                                   | FY 2021 | FY 2024 | FY 2025 | FY 2026 | FY 2031F |
| Electric Two-Wheeler                       | 0.32%   | 5.21%   | 5.87%   | 6.62%   | 25-30%   |

Source: D&B Research Estimates, VAHAN Portal

**Note:** Historical penetration figures are derived using Vahan Portal registration data for electric two-wheelers and total two-wheeler registrations. The FY 2031F range represents D&B estimates based on projected E2W adoption, expected two-wheeler industry growth, evolving policy support, charging infrastructure development, and technology advancements.

India's electric two-wheeler penetration currently stands at approximately 6.6% in FY 2026, having increased from around 0.3% in FY 2021, reflecting steady growth in adoption driven by supportive government policies, improving charging infrastructure, increasing product availability, and advancements in battery technology.

Based on adoption trends and the evolving industry landscape, electric two-wheeler penetration in India to reach approximately 25%–30% by FY 2031F. The forecast reflects continued growth in EV adoption supported by improving affordability, expanding charging infrastructure, technological advancements, and increasing consumer acceptance across urban and semi-urban markets.

## Brief insight on adoption trend of E2W among smaller towns & cities in India

The adoption of electric two-wheelers (E2Ws) in smaller towns and cities (Tier 2 and Tier 3) has accelerated significantly in recent years, supported by government-led initiatives such as the FAME India Scheme and data from the government-backed VAHAN portal. EV penetration in Tier 2 cities increased sharply from 4.16% in FY 2022 to 10.67% in FY 2025, while Tier 3 cities witnessed an even steeper rise from 1.69% to 8.68% during the same period, reflecting faster relative growth compared to metros. This trend highlights that smaller cities are emerging as key demand centers for EV adoption, driven by affordability, policy incentives, and improving accessibility.

Segment-wise, E2Ws dominate adoption in these regions due to their suitability across diverse mobility applications, favourable ownership proposition, and increasing availability of models. Government and industry data<sup>2</sup> indicate that E2Ws account for 70.94% of EV sales in Tier 3 cities and 57.84% in Tier 2 cities, underscoring their role as the primary electrification driver in smaller towns. Within this, **low-speed electric two-wheelers ( $\leq 25$  km/h) play a significant role in driving adoption**, particularly among first-time users and price-conscious consumers, due to their lower upfront cost, simplified ownership requirements, and suitability for travel.

Compared to **internal combustion engines (ICE) petrol two-wheelers**, E2Ws offer a **significantly lower running cost and reduced maintenance requirements**, which is a key decision factor in cost-sensitive markets. While ICE two-wheelers continue to have strong presence due to established refueling infrastructure and familiarity among users, the **cost advantage of E2Ws is increasingly influencing purchase decisions**, especially for high-frequency usage such as daily commuting and local travel.

Overall, the adoption trend in smaller towns is being driven by a combination of lower running costs (compared to ICE vehicles), expansion of charging infrastructure, and demand from e-commerce and delivery segments, alongside targeted subsidies and state-level incentives. **Low-speed E2Ws further support this trend by enabling adoption in areas with limited infrastructure, as they can be conveniently charged at home and are less dependent on public charging networks.** Notably, EV sales growth in 2023 alone increased by 51% across Tier 2 cities and 30% across Tier 3 cities, indicating strong momentum beyond metropolitan regions. As a result, smaller cities are transitioning from early adopters to mainstream EV markets, with E2Ws forming the backbone of India's broader electrification strategy.

### Key Structural Drivers Shaping E2W Adoption in Tier 2 and Tier 3 Markets in India:

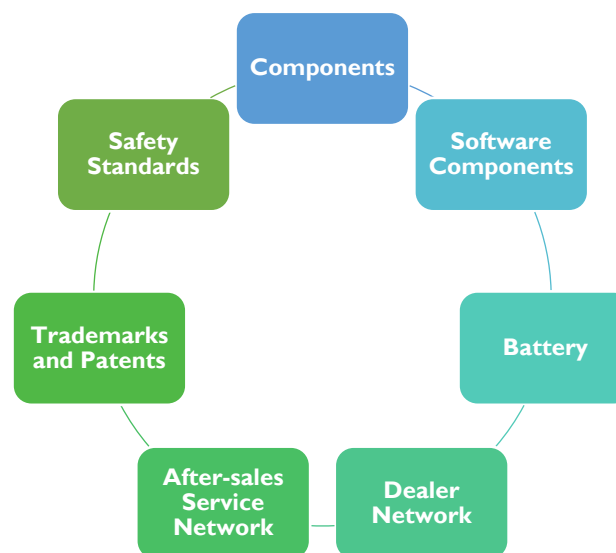
- **Stronger Role of Cost-Efficient Mobility Solutions:** In smaller towns, electric two-wheelers are increasingly adopted as cost-efficient mobility options for both personal and semi-commercial usage. The lower daily operating and maintenance costs compared to ICE vehicles make them an economically viable choice for users in semi-urban and rural markets.

<sup>2</sup> <https://energy.economictimes.indiatimes.com/amp/news/power/electric-vehicle-adoption-surges-in-tier-2-and-3-cities-in-india/121478689?utm>

- **Preference for Affordable and Practical Mobility Solutions:** Consumers in Tier 2/3 cities show a strong preference for low-speed electric two-wheelers and affordable models, often prioritizing affordability and practicality. This has led to higher traction for entry-level electric scooters and locally assembled vehicles, positioning these offerings as key drivers of volume growth in these markets.
- **Limited but Growing Charging Ecosystem:** Unlike metros, adoption in smaller towns is less dependent on public charging infrastructure, as users rely heavily on home charging and informal charging setups. Low-speed E2Ws, with lower battery capacity and flexible charging needs, are particularly well-suited to such environments. However, gradual expansion under schemes such as the FAME India Scheme Phase II and various state EV policies is improving accessibility.
- **State-Level Policy Support and Regional EV Ecosystems:** State governments are playing an important role in accelerating E2W adoption through EV policies, purchase incentives, charging infrastructure development, and streamlined registration processes. Along with expanding dealership networks and improving charging accessibility, these initiatives are supporting the gradual adoption of electric two-wheelers across Tier 2 and Tier 3 cities in different regions of India.

## Ecosystem in Indian E2W market

The ecosystem of the Indian electric two-wheeler (E2W) market comprises a broad network of component manufacturers, battery suppliers, software providers, dealerships, and service infrastructure that collectively support the development and adoption of electric mobility. This ecosystem includes key elements such as electric powertrain components, battery technologies, digital control systems, distribution networks, and after-sales service frameworks. Within this ecosystem, low-speed electric two-wheelers form a significant share of volumes, due to their accessibility under simplified regulatory norms and suitability for utility-oriented mobility requirements. The segment also contributes to the expansion of localized dealership networks, component sourcing ecosystems, and last-mile mobility adoption across emerging mobility markets. In addition, regulatory standards, safety certifications, and intellectual property development play an important role in shaping technological innovation and product reliability in the sector. As EV adoption continues to expand across India, the supporting ecosystem is also evolving to strengthen manufacturing capabilities, improve service networks, and enhance overall vehicle performance and safety.



□ **Components:** Electric two-wheelers rely on a combination of electrical and electronic components that collectively form the EV drivetrain architecture.

- **Core Components:** Key elements include electric motor, battery pack, battery management system (BMS), motor controller, inverter, power electronics controller, drivetrain, onboard charger, and thermal management systems.
- **Electric Motor:** Typically, BLDC (Brushless Direct Current) or PMSM (Permanent Magnet Synchronous Motors), widely used due to high efficiency and compact size.
- **Battery Pack:** Supplies electrical energy to the motor and represents a key value component of the vehicle, playing a crucial role in enabling efficient and affordable mobility solutions, particularly in low-speed electric two-wheelers (LSE2Ws).

- **Supporting Components:** DC-DC converters, wiring harnesses, sensors, and vehicle control modules ensure efficient energy distribution and vehicle operation.
- **Localization Trend:** Increasing localization under government initiatives is driving expansion of domestic production of motors, controllers, and EV power electronics.

The component ecosystem forms the foundation of E2W performance, efficiency, and reliability. As localization and technological advancements progress, the availability and quality of these components are expected to further strengthen the overall EV value chain in India.

#### □ **Software Components:**

Software systems play a critical role in managing vehicle performance, safety, and connectivity, **particularly in high-speed electric two-wheelers.**

- **Core Software Systems:** Key components in high-speed E2Ws include Battery Management System (BMS), Vehicle Control Unit (VCU), telematics systems, and user interface software integrated into digital displays.
- **Battery Management System (BMS):** Monitors battery parameters such as voltage, temperature, and state of charge to ensure optimal performance and safety.
- **Vehicle Control Unit (VCU):** Coordinates communication between the motor controller, battery system, and other vehicle subsystems to regulate acceleration, torque delivery, and energy usage.
- **Telematics & Connectivity:** Telematics platforms and mobile applications enable remote diagnostics, Global Positioning System (GPS) tracking, and performance monitoring, primarily in high-speed models.
- **User Interface Systems:** Software integrated into digital instrument clusters enhances rider experience by displaying battery status, range estimates, and vehicle alerts.

While high-speed E2Ws incorporate advanced software systems, The increasing adoption of digital technologies in high-speed models is enhancing vehicle intelligence, connectivity, and overall performance.

#### □ **Battery:**

Battery technology represents the core energy storage component in electric two-wheelers and plays a critical role in determining vehicle performance, range, and overall lifecycle efficiency.

- **Battery Chemistry:** Lithium-ion battery chemistries such as Lithium Iron Phosphate (LFP) and Nickel Manganese Cobalt (NMC) are commonly used in the Indian E2W market due to their balance of energy density, safety, and lifecycle performance.
- **Charging Infrastructure:** Charging preferences include home charging through portable chargers and public charging stations, with a higher reliance on home-based charging in low-speed electric two-wheeler (LSE2W) segments.

- **Battery Configuration:** Some manufacturers offer vehicles with fixed batteries, while others provide removable battery packs to facilitate convenient charging in residential environments.
- **Battery Swapping Model:** Battery swapping is emerging in select use cases such as delivery and shared mobility, enabling reduced downtime and operational flexibility.

Battery technology continues to evolve with advancements in chemistry, charging infrastructure, and operational models. As adoption increases, battery innovation and ecosystem development are expected to play a critical role in improving efficiency and enhancing user convenience across the E2W segment.

#### □ **Dealer Network:**

The distribution of electric two-wheelers in India is supported by an expanding dealership ecosystem that facilitates market access and customer engagement.

- **Dealership Structure:** The ecosystem comprises exclusive brand showrooms, multi-brand EV dealerships, and franchise-based retail networks.
- **E2W Distribution Expansion:** Manufacturers are expanding dealership presence across metropolitan as well as Tier-2 and Tier-3 cities to enhance market penetration, particularly for low-speed electric two-wheelers (LSE2Ws) aided by simplified ownership requirements and growing adoption across utility-oriented mobility applications.
- **Role of Dealerships:** The dealership network supports vehicle sales, customer education, financing facilitation, and initial service support.

The dealership ecosystem continues to evolve alongside E2W adoption, with a growing focus on expanding reach, improving customer awareness, and strengthening last-mile connectivity. This network remains a critical interface between manufacturers and end-users, supporting both sales growth and service delivery.

#### □ **After-sales Service Network:**

After-sales service infrastructure is emerging as a key enabler of growth in the electric two-wheeler (E2W) ecosystem in India, supporting vehicle reliability, customer satisfaction, and long-term adoption.

- **Service Infrastructure Expansion:** Manufacturers are actively expanding authorized service centres, dealership networks, and mobile service units to enhance accessibility and provide timely maintenance and diagnostics support across urban and semi-urban regions.
- **Growing Digital Integration:** The adoption of digital service platforms, remote diagnostics, and app-based service scheduling is improving operational efficiency and enhancing the overall customer experience.
- **Government Support Initiatives:** The Ministry of Heavy Industries, under schemes such as FAME India Scheme, has supported the development of EV ecosystem infrastructure, including service

readiness. Additionally, the Skill India Mission is promoting EV-focused training programs to build a skilled workforce for maintenance and servicing.

- **Industry-led Skill Development:** OEMs and service providers are increasingly investing in technician training programs and standardized service protocols to improve service quality and consistency.

The after-sales service ecosystem is expected to strengthen further with continued investments in infrastructure, digital tools, and skill development initiatives. These developments are likely to enhance service quality, reduce turnaround time, and build stronger customer confidence, thereby supporting sustained growth in the E2W market.

## □ Trademarks and Patents:

Innovation in the electric mobility sector has led to increasing filings of patents and trademarks related to EV technologies in India.

- **Patent Activity Areas:** Patent filings are concentrated in battery technology, thermal management, electric powertrain design, and charging systems.
- **Industry Participation:** Automotive manufacturers, EV startups, and technology companies are actively filing intellectual property protections to safeguard proprietary technologies.
- **Regulatory Authority:** In India, patents and trademarks are regulated and administered by the Office of the Controller General of Patents, Designs and Trademarks (CGPDTM) under the Ministry of Commerce and Industry.

The growing focus on intellectual property reflects increasing technological advancement and competition within the EV ecosystem. Continued innovation and protection of proprietary technologies are expected to support product differentiation and long-term industry development.

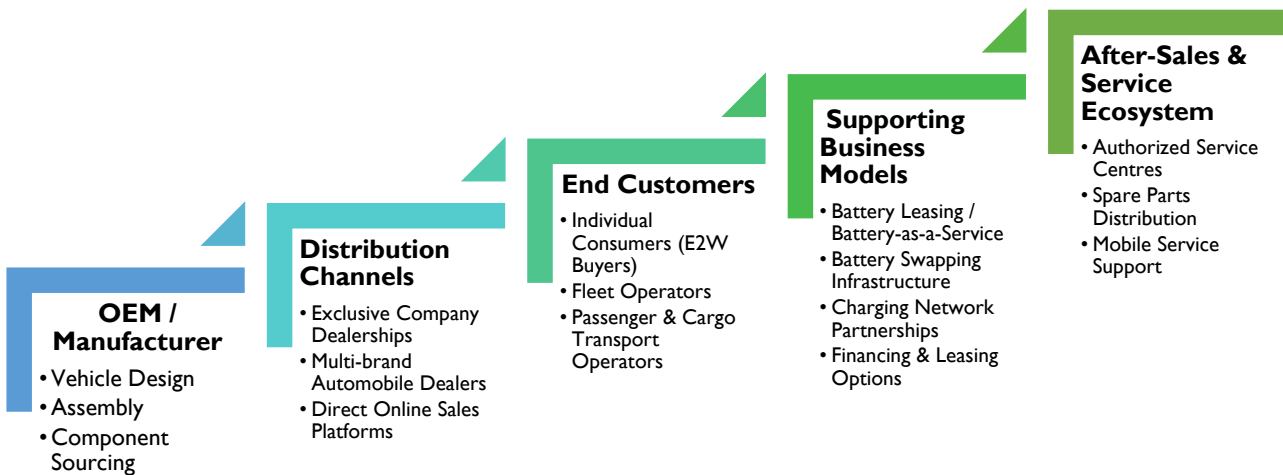
## □ Safety Standards:

The electric two-wheeler market in India is governed by regulatory safety standards and quality certifications to ensure vehicle safety, battery reliability, and operational performance.

- **Regulatory Frameworks:** Safety standards are defined under Automotive Industry Standards (AIS) issued by the Automotive Research Association of India (ARAI) and the Central Motor Vehicle Rules (CMVR) notified by the Ministry of Road Transport and Highways.
- **Key Safety Standards:** AIS-156 for electric two-wheelers and AIS-038 Rev.2 for electric vehicle battery safety outline requirements for battery testing, thermal stability, electrical safety, and performance validation.
- **Mandatory Compliance:** Adherence to these standards is mandatory for vehicle homologation and commercialization in the Indian market.

The implementation of standardized safety norms is critical in ensuring product reliability and mitigating risks associated with electric mobility. As the ecosystem evolves, continued strengthening of safety regulations is expected to enhance consumer confidence and support sustainable market growth.

## Business Model in Indian E2W Space



The business model in the Indian electric two-wheeler (E2W) market is structured around manufacturers (OEMs) that design, assemble, and distribute electric vehicles through a network of dealerships and other sales channels. OEMs typically procure key components such as batteries, electric motors, controllers, and power electronics from specialized suppliers and integrate them during vehicle assembly. The finished vehicles are then distributed through **exclusive company dealerships, franchise showrooms, and multi-brand automobile dealers**, enabling manufacturers to reach customers across metropolitan, Tier-2, and Tier-3 cities.

In addition to traditional dealership-based sales, several manufacturers are increasingly adopting **direct-to-customer sales channels**, including online booking platforms and company-operated retail outlets. These channels allow customers to explore vehicle specifications, compare models, and place bookings digitally, while deliveries are typically completed through authorized dealerships or regional distribution partners. The end-customer base in this market primarily includes individual buyers for personal commuting, along with increasing participation from gig economy users and last-mile delivery segments, particularly in low-speed electric two-wheelers (LSE2Ws) where cost efficiency and favourable ownership proposition are key considerations.

Supporting business models are also emerging within the ecosystem to improve affordability and operational efficiency. These include **battery leasing and battery-as-a-service models, charging infrastructure partnerships, and vehicle financing solutions tailored to price-sensitive consumers**. In parallel, manufacturers are strengthening their **after-sales service ecosystems**, which include authorized service centres, spare parts distribution networks, and mobile service support. These service networks play an

important role in ensuring vehicle reliability, reducing downtime, and building consumer confidence in electric two-wheelers.

#### Traditional channels: OEM selling vehicles directly to customers through own dealerships and multi vehicle dealerships

The traditional distribution model continues to play an important role in the Indian electric two-wheeler (E2W) market. Under this structure, original equipment manufacturers (OEMs) sell vehicles through a network of **company-owned showrooms, exclusive brand dealerships, and multi-brand automobile dealers**. These retail channels enable manufacturers to reach customers across different regions while facilitating product demonstrations, vehicle sales, and initial service support. The dealership-based model, therefore, remains a key component of the electric two-wheeler sales and distribution ecosystem in India.

| Component                                         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OEM-led dealership sales</b>                   | In the Indian electric two-wheeler (E2W) market, vehicle distribution largely operates through traditional dealership-based sales channels. Under this structure, OEMs sell vehicles directly to customers through a network of company-owned showrooms, exclusive brand dealerships, and multi-brand automobile dealerships. These retail outlets serve as the primary interface between manufacturers and end users, enabling companies to showcase their product portfolio and maintain a physical presence in key markets. The dealership-based model helps OEMs manage vehicle distribution efficiently while ensuring standardized sales practices, brand visibility, and localized market reach across different regions in India.                           |
| <b>Customer engagement and sales facilitation</b> | Dealerships play a critical role in facilitating customer interaction and supporting the overall purchase journey. At these outlets, prospective buyers can examine vehicle models, understand product specifications, receive live demonstrations, and compare different variants before making purchase decisions. Dealers also assist customers with financing options, insurance arrangements, and regulatory documentation required for vehicle registration. By offering in-person consultation and product guidance, dealerships help address consumer concerns related to electric mobility, such as vehicle performance, battery range, and charging requirements, thereby improving consumer awareness and encouraging adoption of electric two-wheelers. |
| <b>Initial after-sales support</b>                | In addition to vehicle sales, dealerships often serve as the first level of after-sales support for customers. Many dealerships provide basic servicing facilities, spare                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                         | parts availability, and technical assistance, ensuring that customers have access to maintenance support soon after vehicle purchase. Service personnel at dealership locations typically handle routine inspections, minor repairs, and diagnostic checks, while more complex technical issues may be addressed at specialized service centres. This after-sales support structure helps manufacturers maintain customer satisfaction and ensures that electric two-wheelers remain operational and reliable during regular use.                                                                                                                                                                                                                                          |
| <b>Expansion of dealership networks</b> | To strengthen market penetration and improve product accessibility, several electric two-wheeler manufacturers are actively expanding their dealership networks across India. Many leading companies have established extensive retail touchpoints in metropolitan areas as well as Tier-2 and Tier-3 cities, enabling wider distribution of E2W models. Expanding dealership networks helps manufacturers reach new customer segments, particularly in emerging urban centres where demand for cost-efficient mobility solutions, especially in low-speed electric two-wheelers (LSE2Ws), is increasing. The continued expansion of dealership infrastructure is expected to play an important role in supporting the growth of the electric two-wheeler market in India. |

#### New channels:

Alongside traditional dealership-based distribution, the Indian electric two-wheeler (E2W) market is witnessing the emergence of several new business models aimed at improving affordability, operational flexibility, and customer convenience. These models leverage digital platforms, innovative ownership structures, and mobility services to expand adoption across both personal and emerging usage segments. Direct-to-customer sales, battery service models, and mobility leasing solutions are increasingly being explored by manufacturers and mobility providers to address evolving consumer needs and operational requirements. These models are particularly relevant in low-speed electric two-wheelers (LSE2Ws), where simplified regulatory requirements, ease of operation, and suitability across diverse personal and commercial mobility applications support their adoption .

| Business Model                                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Direct-to-Customer (without dealership)</b> | In this model, electric two-wheeler (E2W) manufacturers sell vehicles directly to customers through <b>company-operated showrooms or online platforms</b> , reducing dependence on traditional dealership networks. Customers can explore vehicle specifications, compare models, and place bookings through digital channels, while delivery and service support are managed through company experience centres or authorized service partners. This approach enables |

|                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                               | manufacturers to maintain closer customer engagement and streamline distribution processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Battery-as-a-Service (BaaS) and Battery Swapping Model</b> | Under this model, the vehicle and battery are treated as separate assets. Customers purchase the vehicle without the battery and subscribe to a <b>battery leasing or battery swapping service</b> , paying usage-based or subscription fees. Battery swapping stations allow users to quickly exchange depleted batteries with fully charged ones, reducing downtime and lowering the upfront cost of ownership. This model is particularly relevant for low-speed electric two-wheelers (LSE2Ws) and delivery-oriented use cases where affordability and operational flexibility are key considerations. |
| <b>Mobility-as-a-Service (MaaS) Model</b>                     | The MaaS model focuses on <b>providing leasing, rental, or shared mobility solutions</b> rather than direct vehicle ownership. EV manufacturers and mobility companies collaborate with fleet operators, ride-hailing platforms, and logistics providers to deploy electric two-wheelers for last-mile connectivity and delivery applications. Under this arrangement, users or operators pay periodic leasing or usage charges, enabling access to vehicles without significant upfront capital investment while benefiting from the lower operating costs of electric mobility.                          |

## Technology & Innovation in Indian E2W market

### Insight on emerging technology & innovations in Indian E2W space

Technological innovation is playing a central role in shaping the growth of electric two-wheelers (E2W) in India. Continuous advancements in battery technologies, electric drivetrains, and energy management systems are significantly improving vehicle performance, driving range, and operational efficiency. Manufacturers are increasingly focusing on developing vehicles with higher energy density batteries, faster charging capabilities, and improved thermal management systems, enabling E2Ws to become more reliable and practical for personal mobility usage.

In addition to hardware improvements, the integration of digital and connected technologies has become a key innovation trend in the E2W ecosystem. Many electric two-wheelers are now equipped with smart features such as connected vehicle platforms, GPS-based tracking, telematics systems, and mobile application integration. These technologies allow users to monitor battery status, vehicle performance, and charging levels in real time, while also enabling remote diagnostics and predictive maintenance. Such features are increasingly being adopted across both premium and low-speed electric two-wheelers (LSE2Ws), enhancing user convenience and operational efficiency.

Government initiatives are further supporting technological development in the EV ecosystem. Programs such as the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme and the Production Linked Incentive (PLI) scheme for Advanced Automotive Technology are encouraging domestic manufacturing of EV components, battery systems, and electric drivetrains. These initiatives aim to strengthen India's EV supply chain and promote innovation in advanced battery technologies, battery management systems, and charging infrastructure. As competition among EV manufacturers and startups intensifies, continued investments in research and development are expected to drive further innovation in areas such as battery performance, connected mobility platforms, and battery-swapping ecosystems in the E2W segment.

#### ➤ **E2W (connected features / superior battery tech / high-speed models / others):**

##### • **Connected Features**

Modern electric two-wheelers are increasingly incorporating connected vehicle technologies that enable real-time data communication between the vehicle, rider, and cloud-based platforms. Features such as **GPS tracking, remote diagnostics, geofencing, over-the-air (OTA) software** updates, and smartphone application integration allow users to monitor vehicle performance, battery status, and riding statistics in real time. These connected capabilities also support predictive maintenance and remote troubleshooting, thereby improving overall vehicle reliability, operational efficiency, and user convenience.

Manufacturers are progressively integrating Internet of Things (IoT)-enabled telematics systems and **advanced digital dashboards** into electric scooters and motorcycles. These platforms facilitate

functionalities such as navigation assistance, ride analytics, anti-theft alerts, and vehicle health monitoring. Connected ecosystems are increasingly being positioned as a key differentiator, particularly in premium electric two-wheelers, while also supporting fleet management and performance optimization for commercial and last-mile delivery applications.

Recent developments across the value chain further reinforce this trend. Semiconductor and embedded technology providers are introducing integrated digital solutions tailored for electric two-wheelers. For instance, **in March 2025<sup>3</sup>, Microchip Technology** developed an electric two-wheeler ecosystem featuring intelligent digital instrument clusters, advanced touchscreen controllers designed for reliable performance in varied operating conditions, and cloud-enabled diagnostic capabilities. These solutions enable real-time data visualization, enhanced user interface interaction, and remote performance tracking, reflecting the growing integration of smart, connected technologies in next-generation electric mobility solutions.

- **Superior Battery Technology**

Battery technology continues to evolve as one of the most critical innovation areas in electric two-wheelers. Most modern E2W models in India utilize lithium-ion batteries with improved energy density, enabling higher vehicle range, faster charging times, and enhanced lifecycle performance. Continuous advancements in battery chemistry, thermal management systems, and battery management systems (BMS) are enabling manufacturers to deliver vehicles with improved reliability, safety, and long-term operational efficiency.

Technological improvements have also contributed to a significant reduction in battery costs alongside enhancements in charging efficiency and energy density. Industry studies indicate that lithium-ion battery costs have declined substantially over the past decade, while energy density improvements have enabled electric two-wheelers to achieve longer driving ranges on a single charge. These developments are expected to support broader adoption of electric mobility, as manufacturers continue to introduce models with higher battery capacity, improved performance, and optimized charging solutions.

Recent industry developments further highlight the pace of innovation in battery technologies and supporting infrastructure.

- **September 2024 – Introduction of Supercapacitor Technology (CollarEV)<sup>4</sup>**

CollarEV introduced Electric Double Layer Super Capacitor (EDLC)-based energy storage technology in India, offering an alternative to conventional battery systems. This technology is

<sup>3</sup> <https://www.microchip.com/en-us/about/news-releases/products/microchip-introduces-electric-two-wheeler-ecosystem-to-accelerate>

<sup>4</sup> <https://www.aninews.in/news/business/collarev-is-leading-the-way-in-india-by-introducing-the-electric-double-layer-super-capacitor-battery-technology-through-pbs20240930192821/>

designed to enable **faster charging cycles, higher power delivery, and improved durability**, indicating potential future applications in electric mobility.

- **November 2025 – Expansion of Battery Swapping Ecosystem (Battery Smart + Lilypad)**<sup>5</sup>  
Battery Smart partnered with Lilypad to expand **battery-swapping infrastructure in Delhi-National Capital Region (NCR)**, focusing on improving accessibility for electric two-wheelers. This initiative aims to **reduce range anxiety, minimize charging downtime**, and support **fleet operators and last-mile delivery services**, thereby strengthening urban EV adoption.
- **2025 (EICMA) – High-Capacity Battery Systems in Premium E2Ws (Honda)**  
Honda unveiled its electric motorcycle (WN7)<sup>6</sup> featuring a **9.3 kWh lithium-ion battery**, highlighting advancements in **battery capacity, power output, and performance benchmarking**. Such developments indicate a broader industry shift towards **high-performance electric two-wheelers with enhanced range and capability**.

Collectively, these advancements are strengthening the technological foundation of the electric two-wheeler segment and supporting its long-term scalability.

- **High-Speed Models**

The development of high-speed electric two-wheelers represents a key innovation trend in India's electric mobility market. While early electric scooters were largely limited to low-speed configurations designed for short-distance urban commuting, recent product launches indicate a clear growing interest towards higher performance vehicles capable of catering to broader and longer-distance mobility requirements. New-generation electric two-wheelers are increasingly designed to deliver improved acceleration, higher top speeds, and enhanced ride quality, positioning them as viable alternatives to conventional internal combustion engine (ICE) scooters and motorcycles.

Many of the latest electric two-wheelers offer top speeds exceeding 80 km/h, supported by advancements in motor technology, power electronics, and battery systems that enable better torque delivery and sustained performance. OEMs are also introducing multiple riding modes, fast-charging capabilities, and improved battery configurations to enhance usability across different driving conditions. The emergence of high-speed electric motorcycles and premium scooters is further expanding the addressable market beyond basic commuting to include performance-oriented and aspirational segments.

Recent industry developments further illustrate this transition. For instance, **TVS Motor Company** continued to strengthen its electric mobility portfolio through the expansion of the TVS iQube range and the premium TVS X platform during **2024–2025**, supported by advancements in

<sup>5</sup> <https://www.eqmagpro.com/battery-smart-and-lilypad-join-forces-to-power-delhi-ncrs-electric-two-wheeler-revolution-eq/>

<sup>6</sup> <https://global.honda/en/newsroom/news/2025/c251104feng.html>

connected technologies and charging infrastructure. Similarly, in <sup>7</sup>**May 2026**, **Ather Energy** unveiled its next-generation **EL platform**, aimed at expanding its presence in the high-volume mass-market electric scooter segment. The platform is designed to support multiple scooter variants, with the first model expected to be launched during the **2026 festive season**. To support this expansion, the company also announced a new manufacturing facility at **Chhatrapati Sambhajinagar**, scheduled to commence operations **before the end of 2026**, with an initial production capacity of approximately **42,000 units per month**. In addition, Ather introduced the **Redux moto-scooter concept** and announced the rollout of **AtherStack 7.0** in **August 2025**<sup>8</sup>, featuring an upgraded electronics architecture and enhanced connected vehicle capabilities. These developments reflect the industry's continued focus on platform innovation, manufacturing scale-up, and the introduction of technologically advanced, high-performance electric two-wheelers in India.

- **Removable and Swappable Battery Configurations:**

Low-speed electric two-wheelers (LSE2Ws) are increasingly being designed with removable battery systems, enabling users to conveniently charge batteries at home or workplaces without relying on public charging infrastructure. This feature is particularly relevant in Tier-1 and Tier-2 cities, where access to dedicated charging stations remains limited. Removable battery configurations enhance user convenience, reduce range anxiety, and support adoption among consumers with limited access to private parking or charging setups. In addition, compatibility with battery swapping networks is being explored to further improve operational flexibility and reduce downtime for users.

- **Lightweight Design and Energy-Efficient Architecture:**

Manufacturers of low-speed electric two-wheelers (LSE2Ws) are focusing on lightweight vehicle design and energy-efficient component integration to optimize performance and reduce costs. The use of lighter chassis materials, compact motors, and simplified drivetrain configurations enables lower energy consumption, thereby extending range even with smaller battery capacities. This approach also helps in reducing overall vehicle cost, making LSE2Ws more affordable compared to the high speed vehicle. Such design optimizations are critical in ensuring that low-speed electric two-wheelers remain economically viable while delivering adequate performance for urban and semi-urban mobility needs.

<sup>7</sup> <https://www.autocarpro.in/news/ather-energy-to-launch-el-platform-scooter-start-operations-at-new-plant-in-aurangabad-before-the-end-of-2026-132404>

<sup>8</sup> <https://economictimes.indiatimes.com/industry/renewables/ather-energy-unveils-new-2w-platform-for-next-generation-of-e-scooters/articleshow/123598470.cms?from=mdr>

## Regulatory Landscape (Focusing on EV as a whole and Especially E2W space)

India's regulatory landscape for electric vehicles, particularly electric two-wheelers (E2Ws), is anchored by a strong national policy framework designed to accelerate adoption, reduce emissions, and build a self-reliant EV ecosystem. Foundational initiatives such as the National Electric Mobility Mission Plan (NEMMP) and the FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) schemes have played a pivotal role in driving early and scaled adoption by offering demand incentives, promoting domestic manufacturing, and supporting charging infrastructure development. The transition from FAME II to the recently launched PM E-DRIVE scheme ensures policy continuity, with a larger financial outlay and a sharper focus on ecosystem expansion, including charging infrastructure, advanced battery manufacturing, and support across multiple EV segments. Notably, E2Ws remain a key focus area due to their mass-market appeal, affordability, and suitability for both personal and commercial applications such as last-mile delivery.

Complementing central initiatives, state-level EV policies across major states such as Delhi, Maharashtra, Gujarat, Tamil Nadu, and Karnataka provide additional incentives including purchase subsidies, tax exemptions, and infrastructure support, thereby accelerating regional adoption. Broader industrial policies such as Make in India, Production Linked Incentive (PLI), and the Phased Manufacturing Programme (PMP) further strengthen the domestic EV value chain by incentivizing localization of components like batteries, motors, and power electronics. Fiscal measures such as a reduced GST rate of 5% on EVs and income tax benefits under Section 80EEB enhance affordability, while policy emphasis on charging infrastructure expansion and battery swapping solutions addresses key adoption barriers such as range anxiety particularly benefiting high-usage E2W segments.

From a regulatory standpoint, the E2W industry is governed by safety and compliance standards under the Central Motor Vehicles Rules and Automotive Industry Standards, particularly AIS-156, which mandates stringent battery safety requirements including thermal, electrical, and mechanical testing. Additional standards issued by the Bureau of Indian Standards, such as IS 16893 and IS 16046, ensure the safety, performance, and reliability of lithium-ion batteries used in EVs. These regulations are critical in improving consumer confidence and reducing safety risks, especially in the E2W segment where battery systems are central to vehicle performance and cost. Overall, India's evolving regulatory framework—combining demand incentives, manufacturing support, and stringent safety norms is creating a conducive environment for sustained growth of the electric two-wheeler market.

### ➤ **AIS-156 Amendment (Battery Safety Norms for E2Ws)**

AIS-156 is one of the most critical regulations governing electric two-wheelers in India, specifically focused on battery safety standards for L-category vehicles, including E2Ws. Following multiple EV fire incidents, the government introduced stricter amendments (including Amendment III – Phase 2), making compliance mandatory under CMVR. These norms are among the most stringent globally for electric two-wheelers, emphasizing enhanced safety protocols for lithium-ion battery systems. The regulation mandates multiple

safety tests such as thermal propagation testing, vibration resistance, mechanical shock, overcharge protection, and short-circuit safety. It also requires advanced Battery Management Systems (BMS), real-time monitoring, and early warning mechanisms to prevent thermal runaway incidents. These requirements significantly improve the reliability and safety of E2Ws, particularly in high-temperature operating conditions such as India.

While AIS-156 is primarily applicable to high-speed E2Ws requiring type approval, its influence extends to the low-speed segment as well. Increasingly, regulators are encouraging stricter safety compliance even for low-speed vehicles due to rising safety concerns. As a result, manufacturers of low-speed E2Ws are gradually adopting AIS-aligned battery standards to build consumer trust and avoid regulatory scrutiny, indicating a shift toward uniform safety norms across the industry.

➤ **Bureau of Indian Standards (BIS) – New EV Safety Standards (IS 18590:2024 & IS 18606:2024)**

The Bureau of Indian Standards (BIS) has recently introduced new safety and quality standards—IS 18590:2024 and IS 18606:2024 to strengthen the regulatory framework for EVs, including electric two-wheelers. These standards focus on critical EV components such as the powertrain, battery systems, and overall vehicle safety architecture. They are applicable across vehicle categories, including L-category vehicles, which cover E2Ws. These standards aim to ensure that EV components meet stringent performance, durability, and safety benchmarks, addressing concerns related to substandard components entering the market. The regulations emphasize improved battery integrity, safer design architecture, and enhanced testing protocols, thereby reducing risks associated with overheating, electrical faults, and system failures.

For the low-speed E2W segment, BIS standards play a crucial role in bridging regulatory gaps created by CMVR exemptions. Since these vehicles are not always subject to full homologation requirements, BIS norms act as an indirect quality control mechanism. Over time, adherence to BIS standards is expected to become a key differentiator for manufacturers, improving overall product reliability and strengthening consumer confidence in low-speed electric mobility solutions.

➤ **Central Motor Vehicles (Eighth Amendment) Rules, 2024 – New Vehicle Categories & Innovation Push**

The Central Motor Vehicles (Eighth Amendment) Rules, 2024 represent one of the latest regulatory updates impacting the EV ecosystem, including electric two-wheelers. This amendment introduced a new vehicle category (L2-5), allowing registration of convertible vehicles that can function as both two-wheelers and three-wheelers. The move reflects the government's intent to promote innovation and flexible mobility solutions in the EV space.

This regulatory change expands the scope of vehicle classification under CMVR, enabling manufacturers to develop new formats of lightweight electric vehicles tailored for urban and last-mile mobility. Such innovations are particularly relevant for low-speed segments, where design flexibility, affordability, and ease of use are

key adoption drivers. The amendment also simplifies approval pathways for emerging vehicle formats, encouraging startups and new entrants in the EV ecosystem. For the low-speed E2W segment, this regulation signals a broader shift toward adaptive and innovation-friendly policies. While not directly altering existing exemptions, it opens opportunities for hybrid low-speed mobility solutions that may operate under relaxed regulatory frameworks. This is expected to drive product innovation, expand use cases, and further accelerate adoption of electric mobility in urban and semi-urban India.

#### Insight on National-Level Policy Framework Driving E2W Growth in India

- **National Electric Mobility Mission Plan (NEMMP):**

The **National Electric Mobility Mission Plan (NEMMP)**, launched in 2013, provides the foundational policy framework for promoting electric mobility in India, with a strong focus on segments such as **electric two-wheelers (E2Ws)**. The policy aims to reduce dependence on fossil fuels, enhance energy security, and lower vehicular emissions, while supporting the development of a robust domestic EV ecosystem. NEMMP has played a key role in enabling **demand creation, technology development, and local manufacturing of EV components**, particularly for mass-market segments such as E2Ws, which are critical for urban and semi-urban mobility.

Under this framework, the government has introduced various supporting initiatives, including **financial incentives for EV adoption, investments in charging infrastructure, and programs to promote domestic manufacturing**. These measures have significantly supported the growth of the E2W segment by improving affordability, expanding product availability, and strengthening ecosystem readiness. NEMMP has also facilitated collaboration between policymakers, manufacturers, and technology providers, laying the groundwork for subsequent initiatives such as the FAME scheme and other EV-focused programs that continue to accelerate E2W adoption in India.

- **FAME and FAME II<sup>9</sup>**

The **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)** scheme, introduced in 2015 under the National Electric Mobility Mission Plan, has been a key driver in promoting the adoption of **electric two-wheelers (E2Ws)** in India. The scheme primarily focused on providing **demand incentives to reduce upfront vehicle cost**, along with support for charging infrastructure and technology development. For the E2W segment, these incentives played a critical role in improving affordability and encouraging early-stage adoption, particularly in urban markets.

The second phase, **FAME II**, launched in 2019 with an outlay of approximately **INR 10,000 crore**, placed stronger emphasis on **scaling adoption of high-speed electric two-wheelers**, especially those used for daily commuting and commercial applications such as last-mile delivery. The scheme introduced stricter eligibility criteria, including performance and localization requirements, thereby promoting higher-quality and

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<sup>9</sup> <https://heavyindustries.gov.in/hil/fame-ii>

technologically advanced E2Ws. In addition to demand incentives, FAME II also supported the expansion of **public charging infrastructure**, contributing to improved ecosystem readiness and sustained growth of the E2W segment in India.

- **PM E-DRIVE Scheme** <sup>10</sup>

The **PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) Scheme** was launched by the **Ministry of Heavy Industries, Government of India**, with the approval of the Union Cabinet chaired by **Narendra Modi**, through Gazette notification S.O. 4259(E) on **29 September 2024**. The scheme is scheduled to be implemented from **1 October 2024 to 31 March 2026**. It replaces and builds upon earlier EV support programs, particularly following the conclusion of the **FAME II Scheme**. Additionally, the **Electric Mobility Promotion Scheme (EMPS-2024)**, which was implemented from **1 April 2024 to 30 September 2024** for electric two-wheelers and three-wheelers, has been subsumed under the PM E-DRIVE scheme. As a result, the effective implementation period of the initiative spans approximately two years, ensuring continuity in EV demand incentives and policy support.

| Vehicle Segment | Maximum No. to be Supported | Total fund support from Ministry of Heavy Industry (MHI) (Cr.) |
|-----------------|-----------------------------|----------------------------------------------------------------|
| e-2 wheelers    | 24,79,120                   | 1,772                                                          |

Source: Ministry of Heavy Industries, Government of India

The PM E-DRIVE scheme aims to accelerate the adoption of electric mobility in India by expanding financial incentives for electric vehicles and strengthening the overall EV ecosystem. The scheme has a total budget outlay of approximately INR 10,900 crore across various EV segments and supporting infrastructure. Of this, approximately INR 1,772 crore has been allocated for supporting the adoption of electric two-wheelers under the scheme. A key objective of the scheme is to promote the large-scale development of EV charging infrastructure across urban centers and major highways, while also supporting vehicle testing facilities and domestic EV manufacturing capabilities. By encouraging technological innovation, improving charging accessibility, and strengthening supply chains, the initiative aims to create a more sustainable and competitive electric mobility ecosystem in India.

- **State-Level Incentives:**

Several states including Delhi, Maharashtra, Gujarat, Tamil Nadu, and Karnataka have introduced EV policies offering purchase subsidies, tax exemptions, and charging infrastructure support. These initiatives

<sup>10</sup> <https://pmedrive.heavyindustries.gov.in/>

complement central schemes and accelerate adoption across urban and semi-urban regions while encouraging investments in EV manufacturing and ecosystem development.

- **EV Manufacturing Policy:**

Government policies focus on promoting domestic manufacturing of EV components such as batteries, motors, and power electronics. These initiatives aim to reduce import dependence, attract investments, and strengthen India's EV supply chain through local value addition and technology development.

- **Make in India, PMP & PLI Schemes:**

Programs such as Make in India, Phased Manufacturing Programme (PMP), and Production Linked Incentive (PLI) schemes incentivize localization and domestic production of EV components and batteries. These schemes support capacity expansion, innovation, and global competitiveness of the EV industry.

- **Tax Incentives:**

Electric vehicles benefit from a reduced GST rate of 5%, significantly lower than ICE vehicles, along with income tax benefits under Section 80EEB on EV loans. These measures enhance affordability and promote consumer adoption.

- **Charging Infrastructure & Battery Swapping Policies:**

Policy initiatives focus on expanding public charging infrastructure and battery swapping networks to improve convenience and reduce range anxiety. Battery swapping is particularly relevant for electric two-wheelers, enabling faster turnaround and higher utilization in daily usage.

## Key Advantages of EV over conventional vehicles

| Category                                       | Electric Vehicles (EVs)                                                                     | Conventional Vehicles (ICE)                                                            | Impact / Benefit                                                                     |
|------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>Total Cost of Ownership (TCO)</b>           | Lower operating cost due to cheaper electricity and lower maintenance requirements          | Higher operating cost due to fuel expenses (petrol/diesel) and higher maintenance      | Lower lifetime ownership cost, especially for high-usage segments (E2W, E3W, fleets) |
| <b>Mechanical Complexity &amp; Maintenance</b> | Simpler drivetrain with fewer moving parts; no engine oil, clutch, or exhaust system        | Complex engine systems requiring regular servicing, oil changes, and part replacements | Lower maintenance cost, reduced downtime, and improved reliability                   |
| <b>Energy Source &amp; Cost Stability</b>      | Powered by electricity with relatively stable pricing; can use renewable energy             | Dependent on fossil fuels with volatile global pricing                                 | Predictable and lower cost per kilometre                                             |
| <b>Environmental Impact</b>                    | Zero tailpipe emissions; reduces CO <sub>2</sub> , NO <sub>x</sub> , and particulate matter | Emits greenhouse gases and air pollutants                                              | Improved air quality and reduced environmental impact                                |

|                                              |                                                                                               |                                                                                       |                                                                              |
|----------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| <b>Energy Security &amp; Fuel Dependence</b> | Utilizes domestically generated electricity, including renewable sources                      | High dependence on imported crude oil and petroleum products                          | Reduced exposure to global oil price volatility and improved energy security |
| <b>Macroeconomic Impact</b>                  | Helps reduce crude oil imports and supports domestic energy utilization                       | Contributes to higher fuel import burden and trade deficit                            | Improves trade balance and long-term economic stability                      |
| <b>Operational Suitability</b>               | More efficient in stop-and-go urban conditions; ideal for daily commuting, high-frequency use | Less efficient in urban traffic with higher fuel consumption in stop-start conditions | Strong suitability for urban commuting, ride-sharing, and last-mile delivery |

## Key Demand Drivers

### Demand Drivers for Low-Speed Electric Two-Wheelers (LSE2Ws)

- **No Registration and Licence Requirement**

Low-speed electric two-wheelers ( $\leq 25$  km/h and  $\leq 250$ W) benefit from a unique regulatory advantage in India, as they are exempt from driving licence and vehicle registration requirements under the Central Motor Vehicles Rules. This significantly lowers the entry barrier for a wide consumer base, including students, elderly users, and individuals without formal driving credentials. The absence of licensing, registration, and insurance requirements reduces both procedural complexity and ownership costs, making these vehicles highly accessible compared to conventional two-wheelers. This regulatory exemption plays a critical role in driving adoption, particularly in semi-urban and rural markets where access to formal licensing infrastructure may be limited. It also enables faster purchase decisions, as users can adopt these vehicles without administrative delays. As a result, low-speed E2Ws have emerged as a convenient mobility solution for a broader demographic segment, supporting their penetration in entry-level and utility-driven use cases across India.

- **Affordable Purchase Price**

Low-speed electric two-wheelers are positioned as one of the most affordable electric mobility options in India, with significantly lower upfront costs compared to high-speed electric scooters and internal combustion engine (ICE) vehicles. Their simpler design, lower battery capacity, and relaxed regulatory requirements contribute to reduced manufacturing and compliance costs, enabling competitive pricing for price-conscious consumers. This affordability makes them particularly attractive in markets where cost remains a primary purchase consideration. The affordability advantage is further reinforced by the growing scale of the overall E2W market, indicating increasing consumer acceptance and improved economies of scale. As production volumes rise and local manufacturing strengthens, the cost of components especially batteries is expected to decline further, enhancing the value proposition of low-speed E2Ws and supporting wider adoption across lower-income and budget-conscious user segments.

- **Lower Operating and Maintenance Costs**

Low-speed E2Ws offer a significantly lower total cost of ownership compared to conventional petrol-powered two-wheelers. Electricity costs per kilometre are substantially lower than petrol expenses, making these vehicles highly economical for daily commuting and frequent last-mile usage. Additionally, their simpler mechanical architecture without components such as engines, gearboxes, and exhaust systems reduces maintenance requirements and servicing frequency. These cost advantages are particularly beneficial in high-usage scenarios such as delivery operations and local commuting, where operating cost savings accumulate over time. The absence of regular oil changes, fewer moving parts, and reduced wear and tear contribute to lower lifetime maintenance costs. As consumers increasingly prioritize cost efficiency, especially in uncertain fuel price environments, low-speed E2Ws are emerging as a financially attractive alternative.

- **Rising Fuel Prices**

India's continued dependence on imported crude oil exposes consumers to fluctuations in global fuel prices, directly impacting the cost of operating petrol and diesel vehicles. Rising fuel prices have increased the overall cost of mobility, prompting consumers to explore more economical alternatives such as electric vehicles. This trend has significantly contributed to the growing interest in electric two-wheelers across various user segments, low-speed E2Ws provide a cost-effective solution by replacing petrol consumption with electricity, which is relatively cheaper and more stable in pricing. As fuel prices remain volatile, the economic advantage of electric mobility becomes more pronounced, especially for users with frequent daily travel needs. This shift is expected to continue driving adoption of low-speed E2Ws as a practical alternative for cost-conscious consumers.

- **Strong Demand for Everyday Mobility Applications**

Low-speed E2Ws are well suited for everyday mobility requirements such as neighbourhood travel, routine commuting, and last-mile connectivity. They are widely used across urban, semi-urban, and rural areas where consumers require a convenient, easy-to-operate, and accessible mode of transportation for daily travel. Their compact design and simple operating characteristics make them well suited for navigating local roads and densely populated areas.

With increasing urbanization, traffic congestion, and evolving mobility requirements, demand for practical personal transportation solutions continues to rise. Low-speed E2Ws effectively address these needs by offering a convenient electric mobility alternative with lower total cost of ownership compared to conventional petrol-powered two-wheelers. Their suitability across a wide range of daily mobility applications is expected to continue supporting adoption across diverse consumer segments in India.

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- **Growth in Tier II, Tier III and Rural Markets**

The adoption of low-speed E2Ws is gaining strong traction in Tier II, Tier III, and rural markets, where affordability and ease of ownership are key decision factors. These regions often have lower vehicle ownership penetration and limited access to public transport infrastructure, creating demand for cost-effective personal mobility solutions. Low-speed E2Ws address these gaps effectively due to their lower upfront cost and minimal regulatory requirements. Additionally, the ability to charge vehicles using standard household electricity makes them highly suitable for areas with limited charging infrastructure. As economic activity and income levels rise in smaller cities and rural regions, demand for affordable mobility solutions is expected to increase further. This trend positions low-speed E2Ws as a key enabler of mobility expansion beyond metropolitan areas.

**Additional Factors Driving Demand for Low-Speed E2Ws:**

- **Growth in Delivery and Commercial Usage:** Rising demand from e-commerce and last-mile logistics is driving increased adoption of low-speed E2Ws for cost-efficient delivery operations.
- **Expanding Dealer Networks:** Increasing penetration of EV dealerships across Tier II, Tier III, and rural markets is improving accessibility and supporting wider adoption.
- **Government EV Ecosystem Support:** Ongoing policy support in infrastructure, localization, and ecosystem development is indirectly enabling growth of low-speed E2Ws.
- **Increasing Environmental Awareness:** Growing consumer focus on reducing emissions and adopting cleaner mobility solutions is supporting EV adoption.
- **Easy Home Charging:** Ability to charge using standard household outlets enhances convenience and reduces dependence on public charging infrastructure.

## Total Cost of Ownership Analysis

D&B India has carried out the Total Cost of Ownership (TCO) assessment exercise for battery operated and Internal Combustion Engine (ICE) 2 Wheelers. The basic assumptions and corresponding analysis are as follows:

| Particulars                  | ICE 2W                                                                                                        | E2W                                                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic assumptions</b>     | Annual distance travelled – 30 Km per day x 300 days per annum = 9,000 Km per annum; Overall tenure – 4 years |                                                                                                                                                                                       |
| <b>Other assumptions</b>     | Petrol price – INR 100/- per litre; Mileage – 45 Km per litre                                                 | Charger capacity – 1.80 KW; Charging time – 5 hours; Battery efficiency – 70%; Electricity Unit Rate – INR 7.5 per KWH; Travel range per charging – 50 Km                             |
| <b>Purchase Price</b>        | INR 90,000/- per vehicle                                                                                      | INR 66,000/-per vehicle (Average of price of high speed and low speed variants, for high-speed price of INR 90,000 is considered and for low-speed price of INR 42,000 is considered) |
| <b>Purchase Cost per Km</b>  | INR 1.43/- per Km                                                                                             | INR 1.83/- per Km                                                                                                                                                                     |
| <b>Operating Cost per Km</b> | INR 2.22/-per Km                                                                                              | INR 0.27/- per Km                                                                                                                                                                     |
| <b>TCO per Km</b>            | <b>INR 3.65/- per Km</b>                                                                                      | <b>INR 2.10/- per Km</b>                                                                                                                                                              |

Source: D&B India Analysis,

Note: Repair & Maintenance (R&M) cost has not been factored in the above analysis, considering that the same would be similar for both ICE 2W (R&M towards wear & tear of moving parts) and E2W (R&M towards electrical & electronic parts).

## Mapping the supply scenario in Indian EV market: Focusing on E2W and E3W market

The electric mobility market in India has witnessed significant expansion over the past few years, particularly in the electric two-wheeler (E2W) and electric three-wheeler (E3W) segments, which have been key contributors to the country's EV adoption. Electric two-wheelers have emerged as one of the fastest-growing vehicle categories due to their affordability, lower operating costs, and suitability for daily urban commuting. Government initiatives such as the FAME Scheme, state-level EV policies, and increasing consumer awareness regarding sustainable mobility have supported the growth of the segment. In addition, the expansion of shared mobility services, last-mile delivery operations, and improvements in charging infrastructure have further accelerated adoption across urban and semi-urban markets.

The electric three-wheeler segment has also witnessed strong adoption, particularly in passenger transportation and last-mile logistics applications. E3Ws offer lower operating costs compared to conventional fuel-based alternatives and have increasingly been adopted by fleet operators and small transport businesses. Growth in e-commerce activities, development of battery-swapping infrastructure, availability of financing options, and supportive regulatory initiatives have contributed to the expansion of the segment. As a result, India has emerged as one of the leading markets globally for electric three-wheelers, attracting participation from both established automotive manufacturers and emerging EV-focused companies.

Together, the E2W and E3W segments continue to play a pivotal role in India's electric mobility transition, supported by favourable policy measures, evolving consumer preferences, improving vehicle economics, and ongoing investments in charging and battery infrastructure. These segments are expected to remain key contributors to EV adoption as the country's electric mobility ecosystem continues to mature.

### Domestic Manufacturing landscape in Indian E2W and E3W space: Insight on domestic production capacity of E2W and E3W in India

India has emerged as a major manufacturing hub for electric two-wheelers (E2W) and electric three-wheelers (E3W), supported by government initiatives such as the FAME II Scheme, the Production Linked Incentive (PLI) scheme for Advanced Chemistry Cells, and localization targets under the Phased Manufacturing Programme (PMP). According to the Ministry of Heavy Industries, based on inputs from the Society of Indian Automobile Manufacturers (SIAM), domestic EV manufacturing capabilities have expanded significantly, transitioning from small-batch assembly to large-scale industrial production.

As of early 2026, the installed production capacity for electric two-wheelers in India is estimated to exceed **8–10 million units per annum**, reflecting substantial investments by both established OEMs and new-age EV manufacturers. This capacity is further expected to scale to approximately **18–20 million units per annum by 2030**, driven by continued demand growth, policy support, and capacity expansion plans. In

comparison, the electric three-wheeler segment demonstrates a more demand-aligned manufacturing structure, with installed capacity estimated at approximately **1.0–1.2 million units annually**, primarily catering to last-mile mobility and logistics applications.

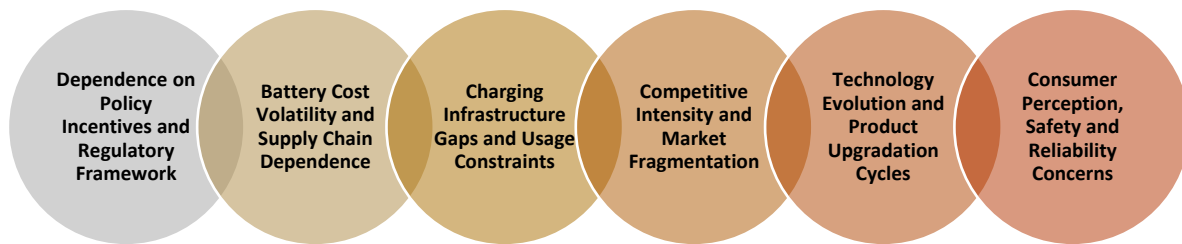
The expansion of large-scale, integrated manufacturing facilities is strengthening the production ecosystem. For instance, Ola Electric’s “Futurefactory” in Tamil Nadu has a current installed capacity of **1 million units per annum**, with plans to scale up to **10 million units annually**, positioning it among the largest integrated electric two-wheeler manufacturing facilities globally. Similarly, Ather Energy currently operates with a manufacturing capacity of approximately **420,000 units per annum** across its Hosur facilities, which is expected to increase to **1.42 million units annually** upon commissioning of its upcoming facility in Maharashtra. Bajaj Auto has also announced (in 2022) investments to establish dedicated EV production capacity of around **500,000 units per annum**, indicating increasing participation from traditional automotive players in scaling EV manufacturing.

The production trend reflects the strengthening of domestic manufacturing capabilities across the EV value chain, including battery packs, electric motors, controllers, and vehicle assembly. Electric three-wheelers continue to represent one of the most mature EV segments in India, supported by strong adoption in passenger mobility and cargo logistics, along with a highly localized and modular manufacturing base.

Overall, the domestic manufacturing landscape for E2W and E3W in India is characterized by rapid capacity build-up, increasing localization of key components, and the emergence of high-scale manufacturing facilities. With sustained policy support, rising demand for cost-efficient mobility solutions, and growing private sector investments, India is progressively strengthening its position as a global manufacturing hub for small electric mobility platforms, particularly in the two-wheeler and three-wheeler segments, which together account for a significant share of EV production in the country.

## Threats & Challenges

Insight on the major threats & challenges faced by the EV Industry

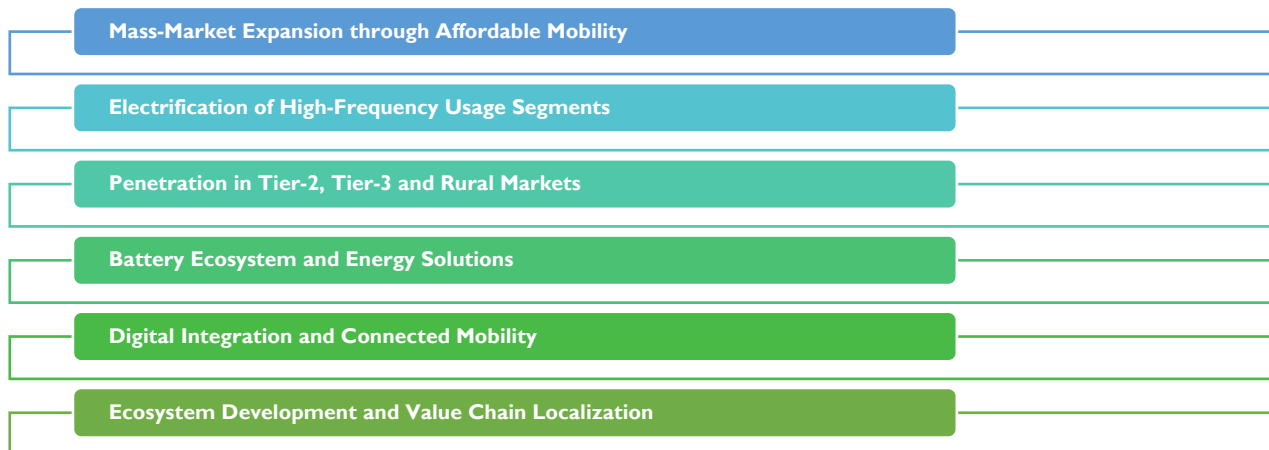


- **Dependence on Policy Incentives and Regulatory Framework:** The E2W industry continues to benefit from government incentives and supportive policies. However, any **changes in subsidy structures, eligibility criteria, or regulatory requirements** may influence demand dynamics and pricing strategies. This is particularly relevant across segments where affordability and ease of ownership are key decision factors.
- **Battery Cost Volatility and Supply Chain Dependence:** Battery systems form a significant portion of vehicle cost. **Fluctuations in raw material prices** (lithium, cobalt, nickel) and reliance on imports for key components create cost pressures across the E2W value chain, impacting pricing flexibility and margins.
- **Charging Infrastructure Gaps and Usage Constraints:** While infrastructure is improving, **charging availability remains uneven**, particularly in Tier 2 and Tier 3 markets. Although certain segments benefit from home-charging flexibility, broader adoption still depends on **continued expansion of reliable and accessible charging networks**.
- **Competitive Intensity and Market Fragmentation:** The industry is witnessing participation from **established OEMs, startups, and regional players**, resulting in increased competition. Maintaining product quality, distribution reach, and brand differentiation while competing on price presents a challenge, particularly in value-driven segments.
- **Consumer Adoption Challenges:** Despite growing awareness and acceptance of electric mobility, adoption remains influenced by factors such as range anxiety, charging accessibility concerns, perceived battery replacement costs, and familiarity with conventional ICE vehicles. In addition, consumers in price-sensitive markets may continue to evaluate EVs against traditional alternatives based on upfront cost considerations, which could impact the pace of adoption across certain customer segments.
- **Consumer Perception, Safety and Reliability Concerns:** Battery-related incidents and performance concerns in certain cases have impacted **consumer perception**. Ensuring adherence to safety standards, consistent product quality, and reliability remains critical for sustained growth across the E2W segment.

## Key Opportunities

### Mapping the emerging opportunities in the Indian E2W market

India's electric two-wheeler (E2W) market presents significant growth opportunities driven by **cost advantages over ICE vehicles, policy support, and expanding use cases across personal and commercial mobility**. The market is evolving beyond early adoption, with both **high-speed and low-speed variants addressing distinct demand segments**, thereby enabling deeper market penetration across urban as well as semi-urban and rural regions.



#### 1. Mass-Market Expansion through Affordable Mobility

E2Ws are increasingly positioned as a **cost-effective alternative to petrol two-wheelers**, particularly for daily commuting. Low-speed electric two-wheelers play a critical role in this transition by enabling **entry-level adoption among relatively affordable price seeking consumers**, especially in Tier 2 and Tier 3 markets.

##### Opportunity Areas:

- Entry-level electric scooters catering to first-time EV adopters
- Low-speed E2Ws supporting utility-oriented and neighborhood mobility applications
- Cost-optimized product variants supported by localized sourcing and simplified vehicle architecture

#### 2. Electrification of High-Frequency Usage Segments

High-utilization applications such as **daily commuting and delivery operations** present strong opportunities for E2W adoption due to lower running costs and improved economics over ICE vehicles. Low-speed variants are particularly suited for **hyperlocal and repetitive usage cycles**, where speed is less critical than cost efficiency.

##### Opportunity Areas:

- Delivery-focused E2W models for e-commerce and food-tech platforms
- Fleet deployment for intra-city and hyperlocal logistics

- Subscription and leasing models for gig-economy users

### 3. Penetration in Tier-2, Tier-3 and Rural Markets

The next phase of growth is expected to come from **non-metro markets**, where demand is driven by affordability and practical mobility needs. Low-speed E2Ws are well-aligned with these markets due to their **lower upfront cost, ease of ownership, and limited dependence on charging infrastructure**.

#### Opportunity Areas:

- Regional distribution and dealership expansion
- Rural-focused mobility solutions
- Financing models targeting first-time vehicle buyers

### 4. Battery Ecosystem and Energy Solutions

The evolution of the battery ecosystem presents opportunities across **manufacturing, swapping, and energy management**. While high-speed variants benefit from advanced battery technologies, low-speed E2Ws enable **simpler and cost-efficient battery solutions**, supporting wider adoption.

#### Opportunity Areas:

- Battery swapping and battery-as-a-service (BaaS) models
- Local battery assembly and pack integration
- Lifecycle management and recycling solutions

### 5. Digital Integration and Connected Mobility

E2Ws are increasingly incorporating **IoT-enabled features, telematics, and digital platforms**, enhancing user experience and enabling data-driven operations. This is particularly relevant for fleet operators and shared mobility use cases.

#### Opportunity Areas:

- Connected E2W platforms and mobile applications
- Fleet tracking and performance optimization tools
- Predictive maintenance and remote diagnostics solutions

### 6. Ecosystem Development and Value Chain Localization

Government-led initiatives are encouraging **local manufacturing of EV components**, creating opportunities across the supply chain. As the industry scales, localization is expected to improve cost competitiveness and reduce import dependence.

#### Opportunity Areas:

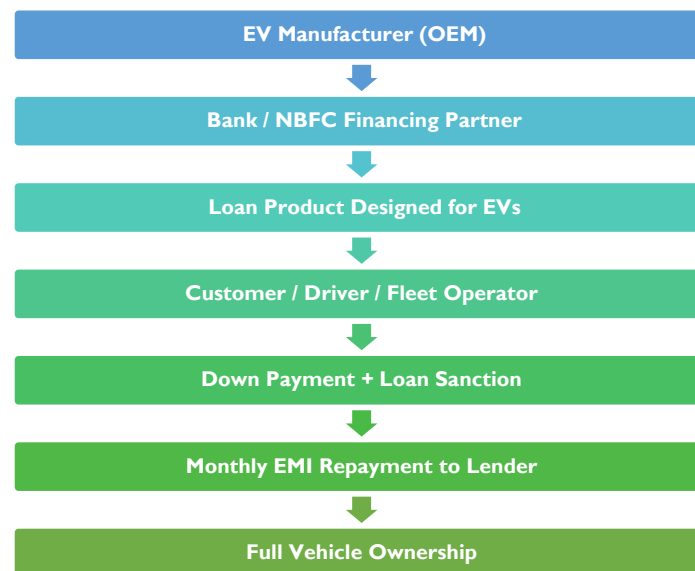
- Domestic manufacturing of motors, controllers, and battery systems
- Component supply chain development

- R&D and innovation in EV technologies

## EV Financing Models

Brief insight on the financing models in E2W space in India

### Traditional Route:



The traditional financing route in India's electric two-wheeler (E2W) and electric three-wheeler (E3W) market typically involves partnerships between electric vehicle manufacturers and financial institutions such as banks and non-banking financial companies (NBFCs). Under this model, OEMs collaborate with lenders to offer structured loan products that enable customers to purchase EVs through instalment-based payment plans. Customers generally pay an upfront down payment, while the remaining vehicle cost is financed through equated monthly instalments (EMIs) over a tenure that usually ranges from two to five years.

Such OEM- lender partnerships help simplify the purchase process by integrating financing options directly into dealership networks or digital sales platforms. These schemes often include benefits such as faster loan approvals, competitive interest rates, and simplified documentation. For many buyers, especially delivery riders, e-rickshaw drivers, and small logistics operators access to formal credit is essential because the upfront purchase cost of EVs can be relatively high compared with conventional vehicles.

This financing approach remains the most widely used in the Indian EV ecosystem because it leverages the established automotive financing infrastructure developed over decades. By combining OEM distribution channels with the lending capacity of banks and NBFCs, the model provides scalable financing solutions and builds confidence among buyers transitioning from internal combustion engine vehicles to electric mobility.

## Specialized lenders: Specialized fintech lenders like Revfin / Ecofy and their solutions

Specialized EV fintech lenders have emerged to address financing gaps in India's electric mobility ecosystem, particularly for electric two-wheelers (E2W). Platforms such as Revfin and Ecofy focus exclusively on providing credit solutions tailored for electric vehicles and other sustainable technologies. Unlike traditional banks, these lenders design financing products specifically for EV drivers, delivery partners, and small fleet operators who may lack conventional credit histories.

These fintech lenders typically use digital underwriting and alternative credit assessment models to evaluate borrowers. Instead of relying solely on credit scores, they may analyze factors such as digital payment records, driver income patterns, telematics data from vehicles, and behavioural assessments. This allows them to extend financing to first-time borrowers, gig-economy workers, and micro-entrepreneurs who are often underserved by traditional banking institutions.

By enabling faster loan approvals and flexible repayment structures, specialized EV lenders play an important role in accelerating EV adoption in commercial mobility segments. Their solutions are particularly relevant for last-mile delivery services, e-commerce logistics, and passenger e-rickshaw operators, where drivers require rapid access to financing to start income-generating operations with electric vehicles.

## Leasing models

|                      |                                           |
|----------------------|-------------------------------------------|
| <b>Leasing Model</b> | OEM manufactures EV                       |
|                      | Leasing company purchases & owns EV       |
|                      | Drivers/fleet operators use EV            |
|                      | Lease payments flow back                  |
|                      | Leasing company recovers cost & reinvests |

In the leasing model, electric vehicles are purchased and owned by a leasing company or mobility platform, which then provides these vehicles to drivers or fleet operators through lease agreements. Instead of paying the full purchase price upfront, users pay a fixed periodic fee usually monthly to access and operate the vehicle. This approach significantly lowers the initial investment required to adopt electric two-wheelers (E2W) and electric three-wheelers (E3W), making the model attractive for gig-economy workers and small logistics businesses.

Leasing companies typically procure vehicles directly from manufacturers and deploy them across commercial mobility segments such as last-mile delivery, ride-hailing, and cargo transportation. The lease payments collected from drivers help the leasing company recover vehicle costs over time while maintaining ownership of the asset. In many cases, leasing packages also include maintenance, insurance, and servicing, ensuring higher vehicle uptime and reducing operational complexity for drivers.

This model is increasingly used in India's EV ecosystem because it enables rapid fleet expansion without requiring drivers or operators to make large capital investments. By converting a vehicle purchase into a predictable operating expense, leasing supports wider adoption of electric mobility, particularly in high-utilization segments such as e-commerce logistics and urban passenger transport.

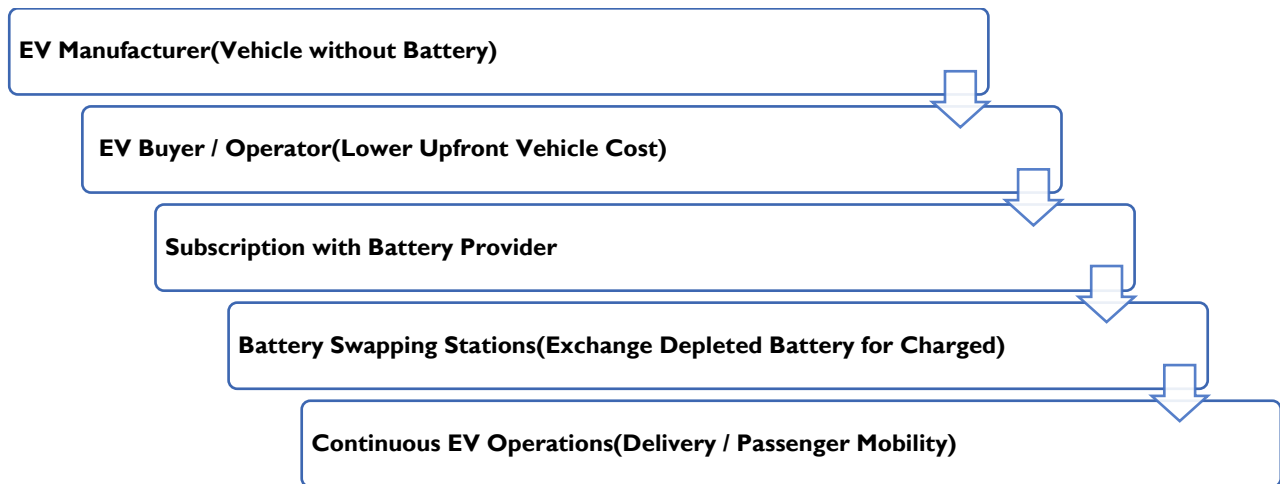
#### Buyback / Resale programs



Buyback or resale assurance programs are financing support mechanisms used by electric vehicle manufacturers to address customer concerns regarding depreciation and resale value. Under this model, the OEM guarantees that it will repurchase the vehicle after a specified period typically three to five years at a predetermined residual value. This assurance reduces uncertainty around long-term ownership costs and makes electric two-wheelers (E2Ws) more financially attractive for buyers.

For individual drivers, delivery riders, and fleet operators, resale value plays a critical role in the vehicle purchase decision. Since electric vehicle technology is evolving rapidly, buyers may worry about future battery performance or market demand for used EVs. Buyback programs help mitigate this concern by providing a structured exit option, enabling customers to upgrade to newer models without bearing the full depreciation risk. From an ecosystem perspective, buyback programs also help manufacturers build a secondary market for used electric vehicles. Returned vehicles can be inspected, refurbished, and resold to price-sensitive customers such as small fleet operators or first-time EV adopters. This approach supports broader EV adoption by extending the lifecycle of vehicles while improving affordability in the market.

## Battery-as-a-Service / Battery Swapping models



The Battery-as-a-Service (BaaS) or battery swapping model separates battery ownership from the vehicle purchase. Under this structure, customers buy the electric vehicle without the battery, which significantly lowers the upfront cost of the vehicle. Instead of owning the battery, users subscribe to a battery service provided by a specialized operator and pay either a fixed subscription fee or a pay-per-swap charge when replacing depleted batteries.

Battery service providers deploy networks of battery swapping stations where drivers can quickly exchange discharged batteries for fully charged ones. This process typically takes only a few minutes, allowing vehicles to remain operational without long charging downtime. Such models are particularly beneficial for high-utilization electric two-wheelers (E2Ws) used in delivery services and electric three-wheelers (E3Ws) operating in passenger transport and cargo mobility.

The BaaS model also shifts battery maintenance, performance management, and lifecycle risks from the vehicle owner to the service provider. This improves operational efficiency for drivers while ensuring that batteries are properly maintained and upgraded over time. As a result, battery swapping models are increasingly being explored as a scalable solution to accelerate EV adoption in India's last-mile mobility and logistics segments.

## Competitive Landscape

### Insight on Competitive Landscape in India

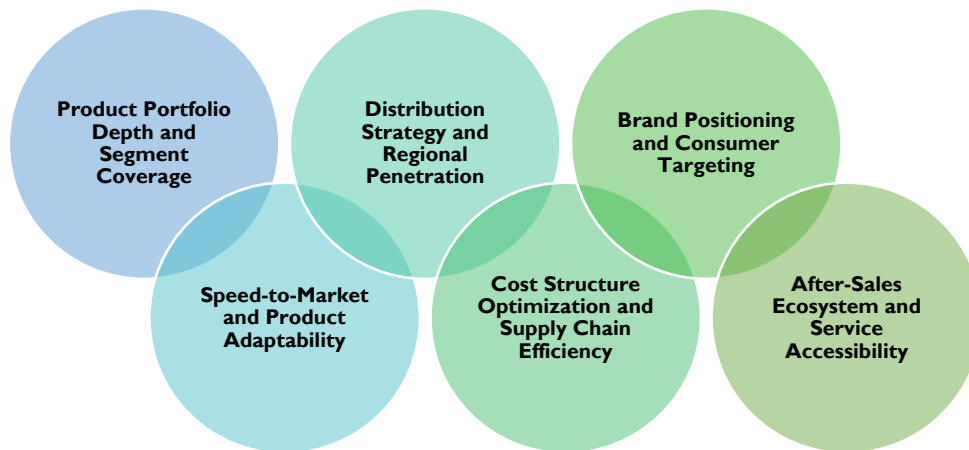
The competitive landscape of the Indian electric two-wheeler (E2W) market is highly dynamic and characterized by the presence of both established automotive manufacturers and emerging EV-focused startups. In the E2W segment, leading players include Ola Electric, TVS Motor Company, Bajaj Auto, Ather Energy, and Hero MotoCorp. These companies dominate the market through strong product portfolios, expanding distribution networks, and investments in charging infrastructure and battery technologies. For example, Ola Electric has historically led the E2W market with a significant share, while legacy OEMs such as TVS and Bajaj have rapidly gained traction through established dealership networks and trusted brands.

Competition in the E2W space has intensified as traditional two-wheeler manufacturers increasingly scale up their electric offerings. Products such as the TVS iQube and Bajaj Chetak have gained strong adoption due to reliability, service coverage, and brand recognition. At the same time, EV-native companies like Ather Energy focus on advanced technology, connected features, and premium positioning. As a result, the market is witnessing frequent shifts in market share among key players, reflecting a maturing industry where both startups and legacy OEMs compete on pricing, performance, and after-sales service capabilities.

Within the E2W segment, the low-speed electric two-wheeler ( $\leq 25$  km/h) sub-segment remains relatively fragmented and volume-oriented, characterized by the presence of multiple regional and emerging manufacturers. Key participants in this segment include Warivo Electric Mobility Limited, Tunwal E-Motors, and Zelio E-Mobility. These companies primarily compete through broad product accessibility, simplified ownership requirements, localized distribution reach, and utility-oriented mobility offerings catering to evolving consumer requirements across emerging mobility markets.

Overall, the Indian E2W competitive landscape is evolving rapidly, with gradual consolidation in the high-speed segment driven by technology advancement, brand positioning, financing access, and expanding dealership/service infrastructure. In comparison, the low-speed segment continues to support wider EV penetration through accessible product offerings and operational simplicity. Increasing EV adoption, improving battery economics, localisation initiatives, and strengthening charging and service ecosystems are expected to further intensify competition across both segments.

## Analysis of key factors that are shaping competition in Indian E2W Space



- **Product Portfolio Depth and Segment Coverage:** A key differentiator among players is the ability to **cater to multiple consumer segments through a diversified product portfolio**. Companies offering a range of models across price points and performance categories are better positioned to capture broader demand. While high-speed E2Ws address urban commuting needs, low-speed variants enable manufacturers to **tap into entry-level and underserved markets**, enhancing overall market reach.
- **Speed-to-Market and Product Adaptability:** The ability to **quickly introduce new models, upgrade existing products, and respond to changing consumer preferences** is becoming increasingly important. Startups often demonstrate agility in product innovation, whereas established OEMs leverage structured development processes and scale. In the low-speed segment, adaptability is reflected in **cost optimization and design simplification tailored to local usage patterns**.
- **Distribution Strategy and Regional Penetration:** Competitive advantage is significantly influenced by how effectively companies **penetrate non-metro markets**. While leading OEMs rely on established dealership networks, many players especially in the low-speed segment—expand through **region-specific dealer partnerships and localized sales channels**, enabling deeper reach in Tier 2, Tier 3, and rural areas.
- **Cost Structure Optimization and Supply Chain Efficiency:** Efficient management of **component sourcing, assembly processes, and vendor networks** plays a critical role in sustaining competitiveness. Players that achieve better cost control can offer competitive pricing while maintaining margins. This is particularly relevant in the low-speed segment, where **cost efficiency and simplified design architecture** are central to market positioning.
- **Brand Positioning and Consumer Targeting:** Players are increasingly differentiating themselves through **targeted brand positioning**, aligned with specific consumer segments. High-speed E2Ws are often positioned around **performance, reliability, and advanced features**, while low-speed variants are positioned around **ease of use, practicality, and everyday mobility needs**, allowing companies to build distinct value propositions.

- **After-Sales Ecosystem and Service Accessibility:** Availability of **service centers, spare parts, and maintenance support** influences long-term customer satisfaction and repeat purchases. Companies with strong after-sales ecosystems are better placed to build trust, especially in emerging markets. In low-speed segments, **accessible and low-cost servicing models** play a key role in customer retention.

## Company Profiling: Warivo Electric Mobility Limited

### Company Overview:

Warivo Electric Mobility Limited, founded in 2018 and based in India, specializing in the manufacturing of electric two-wheelers. The company focuses on delivering affordable, reliable, and efficient mobility solutions tailored to the needs of mass Indian consumers. Built with a vision to promote sustainable transportation, Warivo offers a diverse portfolio of 16 models, including both low-speed and high-speed electric scooters designed for urban and semi-urban commuting. Its products emphasize safety, durability, and performance, incorporating advanced features such as smart battery management systems, thermal protection, and innovative design elements to enhance user experience and reliability.

The company currently operates 1 manufacturing unit, enabling it to efficiently meet rising market demand. Warivo's manufacturing operations are anchored by a modern facility in Ellenabad, Haryana, supported by a robust and expanding distribution network of over 300+ dealers across 15+ states in India. Its integrated operational model ensures streamlined production, stringent quality control, and timely product delivery. Warivo's scooters are developed with a focus on practical usability, offering features such as large storage capacity, extended battery range, and enhanced rider comfort. The company also provides a 3-year warranty on certain models, reinforcing customer trust and confidence. In addition, Warivo maintains a structured after-sales service system with quick turnaround times, ensuring effective customer support and long-term satisfaction.

Warivo Electric Mobility Limited continues to strengthen its position in the rapidly growing EV ecosystem through continuous innovation, digital integration, and customer-centric strategies. The company is actively investing in research and development, focusing on advanced EV technologies, connected mobility solutions, and improved battery efficiency. With increasing demand for eco-friendly transportation and supportive government policies, Warivo Electric Mobility Limited aims to expand its geographical footprint, further scale its manufacturing capacity, and enhance its dealer network. By aligning its business strategy with sustainability, affordability, and technological advancement, the company is positioning itself as a reliable and forward-looking mobility solutions provider in India's electric two-wheeler market.

### Key Achievements:

- Received multiple ICAT certifications for high-speed and low-speed electric scooters
- Achieved ISO 9001:2015 (Quality Management) certification
- Achieved ISO 14001:2015 (Environmental Management) certification
- Achieved ISO 45001:2018 (Occupational Health & Safety) certification

## Products Offered:

| Segments           | Subsegments                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| High Speed Scooter | <ul style="list-style-type: none"> <li>• CRX</li> <li>• Aero</li> </ul>                                                                       |
| Low Speed Scooter  | <ul style="list-style-type: none"> <li>• Nova S</li> <li>• Nova X</li> <li>• Nova</li> <li>• Edge +</li> <li>• EDGE</li> <li>• NEO</li> </ul> |

## Key Customer Segments:

- **Urban & Semi-Urban Daily Commuters:** Urban and semi-urban commuters use scooters for short daily trips like work and errands, valuing low costs, convenience, and easy charging. Low-speed scooters are especially popular as they are affordable, simple to use, and often don't require a license, making them accessible to more people.
- **Students & Young Riders (Gen Z / Millennials):** Students and young riders prefer electric scooters that are affordable, stylish, and easy to use. Low-speed EVs attract them because they are cheaper and often don't require a license, making them ideal for first-time riders.
- **Elderly & Comfort-Oriented Riders:** Elderly and comfort-oriented riders prefer electric scooters that are simple, safe, and easy to use. They value features like lightweight design, reverse gear, and smooth handling, focusing more on safety and convenience rather than speed.
- **Family Buyers (Household Use):** Family buyers often choose electric scooters as a second household vehicle for everyday tasks like grocery runs, school drops, and short local commutes. They prefer models with a comfortable large seat, ample storage space, and high reliability for regular use.
- **Value-Conscious Buyers ("Smart Value Buyers"):** Smart value buyers are highly price-sensitive customers who look for both low upfront cost and low running expenses. This segment is especially strong in Tier 2, Tier 3, and rural markets, where the adoption of electric scooters is largely driven by the opportunity to save on fuel costs while maintaining affordable daily mobility.
- **Institutional & Bulk Buyers (B2B Segment):** Institutional and bulk buyers, forming the B2B segment, include delivery companies, logistics operators, and large campuses or organizations. They prioritize electric scooters that offer low cost per kilo meter, high uptime, and strong fleet efficiency, as these factors directly impact operational savings and productivity.

- **Rural & Semi-Urban Mass Market:** Rural and semi-urban mass market users are targeted through roadshows, village campaigns, and strong dealer networks. They look for durable, low-maintenance electric scooters that provide affordable and reliable mobility for everyday use.

#### Key Strengths:

- **Mass-Market Focus & Strong Product-Market Fit:** The brand's mass-market focus ensures a strong product-market fit by targeting everyday Indian consumers such as students, families, and daily commuters. Its products are designed with affordability, practical daily usage, and suitability for Indian road conditions in mind, making them highly relevant to the needs of the majority. This close alignment with mass demand becomes a significant competitive advantage.
- **Affordable & Value-Driven Offering:** The brand offers an affordable and value-driven range of scooters, making them accessible to a wide customer base. Combined with very low running and maintenance costs compared to petrol vehicles, this makes them highly attractive to India's price-sensitive market.
- **Wide Distribution Network:** The brand has built a wide distribution network with 300+ dealers across 15+ states, enabling strong reach especially in Tier 2, Tier 3, and rural markets. This extensive presence ensures deep market penetration and makes its products easily accessible to a large and diverse customer base.
- **Differentiated Product Features & Innovation:** The brand stands out through differentiated product features and practical innovation, including a smart battery management system (BMS), advanced safety features like thermal protection and sensors, and user-friendly additions such as reverse gear, cruise control, and large storage. Instead of focusing only on design, it emphasizes functionality and real-world usability, which enhances its appeal.
- **Diverse Product Portfolio:** The brand offers a diverse product portfolio that includes both low-speed and high-speed electric scooters, along with multiple variants across different price points. This variety allows it to cater to a wide range of customer segments, from budget-conscious buyers to performance-focused users.
- **Strong Alignment with EV Industry Tailwinds:** The brand is strongly aligned with EV industry tailwinds, benefiting from factors such as government Policies or incentives, rising fuel prices, and increasing consumer adoption of electric vehicles. Operating in this fast-growing sector positions it well for long-term growth and expansion.

## Peers Profile:

| Company Name                    | Profiling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Zelio E-Mobility Limited</b> | Zelio E-Mobility Limited, established in 2021, is an electric two-wheeler manufacturing company headquartered in (Haryana) India, focused on providing affordable and accessible low-speed electric scooters for daily commuting. The company primarily caters to price-sensitive consumers in Tier 2 and Tier 3 cities, offering a range of license-free electric scooters designed for students, elderly riders, and short-distance urban users. Over the years, Zelio has expanded its product portfolio with multiple variants emphasizing simplicity, low maintenance, and cost efficiency. The company operates through a growing dealership network and focuses on delivering practical mobility solutions with an emphasis on affordability, ease of use, and localized market penetration.                                                                                                                         |
| <b>Tunwal E-Motors Limited</b>  | Tunwal E-Motors Limited, established in December 2018, is a 100% electric two-wheeler and three-wheeler manufacturing company headquartered in Pune, Maharashtra, focused on designing, developing, manufacturing, and distributing affordable and eco-friendly electric scooters. The company caters to a range of consumer segments across urban, semi-urban, and rural markets, offering both electric two-wheelers and three-wheelers for varied commuting needs. Tunwal's product portfolio includes variants such as the Alfa Pro, Alfa Lite, Storm XL, Storm ZX, Lithino Pro, and Mini Lithino, emphasizing affordability, low maintenance, and sustainable commuting. The company operates through a dealership network of 400+ dealers across India and focuses on delivering practical electric mobility solutions with an emphasis on accessible pricing, after-sales service, and localized market penetration. |

## Financial KPI

| Particular                        | Unit       | Warivo Electric Mobility Limited |             |             |             | Zelio E Mobility Limited |             |             | Tunwal E-Motors Limited |             |             |
|-----------------------------------|------------|----------------------------------|-------------|-------------|-------------|--------------------------|-------------|-------------|-------------------------|-------------|-------------|
|                                   |            | As at end for Fiscal             |             |             |             | As at end for Fiscal     |             |             | As at end for Fiscal    |             |             |
|                                   |            | As of December 2025,             | Fiscal 2025 | Fiscal 2024 | Fiscal 2023 | Fiscal 2025              | Fiscal 2024 | Fiscal 2023 | Fiscal 2025             | Fiscal 2024 | Fiscal 2023 |
| <b>Total Income</b>               | ₹ in Lakhs | 24,164.80                        | 13,729.62   | 6,213.81    | 4,366.94    | 17,379.64                | 9,489.83    | 5,162.30    | 18,486.82               | 10,553.69   | 7,655.74    |
| <b>Revenue From Operations</b>    | ₹ in Lakhs | 24,134.61                        | 13,674.61   | 6,190.61    | 4,308.88    | 17,218.94                | 9,442.50    | 5,125.07    | 17,859.45               | 10,460.07   | 7,650.18    |
| <b>EBITDA</b>                     | ₹ in Lakhs | 2,402.48                         | 840.41      | 356.06      | 455.29      | 2,103.13                 | 878.78      | 404.81      | 1,236.72                | 1,783.16    | 660.71      |
| <b>EBITDA Margin</b>              | in %       | 9.95%                            | 6.15%       | 5.75%       | 10.57%      | 12.21%                   | 9.31%       | 7.90%       | 6.92%                   | 17.05%      | 8.64%       |
| <b>PAT</b>                        | ₹ in Lakhs | 1,566.56                         | 444.35      | 87.04       | 260.29      | 1,598.21                 | 631.90      | 306.66      | 1,180.05                | 1,181.17    | 372.48      |
| <b>PAT Margin</b>                 | in %       | 6.49%                            | 3.25%       | 1.41%       | 6.04%       | 9.28%                    | 6.69%       | 5.98%       | 6.61%                   | 11.29%      | 4.87%       |
| <b>Debt Equity Ratio</b>          | In Times   | 1.11                             | 1.73        | 1.99        | 1.53        | 1.15                     | 1.32        | 2.19        | 0.32                    | 1.00        | 2.30        |
| <b>Return on Equity</b>           | in %       | 88.43%                           | 33.22%      | 8.86%       | 35.22%      | 85.54%                   | 83.89%      | 107.99%     | 19.18%                  | 82.17%      | 59.77%      |
| <b>Return on Capital Employed</b> | in %       | 57.57%                           | 21.38%      | 10.92%      | 23.31%      | 51.76%                   | 44.77%      | 44.33%      | 19.80%                  | 51.88%      | 26.10%      |
| <b>Return of Assets</b>           | in %       | 23.42%                           | 8.26%       | 2.60%       | 10.29%      | 33.70%                   | 28.48%      | 25.68%      | 8.75%                   | 17.79%      | 6.94%       |
| <b>Interest Coverage Ratio</b>    | In Times   | 10.22                            | 3.64        | 1.50        | 4.71        | 11.31                    | 8.29        | 8.40        | 9.59                    | 17.34       | 13.58       |

Note: Q3 balance sheet is not available for Zelio E Mobility Limited and Tunwal E-Motors Limited. For Warivo Electric Mobility Limited, the ROCE, ROE, and ROA metrics for December 2025 have been annualized

- We have considered Consolidated Financial Statements
- Total Income: Includes revenue from operations and other income.
- EBITDA: PBT + finance costs + depreciation & amortization – other income.
- EBITDA Margin: EBITDA / revenue from operations.
- PAT: Profit after tax from continuing operations.
- ROE: Profit/Average Shareholder's Equity
- ROA: Profit/Average Total Assets
- ROCE: EBIT / Average capital employed.
- Capital Employed: Total Shareholder's Equity + Long Term Borrowing + Short term borrowing + Deferred Tax Liabilities - Deferred Tax Assets
- Debt-to-Equity: Total borrowings / shareholders' equity
- Interest Coverage Ratio: EBIT/ Finance Cost