India EV Electrification and Localisation – Policy, Technology and Industry Overview

This document summarizes the current state of electric-vehicle (EV) electrification in India, including market and grid challenges, supportive and restrictive government policies, the way India is currently meeting demand for key EV components, and the degree of localisation across major subsystems and manufacturers.

1. Electrification Overview in India

In the Indian context, electrification mainly refers to two linked transitions: first, a shift from internal-combustion-engine vehicles to electric vehicles across two-wheelers, three-wheelers, cars, buses and freight; and second, an expansion and decarbonisation of the power system so that these EVs are supplied reliably with cleaner electricity.

India has set ambitious targets for EV penetration by 2030, including high adoption in the two-wheeler and three-wheeler segments and a meaningful share in passenger cars and buses. Achieving these goals requires simultaneous progress in vehicle affordability, charging infrastructure, grid capacity and domestic manufacturing.

2. Market-side Challenges for EV Adoption

High upfront cost and price-sensitive customers. Most Indian buyers are extremely price sensitive and the market is dominated by two-wheelers and small cars. Even after subsidies, many EVs still carry a higher upfront cost than comparable petrol or diesel vehicles, so long-term savings on fuel and maintenance are often not enough to overcome the initial price barrier for mass-market consumers.

Limited awareness and range anxiety. Potential buyers frequently have doubts about real-world range, battery life, resale value and the availability of charging, especially outside major cities. Uneven public-charging density reinforces range anxiety and pushes risk-averse customers back towards conventional vehicles.

Product mix and financing constraints. EV penetration has been strongest in two-wheelers and three-wheelers, while private cars and heavy commercial vehicles remain a smaller share of the EV parc. Financing products, leasing structures and residual-value models for EVs are still evolving, and some lenders treat EVs as higher-risk assets compared with mature internal-combustion segments.

3. Infrastructure and Grid Challenges

Sparse and uneven charging network. Although the charging network has grown rapidly, public chargers are still concentrated in large cities and along a few main corridors. Small towns and rural areas remain under-served, and low utilisation at many early sites can weaken business cases for further private investment.

Transmission and distribution bottlenecks. India is expanding renewable capacity faster than transmission in some regions, leading to grid congestion and occasional curtailment of solar and wind. Approvals, rights-of-way and coordination between agencies can be slow, and local distribution networks in dense urban areas may not yet be ready for large clusters of fast chargers without targeted upgrades.

Balancing variable renewables with rising EV load. Integrating high shares of solar and wind while also adding EV loads requires more storage, flexible generation and smarter dispatch. Without better demand management and time-of-day tariffs, EV charging can add stress at peak times and at weak nodes in distribution networks.

4. Industrial and Supply-chain Challenges

Battery import dependence and cost. India still imports the vast majority of lithium-ion cells used in EVs. This raises costs and exposes the ecosystem to global price and supply shocks. Domestic cell and component manufacturing is expanding under production-linked incentive schemes, but localisation is still partial and recycling infrastructure is at an early stage.

Technology and skills gap. There is a shortage of engineers and technicians with deep hands-on experience in EV-specific areas such as battery systems, high-power electronics, functional safety and software-defined vehicles. Testing and certification facilities for advanced components are limited, which can slow approvals and product development.

5. Government Policies Supporting Electrification

FAME II purchase and charging support. The second phase of the Faster Adoption and Manufacturing of Electric Vehicles (FAME II) scheme provided purchase incentives for electric two-wheelers, three-wheelers, cars and buses, along with support for public-charging infrastructure. This helped to kick-start demand, especially for fleets, two-wheelers and buses.

PM E-DRIVE and successor incentives. Following the phase-out of earlier schemes, the PM Electric-Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) scheme was introduced to continue supporting electric two-wheelers, three-wheelers and buses. It targets millions of vehicles over a two-year period and aims to give manufacturers better policy visibility in the near term.

Production-linked incentives for batteries and components. Production-linked incentive schemes for advanced chemistry cell batteries and for automotive components are intended to anchor domestic manufacturing of cells, battery packs, motors, inverters and other EV subsystems. The objective is to lower import dependence and bring down costs through scale and localisation.

State EV policies and local incentives. Many states have their own EV policies that complement central schemes. These may include additional purchase incentives,

exemptions from road tax and registration fees, mandates for EV-ready parking, scrappage-linked bonuses and targets for public-charging density in urban areas.

6. Policy Hindrances and Gaps

Stop-start subsidies and limited horizons. Changes in subsidy rates, programme design and scheme durations have created uncertainty for manufacturers and dealers at times. Short scheme horizons and abrupt revisions can make it harder to plan long-term investments in new platforms and charging infrastructure.

Segment skew in incentives. Support has been concentrated on two-wheelers, three-wheelers and buses, whereas private passenger cars and heavy freight vehicles receive relatively weaker or more indirect incentives. This can slow electrification in segments that are important for oil imports and urban air quality.

Grid and regulatory bottlenecks. Slow approvals for transmission projects, unclear or inconsistent tariffs for public charging, and uneven enforcement of EV-ready building codes can hold back infrastructure growth. Regulatory frameworks for advanced concepts such as vehicle-to-grid integration are still evolving.

7. How India Currently Meets EV Component Demand

Heavy reliance on imported battery cells. Despite policy support for domestic cell manufacturing, India still imports almost all of the lithium-ion cells used in EVs. These imports come mainly from East Asian suppliers, and represent one of the largest single cost components in an electric vehicle.

Local assembly of battery packs and BMS. Battery packs, modules and battery management systems are increasingly designed and assembled in India. Local firms handle pack mechanical design, thermal management, wiring, embedded BMS firmware and integration with the vehicle, while the underlying cells and many specialised chips are still imported.

Motors, inverters and other components. India has strong capabilities in auto components and is localising many EV parts such as motors, housings, harnesses and chassis elements, especially for two-wheelers and three-wheelers. However, critical items such as rare-earth magnets, high-end power semiconductor devices and some advanced electronics remain import-heavy.

8. Engineering Technology and Skills Gaps

Skills gap in EV-specific disciplines. Only a small fraction of the automotive workforce has hands-on experience with EV powertrains, battery systems, fast charging, functional safety and software-defined architecture. Many engineers are still primarily trained around internal-combustion-engine platforms.

Ecosystem and infrastructure constraints. Beyond individual skills, India needs deeper capabilities in cell chemistry, materials processing, high-volume automated manufacturing,

and specialised testing. Laboratory and certification capacity for cells, packs, inverters and high-power chargers is still developing.

Evidence of growing capability. At the same time, several Indian companies and start-ups have demonstrated end-to-end engineering of electric two-wheelers, powertrains, charging hardware and telematics. Collaborations between industry and academic institutions are helping to close technology gaps in areas such as motor design, power electronics and advanced manufacturing.

9. Subsystem-wise Localisation Status

9.1 Battery Cells, Packs and Battery Management Systems

Cells. Local manufacturing of lithium-ion cells is still at an early stage. Announced gigafactory projects are progressing, but for now most cells are imported. This is the deepest localisation gap in the EV value chain.

Packs and modules. Battery pack and module assembly has much higher localisation. Indian companies increasingly design pack architecture, cooling, enclosures and interconnections, and assemble packs domestically using imported cells.

Battery management systems. BMS hardware and firmware are often engineered in India, with local teams developing control algorithms, safety logic and communication protocols. However, many of the underlying integrated circuits and precision components still come from global semiconductor vendors.

9.2 Motors, Inverters and Drivetrains

Traction motors. Localisation is relatively strong for motors used in electric two-wheelers and three-wheelers, where Indian firms manufacture large volumes of BLDC and PMSM machines. For high-performance motors used in cars and heavy commercial vehicles, a higher share is still imported, particularly where rare-earth magnets and very high efficiency are required.

Inverters and motor controllers. Many Indian companies design and build motor controllers and inverters, including power PCBs, cooling arrangements and control firmware. The main imported content consists of power modules, IGBT or wide-bandgap devices, driver ICs and some safety-critical components.

Magnets and materials. Rare-earth permanent magnets for high-efficiency motors are largely imported. Scaling domestic production of such materials is a key challenge for deeper localisation of advanced drivetrains.

9.3 On-board Chargers Inside Vehicles

Current status. On-board chargers for two-wheelers, three-wheelers and passenger cars are increasingly designed and assembled in India. Engineering teams handle topologies,

magnetics, control firmware and protection design for typical power levels such as 3.3 to 7.4 kilowatts.

Imported elements. Key semiconductors, high-frequency cores and some controller ICs are still imported. Many designs are based on reference platforms provided by international chip suppliers, with customisation and integration done locally.

9.4 DC Fast Chargers and Public EVSE

Local manufacturing footprint. India now has a sizeable base of companies that manufacture AC and DC chargers domestically. These firms produce wallboxes, urban DC chargers and high-power highway chargers, and in some cases export equipment to other markets.

Imported power hardware. Behind the enclosures, many high-power rectifier bricks, silicon-carbide or IGBT stacks, control ICs, high-voltage contactors and other specialised components are imported. Local value addition focuses on mechanical design, system integration, software, metering and communication standards.

9.5 Vehicle Control Units, Electronics and Software

Electronic control units. Vehicle control units, body control modules and safety-critical ECUs are often assembled in India, but rely on imported microcontrollers and automotive-grade system-on-chips. Complete indigenous design and fabrication of these chips has yet to emerge at scale.

Telematics and software. Indian companies are strong in telematics, fleet-management platforms, charger management systems and mobile applications. Software and cloud infrastructure for EVs and charging networks is a growing area of domestic expertise.

10. Key Indian Manufacturers of Chargers and Motor Controllers

10.1 EV Charger Manufacturers in India

India has a diverse set of domestic manufacturers that design and assemble EV chargers. These include companies focused purely on hardware and others that both make chargers and operate charging networks. Localisation typically covers enclosures, power PCBs, embedded firmware and system integration, while power semiconductors and some high-voltage components are imported.

- Bolt.Earth – manufactures AC and DC chargers in India and operates a large charging network.
- Tata Power EZ Charge – produces and deploys AC and DC chargers for homes, public use, fleets and depots.
- Exicom Tele-Systems – a leading domestic supplier of AC chargers and DC fast chargers.
- Servotech Power Systems (Incharz) – manufactures chargers and runs public charging infrastructure.

- Plugzmart – Indian manufacturer of smart AC/DC chargers and back-end management systems.
- ChargeZone – builds and operates DC fast-charging infrastructure for highways and fleets.
- Okaya EV Charging Solutions – supplies AC and DC chargers for multiple vehicle segments.
- Delta Electronics India – manufactures a range of chargers at its Indian facilities.
- ABB India – produces EV chargers locally based on global designs for a range of power levels.
- Sun Mobility – provides modular chargers integrated with battery-swapping solutions.
- Other charging-station brands such as GLIDA, Statiq and Volttic – use a mix of in-house and partner-manufactured chargers.

10.2 Motor, Inverter and Motor-controller Manufacturers in India

A number of Indian firms specialise in electric motors, inverters and motor controllers, particularly for two-wheelers and three-wheelers. Many of these companies are explicitly focused on localisation and on replacing imported drivetrains with indigenous designs.

- Sona Comstar – manufactures drive motors, hub motors, differentials and motor controllers.
- Tata AutoComp Systems – supplies motors, inverters and chargers within larger OEM ecosystems.
- Virya Mobility 5.0 (Maini Group) – produces motors, controllers, chargers and DC-DC converters.
- Elecnovo – designs and manufactures EV motors and electronic controllers in India.
- EMF Innovations – builds BLDC and PMSM motors and controllers, especially for two- and three-wheelers.
- Shakti Pumps – manufactures BLDC motors and controllers for three-wheelers and other EV applications.
- Sterling Gtake – develops motor controllers and matched motors for multiple vehicle segments.
- Physics Motors – offers BLDC and PMSM motors and controllers spanning small to medium powers.
- Konmos Technologies – produces PMSM motors and controllers with in-house R&D.
- Axiom EV Products – supplies chargers, DC-DC converters and motor controllers.
- Dana TM4 (India) – provides motors, inverters and control units from Indian facilities.

10.3 Firms Explicitly Focusing on Localisation

Several OEM and supplier ecosystems are highlighted for their localisation efforts. Tata Motors and Tata AutoComp, Mahindra and Ashok Leyland are building domestic supply chains for motors, inverters, thermal systems and chargers. Component specialists such as Sona Comstar, Virya Mobility, Elecnovo, EMF Innovations, Sterling Gtake, Physics Motors,

Konmos and Shakti Pumps promote themselves as indigenous providers of motors and controllers for two-wheelers, three-wheelers and light commercial vehicles. On the charging side, companies such as Exicom, Servotech, Plugzmart, Okaya, Bolt.Earth, ChargeZone and Tata Power emphasise manufacturing chargers in India and steadily reducing imported content over time.

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