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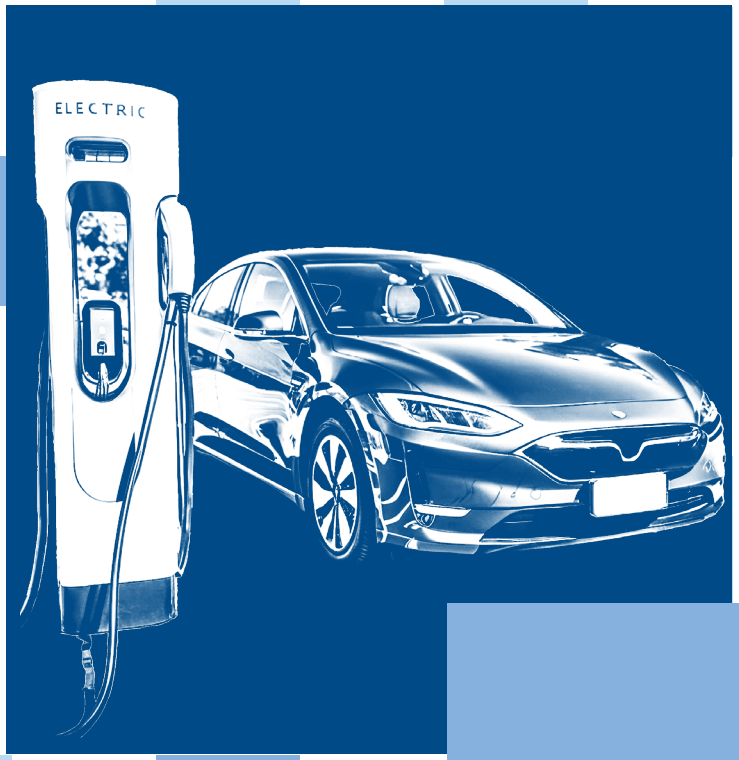

Nurturing Electric Mobility: India's Path to an EV Revolution

Sunil Mani

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The author is a Visiting Professor at Centre for Development Studies, Trivandrum, Kerala, India and Ahmedabad University. The views expressed are personal. This is a summarised version of a larger paper by Mani, Sunil (2024), State and its technological solution to Climate Change in India, Solar PV Module Manufacturing in India.

India stands on the cusp of an electric vehicle (EV) revolution, driven by an intricate web of government policies and institutional support at both national and sub-national levels. As the country aims to transform its automotive landscape, various initiatives have been implemented to foster the growth of the EV industry. However, significant challenges persist, particularly in developing the technological capabilities needed for battery cells, powertrains and charging infrastructure.

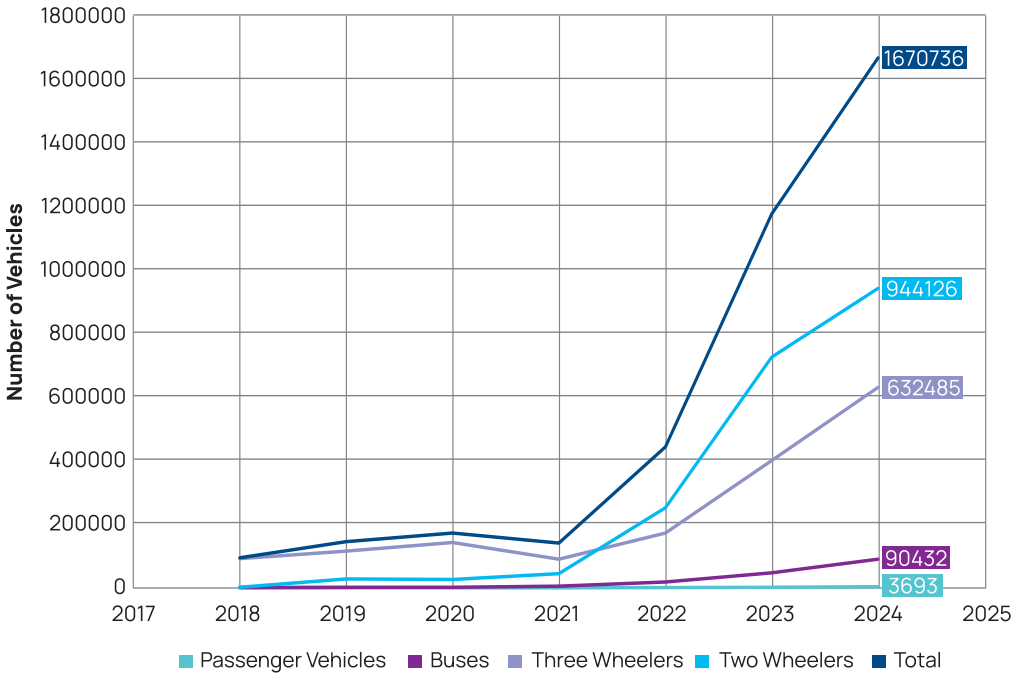
Emergence and Growth of the EV Industry in India

The journey of the Indian EV industry began with the launch of the Reva Electric Car in 2001 by the Reva Electric Car Company, now known as Mahindra Electric. Despite its pioneering status, Reva faced several challenges, including high pricing and a limited dealer network, which hampered its market penetration.

The turning point came with the introduction of the National Electric Mobility Mission Plan (NEMMP) 2020 in 2013, aiming to promote manufacturing and R&D in the EV sector. This was followed by the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme in 2015, which provided financial incentives for EV adoption and the development of charging infrastructure.

These policy initiatives were crucial in setting the stage for the EV industry in India. By 2023-24, electric cars accounted for 2 percent of total car sales in India, with over 90,000 electric cars sold out of 4.22 million passenger vehicles. This growth, averaging an annual rate of 79 percent between 2018 and 2024, underscores the effectiveness of the policies in place. See Figure 1 for trends on sales of EVs in India.

Figure 1 Type Sales of EVs in India (in numbers)



Source: Compiled from the website of Society of Manufacturers of Electric Vehicles

Structure of the EV Industry: Dominance of Two-Wheelers and Three-Wheelers

Unlike the global EV landscape, which is predominantly dominated by passenger cars, the Indian EV industry is characterised by the dominance of two-wheelers and three-wheelers. This unique structure is largely driven by the demand for affordable and efficient mobility solutions in urban and semi-urban areas.

Two-wheelers account for the majority of EV sales in India, driven by the need for cost-effective and efficient transport options for the masses. The low cost of ownership, ease of use and government incentives have spurred the adoption of electric scooters and motorcycles. Companies like Hero Electric and Okinawa have capitalised on this demand, leading the market with their extensive range of electric two-wheelers.

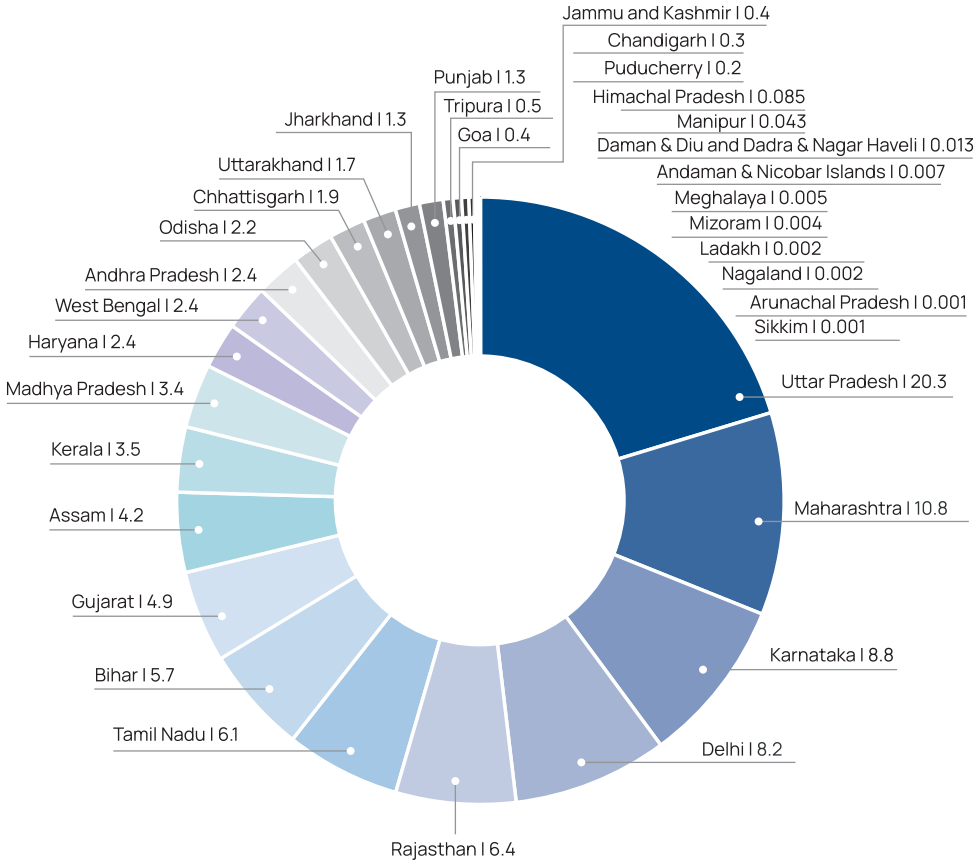
Three-wheelers, particularly electric rickshaws, also play a significant role in India's EV ecosystem. They are widely used for short-distance transport and goods carriage, especially in urban and peri-urban regions. The affordability and economic benefits of electric three-wheelers have driven their popularity, with companies like Mahindra Electric and Piaggio

spearheading innovations in this segment.

This focus on two-wheelers and three-wheelers contrasts sharply with the EV markets in countries like the US, China and Norway, where passenger cars dominate. The Indian approach reflects the specific needs of its population and urban infrastructure, highlighting the importance of tailored strategies in promoting EV adoption.

Further, most of the EVs are concentrated in a few states (Figure 2).

Figure 2 Distribution of the Stock of EVs in India Based on Vehicle Registration Data



Source: Ministry of Transport and Highways, Government of India, https://pib.gov.in/PressReleasePage.aspx?PRID=1947389 (Retrieved on July 29, 2024)

Indian Policy Landscape

India's policy framework for EVs is comprehensive, focusing on reducing the cost of EVs, promoting domestic manufacturing and building necessary infrastructure. The NEMMP 2020 and the FAME scheme are pivotal in addressing the high upfront costs of EVs and fostering market demand.

In addition to these initiatives, the Production-Linked Incentive (PLI) Scheme launched in 2021 has been instrumental in promoting the domestic manufacturing of advanced automotive technology products, including EVs. The reduction of Goods and Services Tax (GST) on electric vehicles from 12 percent to 5 percent and on chargers from 18 percent to 5 percent, further illustrates the government's commitment to making EVs more affordable.

At the state level[2], various governments have introduced additional incentives to boost EV adoption. For instance, states like Delhi, Maharashtra and Gujarat offer subsidies on the purchase of EVs and incentives for setting up charging infrastructure. These sub-national policies complement the central initiatives, creating a conducive environment for the growth of the EV industry across the country.

Technological Advancements and Domestic Innovation

While policy support has been robust, technological advancements and domestic innovation remain critical to the success of India's EV industry. Globally, leaders in EV technology like Tesla and BYD have set high benchmarks in battery efficiency and production scalability. India, though making strides, still has a gap to bridge in terms of technological advancements.

The Indian government has recognised the importance of domestic innovation in EV technology. Efforts are being made to enhance battery manufacturing capabilities, electric drivetrains and charging infrastructure. Notably, Tata Motors, one of the largest electric car manufacturers in India, has been granted numerous patents in diverse automotive technologies, reflecting significant domestic efforts to innovate.

Dependence on Foreign Suppliers

Despite these efforts, India remains heavily dependent on foreign suppliers, especially from China, for critical EV components and materials. This reliance spans battery cells, electric motors and various

[2] The reader can find details of state policies for EVs in Chapter 7 of the CTIER Handbook: Technology and Innovation in India 2025

electronic components that are vital for EV manufacturing. Over 80 percent of the lithium-ion batteries used in Indian EVs are imported from China, underscoring the vulnerability of India's EV supply chain to geopolitical tensions and supply disruptions.

The dependence on Chinese imports is driven by China's dominance in the global EV supply chain, supported by its significant investments in battery technology and rare earth materials. This dependence not only affects the cost competitiveness of Indian EVs but also raises concerns about the long-term sustainability of India's EV industry.

To mitigate these risks, the Indian government has been encouraging investments in local battery manufacturing through initiatives like the PLI Scheme. Collaborations with international players for technology transfer and joint ventures are also being pursued to build domestic capabilities. However, building a self-reliant EV supply chain will require sustained efforts and significant investment in R&D and infrastructure development.

Barriers to EV Adoption

Despite the progress, several barriers continue to hinder the widespread adoption of EVs in India. One of the primary challenges is the high cost of acquiring an EV, driven largely by the expensive battery technology. Batteries account for approximately 40-50 percent of an EV's cost, making them less affordable for the average consumer.

Another significant barrier is the lack of adequate charging infrastructure. As of 2024, India had about 12,146 public EV chargers, a stark contrast to countries like China, which has over 1.2 million public chargers. The uneven distribution of these chargers, particularly in rural areas, further exacerbates the issue. The high upfront investment costs for fast charging stations and the lack of standardisation in charging equipment are additional challenges that need to be addressed.

Consumer perceptions also play a role in slowing down EV adoption. Range anxiety, or the fear of running out of battery power without access to a charging point, remains a significant concern. Although the range of EVs has been improving, the convenience of quick refuelling with internal combustion engine (ICE) vehicles still makes them a more attractive option for many consumers.

Comparative Analysis with Global Leaders

Benchmarking India's progress against global leaders like Norway, China and the US provides valuable insights. These countries have seen significant EV penetration due to strong policy support, financial incentives and stringent emission regulations. For instance, Norway's aggressive policies, including substantial subsidies and the development of extensive charging infrastructure, have resulted in EVs accounting for more than 50 percent of new car sales.

China's focus on domestic manufacturing and large-scale investment in charging infrastructure has made it the largest market for EVs in the world. The US, with its emphasis on technological innovation and public-private partnerships, has also made significant strides in EV adoption. India3 can learn from these experiences, particularly in areas of policy design, public-private partnerships and consumer incentives.

The Road Ahead

India's EV industry shows significant promise, but achieving its full potential will require concerted efforts in policy implementation, technological innovation and infrastructure development. Increased investment in R&D to develop indigenous technologies, along with strategic policy support, is essential for reducing reliance on imports and enhancing the global competitiveness of Indian EVs.

The evolving policy landscape, especially regarding charging infrastructure, suggests potential for accelerated development with appropriate support and investment. As India continues to pursue its ambitious goals in the EV sector, the interplay between policy, technology and market forces will be crucial in shaping the future of electric mobility in the world's third-largest automotive market.

In conclusion, while India has made significant strides in promoting the EV industry, overcoming the technological and infrastructural challenges remains critical. With sustained policy support and a focus on innovation, India can position itself as a major player in the global shift towards sustainable transportation.

References

Press Information Bureau (PIB). (2023), "Electric Vehicles", Ministry of Road Transport and Highways, Government of India, available at https://pib.gov.in/PressReleasePage.aspx?PRID=1947389, accessed on 29 July 2024

Society of Manufacturers of Electric Vehicles (SMEV), EV Industry Statistics, available at https://www.smev.in/statistics, accessed on 1 February 2025