

Chapter 9

Electric Mobility and Electric Vehicles Management in India



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Abstract Mobility allows people to access various needs of their lives including jobs, education, health care and other services. India has potential to achieve electric mobility future by utilising existing conditions, government programmes and policies. To upscale adoption of electric vehicles and for its management in India, issues such as charging infrastructure, research & development, financing of electric vehicles, battery and cell manufacturing, proper regulatory framework, fiscal and non-fiscal incentives, availability of power and its infrastructure, consumer awareness need to be addressed immediately. In this backdrop, this paper initially highlights the vision and opportunity of electric vehicles in India and then tries to explain that the electric mobility pathway would provide clean, low cost mobility, create new jobs, reduce oil imports, improve health of people and would have positive economic impact. The paper highlights the policies and number of incentives provided by Government of India. In the end, the paper mentions the challenges which need to be addressed to boost adoption of electric vehicles in future.

Keywords Electric mobility · Electric vehicle management · Initiatives · Incentives · Challenges

9.1 Introduction

The transportation sector, driven almost entirely on fossil fuels in the form of petroleum products, has a large environmental footprint and linked negative externalities. Not only does the sector impact local air quality and global challenges of climate, but it also has implications on human health and biodiversity.

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In addition to greenhouse gas (GHG) emissions, the sector is also responsible to large extent for emissions of pollutants such as CO, SO_x, NO_x and particulate matter, all of which directly affect human health and biodiversity. The uncontrolled growth of automobiles has led to the transport sector becoming one of the key sources responsible for degrading local air quality and pollution. According to the study on 'Air Pollution and Green House Gases in Delhi' by IIT, Kanpur in 2016, [1] vehicles contribute significantly to PM10 and PM 2.5.

As per IQ Air in 2020 [2] among the world's most polluted countries, India was ranked third in terms of PM 2.5. As per World Air Quality Report (2020), [3] India continues to dominate annual PM 2.5 rankings by city—22 of the top 30 most polluted cities globally are located in India. In Paris Agreement, India has committed to reduce the emissions intensity of GDP by 33–35% by 2030 below 2005 levels. In order to meet the global commitment and mitigate adverse impact of the automobiles, the Government of India is keen to shift towards electric vehicles. Therefore, it is important to introduce alternative modes of transport with rapid urbanisation, economic growth, increase in travel demand, climate change and energy security. Electric mobility is a viable option to address these challenges.

As per Invest India, [4] automobile sector contributes to 49% of India's manufacturing GDP and 7.1% of India's GDP. The second Automotive Mission Plan (AMP) [5] outlines the plan to elevate the automotive industry to world class levels. India is expected to be the world's third-largest automotive market in terms of volume by 2026. The industry currently manufactures 26 million vehicles including passenger vehicles, commercial vehicles, three wheelers, two wheelers and quadricycles in April–March 2020, of which 4.7 million are exported. India holds a strong position in the international heavy vehicles arena as it is the largest tractor manufacturer, second-largest bus manufacturer and third-largest heavy trucks manufacturer in the world. The electrical vehicles (EV) market is expected to grow at CAGR of 44% between 2020 and 2027 and is expected to hit 6.34 million-unit annual sales by 2027. The EV industry will create five crore direct and indirect jobs by 2030. A market size of \$50 billion for the financing of EVs in 2030 has been identified—about 80% of the current size of India's retail vehicle finance industry, worth \$60 billion today. India's passenger vehicle industry is expected to post a growth of 22–25% in financial year 2022. The electric vehicle market in India is expected to be valued at \$2 billion by 2023. With battery costs declining faster than anticipated, electric vehicles economics and five-year TCO would become favourable.

Mobility is one of the most critical inputs required for development. It allows people to access various needs of their lives including jobs, education, health care and other services. India has low vehicle per 1000 population and has opportunity to move towards electric mobility. The shift towards electric mobility would provide clean, low cost mobility, provide new jobs, reduce oil imports, improve health of people and would have positive economic impact.

As per NITI Aayog and World Energy Council [6] report due to climate change, advances in renewable energy, urbanisation, data capture and analysis, battery chemistry and energy security are circumstances which have led electric mobility to enter the mass market.

As per Viswanathan and Sripad [7], 20 per cent of CO₂ emissions and 30 per cent of particulate emissions in India are caused by motorised two-wheelers. Therefore, under FAME, they have considered the need to electrify the motorised two-wheeler.

IEA (2021) [8] report mentioned that by end of 2020, there were 10 million electric cars. Electric car registrations increased by 41% in 2020, despite pandemic and around 3 million electric cars were sold globally (a 4.6% sales share). For the first time, Europe overtook China in terms of world's largest electric vehicle (EV) market. The global EV fleet reaches 230 million vehicles in 2030 (excluding two/three-wheelers), a stock share of 12% in Sustainable Development Scenario. The cost of electric vehicles would be down in future due to advances in battery technology and mass manufacturing.

NITI Aayog and Rocky Mountain Institute [9] report mentions that there is need to overcome the key barriers related to electric vehicles adoption including technology cost, infrastructure availability and consumer behaviour. Financing is a hurdle for India's electric mobility transition. The end-users face a range of challenges like high interest and insurance rates apply to retail loans, loan-to-value ratios are low and specialised finance options are limited. The quantum of finance required for electric vehicles adoption scenario is considerable. Between 2020 and 2030, the estimated cumulative capital cost of the country's EV transition will be INR 19.7 lakh crore (USD266 billion) across vehicles, electric vehicle supply equipment (EVSE) and batteries (including replacements). The estimated size of the annual EV finance market will be INR 3.7 lakh crore (USD50 billion) in 2030. There are six targeted instruments and four ecosystem enablers that financial institutions, the EV sector and the government can adopt to mobilise the capital and financing associated with India's EV transition. The targeted instruments are priority sector lending; interest rate subvention; product guarantees and warranties; risk-sharing mechanism (government and multilateral-led); risk-sharing mechanism (fleet operator-led) and secondary market development. The ecosystem enablers are digital lending; business model innovation; fleet and aggregator electrification targets and open data repository for EVs. Finally, innovative procurement and leasing initiatives that lead to early deployments at scale can help prove the techno-economic viability of electric vehicles and increase supply chain investments. The report mentions that supporting the design of effective financing solutions can help unlock the capital needed for India's EV transition.

9.2 Vision and Opportunity of Electric Vehicles in India

By 2026 as per Automotive Mission Plan (AMP) 2030 [5] vision, the Indian automotive industry will be among top three of the world in engineering, manufacture and export of vehicles and auto components. NITI Aayog and Rocky Mountain Institute [10] report highlights that by 2030 in transformative scenario, the percentage of electric vehicle would be 40% for two-wheeler, 100% for three-wheeler, 40% BEV for four-wheeler (personal), 100% BEV for four-wheeler (commercial) and 100%

for public transit. By pursuing shared, connected and electric mobility, India can save 64% of anticipated passenger road-based, energy demand and 37% of carbon emissions in 2030. This would save Rs 3.9 lakh crore or USD ~60 billion. The report highlighted list of actionable solutions.

Stanley [11] report mentions that by 2030, India would become global leader in shared mobility. According to Morgan Stanley expectations by 2030, India will have 35% of miles shared by 2030 and 30% of EV penetration. China will have 30% of miles shared by 2030 and 30% of electric vehicles penetration.

Bloomberg NEF's 2020 Battery Price Survey [12] predicts that by 2023, average pack prices will be \$101/kWh. The drop in battery prices could provide necessary thrust for high uptake of electric vehicles (EVs) by bringing them at par with internal combustion engine (ICE) vehicles.

ICCT [13] mentioned that on 11 June 2021, Department of Heavy Industries made some very encouraging modifications to the FAME-II scheme. Purchase incentives for electric two-wheelers (E2W) were increased by 50% to INR 15,000 per kWh of battery capacity. The limit on this incentive was also relaxed from 20% of the ex-showroom price to 40% of the ex-showroom price. Following the FAME-II subsidy revision announcement, manufacturers were also quick to announce retail price cuts for the shorter-range models that currently dominate the market. The latest revised incentives also make an already attractive TCO proposition even more alluring for consumers. Going back to the mid-range example, both 5-year and 10-year TCO parity was already achieved before the additional FAME-II incentives. The additional incentives combined with state-level incentives, which include direct incentives and a full road tax-waiver, make for a very compelling case by lowering electric two-wheeler TCO below conventional models.

Transition to electric vehicles can provide benefits like increase in energy security, air pollution and greenhouse gas emissions reduction and industrial development. As on 2 August, 2021, total registered electric vehicles in India were 730,237 as per e-Vahan portal. The year-wise electric vehicles sales trend in India is shown in Fig. 9.1. The total EV registered has been increasing from 2014–15 to 2019–20 in India, but due to pandemic, little slowdown was seen in 2020–21. But overall trend shows that the number of electric vehicles registered has been increasing. The electric vehicle addition was highest for three-wheeler followed by two-wheeler.

As per Society of Manufacturers of Electric Vehicles (SMEV), data published in autocar Website, [15] the electric vehicle sales in India in financial year 2021 were 143,837 for two-wheelers, 88,378 for three-wheelers, 5905 for cars, and the total was 238,120. In financial year 2020 was 152,000 for two-wheelers, 1,40,683 for three-wheelers, 2814 for cars, and the total was 2,95,497. In financial year 2021, electric two-wheeler sales down by 5.37%, three-wheeler sales down by 59% and electric passenger vehicle sales up 110 per cent. The difference in vehicle data available in e-vahan and with Society of Manufacturers of Electric Vehicles could be due to number of registered electric vehicles in India.

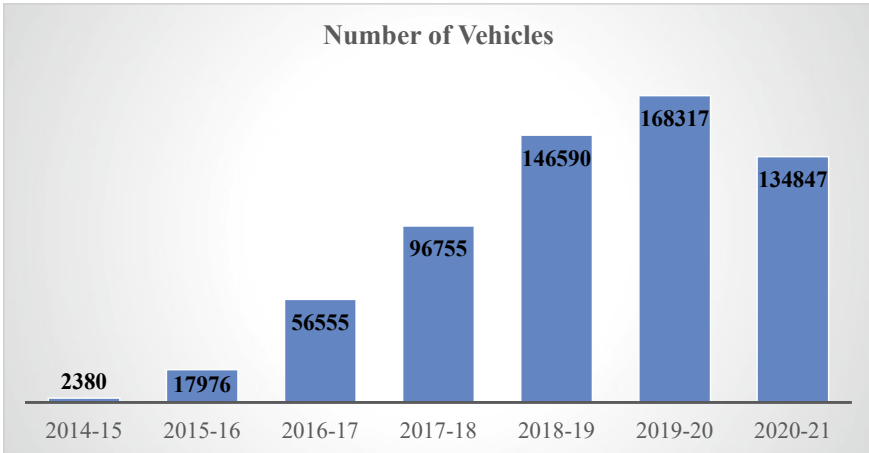


Fig. 9.1 Year-wise registered electric vehicles sales. *Source* <https://vahan.parivahan.gov.in/vahan4/dashboard/vahan/view/reportview.xhtml> (accessed on 2 August, 2021). This was as per e-vahan portal and for Electric (BOV) [14]

9.3 Initiatives and Incentives by Government of India

The Government of India has undertaken many initiatives to promote adoption and manufacturing of electric vehicles in India.

9.3.1 *National Electric Mobility Mission Plan (NEMMP) 2020 and Faster Adoption and Manufacturing of Hybrid & Electric Vehicles in India (FAME India) Scheme*

National Electric Mobility Mission Plan 2020 [16, 17] document provides vision and roadmap for electric vehicle adoption and manufacturing. It was designed to increase national fuel security, to provide affordable and environmentally friendly transportation and to enable automobile industry to achieve leadership in manufacturing. As part of National Electric Mobility Mission Plan 2020, Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) [18] Scheme was formulated in year 2015 by Department of Heavy Industry to promote manufacturing of electric vehicles in India by providing incentives on purchase of electric vehicles and for establishing charging infrastructure. Department of Heavy Industry (DHI) is nodal department for Faster Adoption and Manufacturing of Hybrid & Electric

Vehicles in India (FAME India) Scheme since 1 April 2015, Phase-I of the scheme was extended from time to time, and the last extension was allowed till 31 March 2019. Currently, Phase-II of FAME India Scheme is implemented from 1 April, 2019 for a period of 3 years with a total budgetary support of Rs. 10,000 crores. The Phase-II of FAME India Scheme will focus on electrification of public and shared transport and aim to provide demand incentive to approximate 7000 electric buses, 5 lakh electric three-wheelers, 55,000 electric four-wheeler passenger cars and 10 lakh electric two-wheelers. The creation of charging infrastructure is also supported under the scheme.

About 2.8 lakh hybrid and electric vehicles were supported in first phase of FAME Scheme by providing demand incentives of Rs. 359 crore. Department of Heavy Industry sanctioned 425 electric and hybrid buses for various cities with total cost of Rs. 300 crores and 500 charging stations/infrastructure for Rs. 43 crore (approx.) under Phase-I of FAME India Scheme. Under Phase-II of FAME India Scheme till 26.02.2020, 14,160 electric vehicles have been supported amounting Rs.50 crore, and 5595 electrical buses have been sanctioned to various State/City Transport Undertakings of around Rs. 2800 crore. DHI has also sanctioned 2636 charging stations of about Rs 500 crore (approx.) in 62 cities across 24 States/UTs.

Present status of FAME as on 6 September, 2021: As per DHI dashboard, under FAME-II, the total number of vehicles sold is 111,936, the fuel saved (in litres) is 26,010,704, and CO₂ reduction (in kg) is 59,195,734. Figure 9.2 shows number of vehicles sold state wise.

The total number of electric vehicle sold in India under FAME India Scheme as of August 2021 is 3.87 lakh electric vehicles and 6740 electric buses.

9.3.2 National Mission on Transformative Mobility and Battery Storage

To drive clean, connected, shared, sustainable and holistic mobility initiatives, the Government of India has set up National Mission on Transformative Mobility and Battery Storage [19, 20]. The role of mission is as follows:

- To recommend and drive the strategies for transformative mobility and Phased Manufacturing Programmes for Electric Vehicles, Electric Vehicle Components and Batteries.
- To launch Phased Manufacturing Program (PMP) to localise production across the entire electric vehicle value chain.
- To finalise the details of the value addition that can be achieved with each phase of localisation with a clear Make in India strategy for the electric vehicle components as well as battery.
- To coordinate with key stakeholders in ministries/departments and the states to integrate various initiatives to transform mobility in India.

domestic manufacturers, reduce import dependence and make India leader in electric vehicles. Through this scheme, the Government of India would be able to realise goal of Atmanirbhar Bharat. The scheme intends to optimally incentivize potential investors, both domestic and overseas, to set-up Giga-scale ACC manufacturing facilities with emphasis on maximum value addition and quality output and achieving pre-committed capacity level within a pre-defined time period. The net saving would be Rs. 200,000 crore to Rs. 250,000 crore on account of oil import bill reduction. The Advanced Cell Chemistry (ACC) programme will help in reduction of greenhouse gas (GHG) emissions as will facilitate demand for electric vehicles which is less polluting.

9.3.5 Production-Linked Incentive (PLI) Scheme for Automobile and Auto Components

Production-Linked Incentive (PLI) Scheme in the Automobile and Auto Components sectors was introduced to enhance manufacturing capabilities and exports, and the approved outlay is Rs. 57,042 crore over a five-year period.

The battery waste management rules have been amended by Ministry of Environment, Forest and Climate Change (MoEFCC) to include lithium ion batteries under the ambit of 'Extended Producer Responsibility'. Department of Heavy Industry (DHI) had floated Expression of Interest (EoI) for deployment of EV charging stations on the highways, across the country. Ministry of Road Transport and Highways (MoRTH) has allowed registration of vehicles without batteries, and this would promote alternate business models like battery swapping. MoRTH has removed mandatory requirement of spare tire in cars, and this would provide extra space for electric vehicle batteries in vehicles.

9.3.6 Charging Stations

To accelerate electric vehicle adoption, it is important to have adequate charging infrastructure. In this regard, Ministry of Power has issued 'Charging Infrastructure for Electric Vehicles—Guidelines and Standards' defining the roles and responsibilities of various stakeholders. A policy on charging infrastructure has been issued, and this would permits private charging at residences/offices where tariff for supply of electricity to electric vehicle charging station shall not be more than the average cost of supply plus 15%. Ministry of Power has issued a notification clarifying a clause in the Electricity Act 2003 that charging for the purpose of charging an electric vehicle is classified as a service and that no licence is required for this business activity.

9.3.7 Other Initiatives

Income tax deduction of ₹1.5 lakh on the interest paid on loans to purchase electric vehicles. This amounts to a benefit of around Rs. 2.5 lakh over the loan period who would take loans to purchase electric vehicle. Similarly, GST on electric vehicles has been reduced from 12 to 5%. Similarly, GST on electric vehicles chargers has been reduced to 5% from 18%. Exemption of customs duties on certain parts of electric vehicles and capital goods is used for manufacturing of lithium ion cell. Exemption has been granted to all battery-operated transport vehicles and transport vehicles running on ethanol and methanol fuels from the requirement of permits. Ministry of Finance has rationalised the custom duty rates for all categories of vehicles—two-wheeler, three-wheeler, four-wheeler and buses and trucks which have been reduced to incentivize uptake of electric vehicles. This includes reduction of duty for completely knocked down and semi-knocked down unit of vehicles.

A pioneering initiative has been taken by Indian Space Research Organisation (ISRO) for commercialization of indigenously developed lithium ion battery technology. In this regard, ten firms have been shortlisted for the transfer of technology.

NITI Aayog has prepared a concessionaire Agreement for Public Private Partnership in Operation and Maintenance of Electric Buses in cities through Operating Expenditure (OPEX) Model. This would reduce the requirement of upfront capital as the lease would be signed on per km basis.

A grand challenge for developing the Indian Standards was initiated by Department of Science and Technology (DST), and Bureau of Indian Standards (BIS) has notified general requirements for electric vehicle charging based on CCS and Chademo charging standards.

Ministry of Housing and Urban Affairs (MoHUA) has prepared a draft for amendment of building code and town planning rules for provisioning for electric vehicle charging stations in private and commercial buildings. Ministry of Road Transport and Highways (MoRTH) has notified green number plates for battery-operated vehicles. Driving licenses are to be given for age group 16–18 years to drive gearless electric scooters/bikes up to 4 kWh battery size. Ministry of Road Transport and Highways has issued Draft Notification to exempt battery-operated vehicles from paying registration fees.

National common mobility card has been launched, which would allow payments across all segments including metro, bus, suburban railways, toll, parking, smart city and retail. These are bank issued cards on debit/credit/prepaid card product platform. The customer may use this single card for payments.

9.3.8 Electric Vehicle (EV) Policies Released by States and UTs

States and UTs have taken the lead in leapfrogging towards the electric mobility in the country. As on September, 2021, fourteen states and UTs have released the electric vehicle policy. Out of this, 13 states/UTs have finalised the EV policies, while six states have EV policies in the draft stage.

The 13 states/UTs which have finalised the EV policy are Andhra Pradesh, Karnataka, Kerala, Maharashtra, Tamil Nadu, Uttarakhand, Uttar Pradesh, Delhi, Madhya Pradesh, Telangana, Gujarat, Odisha and Assam.

The six states which have EV policies in the draft stage are Chandigarh, Bihar, Haryana, Himachal Pradesh, Punjab and Goa.

9.4 Challenges Which Need to Be Addressed to Boost Adoption of Electric Vehicles

NITI Aayog and World Energy Council [6] report mentions that the limiting factor of batteries on driving range could be addressed by developing ecosystem for fast charging or swapping of batteries. There is need to have proper infrastructure in every kilometer in dense areas. The report mentions that to make electric vehicles economically viable provide charging infrastructure and increase efficiency of vehicles. The other recommendations mentioned are policy for charging/swapping infrastructure; to make early impact focus on small and public vehicles; research and development; transforming auto-ancillaries: focus on power electronics industry and electricity distribution system/impact on the grid.

The issue of charging infrastructure, research & development, financing of electric vehicles, battery and cell manufacturing, proper regulatory framework, fiscal and non-fiscal incentives, availability of power and its infrastructure, consumer awareness, etc., need to be addressed to upscale electric vehicle adoption.

9.4.1 Increase Number of Charging Infrastructure in Country

There is need to increase the number of charging infrastructure as demand for electric vehicle increases in India. As on March 2021, India has 1800 charging stations. A study conducted by Singh et al. [22] for the Centre for Energy Finance shows that by 2030 around 29 lakh public charging stations are required to support EV adoption. Out of 29 lakh charges, around 21 lakh, i.e. 71%, would be low capacity charges used in two-wheelers and three-wheelers. The lack of space to charge electric vehicles is

also a hurdle. Therefore, there is need to have dedicated parking space to charge electric vehicles.

9.4.2 Need to Push Research and Development (R&D)

Create a research & development fund (with private partnership) to be a leader in the next generation technologies. Create a dedicated R&D institution for EVs, comprising industry, academia and government. There is need to develop batteries which look beyond Lithium & Cobalt, and are made up of materials readily available in India. Strong R&D focus on fuel cells is also required.

9.4.3 Enable Financing for Electric Vehicles (EVs)

EVs are finding it very hard to access institutional finance. Even if they are able to get it, they are getting it at a high rate. India is being a cost-sensitive market, and upfront price of electric vehicles is being higher; without loans, the ecosystem will not take off. There is need to address the financing issue immediately.

9.4.4 Drive EV Manufacturing

There is need to take top high value components of EVs and aim to make India the export hub of these components. There is need to drive these on missions mode with specific states.

9.4.5 Drive EV Battery and Cell Manufacturing

India is importing batteries and does not have enough in-house supply of key raw materials, and this makes cell manufacturing a very costly affair. The manufacturers need to ensure adequate localization. The state governments in India are offering subsidies and addressing the infrastructure need for giga factories. There is need to sign Memorandum of Understanding (MoU) for procurement of raw material from countries rich in these resources.

9.4.6 Create Framework for Time of Day (ToD) Tariff

Discoms charge a flat rate of electricity throughout the day from users, even though the production is higher in the day (solar). Discoms need to have a lower price for electricity during day and higher during night. This will incentivize distributed storage where the users (including EV owners) buy electricity at a lower rate and may be use it or pump it back to the grid and earn money out it. The solar generation would go up, and cost of storage by discoms would go down as distributed storage (like batteries and EVs) would come up.

9.4.7 Consumer Awareness

Massive campaigns are required to influence consumer behaviour and to educate the citizens to adopt sustainable mobility choices. There is need to increase consumer awareness campaign for electric vehicle through print and social media.

9.4.8 Fiscal and Non-fiscal Incentives

There is need to provide fiscal and non-fiscal incentives by central and state government to upscale adoption of electric vehicles like subsidy, interest subvention, scrapping incentive, etc.

9.4.9 Congestion Pricing

EVs, though clean, do not solve the problem of congestion and do not incentivize people to move towards public transport. Do a pilot in a city, where the private vehicle owners are required to pay a small fee for entering in certain areas of the city. With the mandate of FAST tag across the country, the implementation would be seamless. The collected money can be put in a fund and used for promotion of electric public transport.

9.4.10 *Mandate Battery Manufacturers to Procure Raw Materials (Say 15–20%) from Recycled Materials in India*

A lot of e-waste is getting generated which is going into landfills without getting recycled. There is need to create a blockchain-based solution to track every battery from cradle to grave. The battery manufacturer's should be mandated to procure a certain percentage of raw material from the Indian recycle (& not import), which can be easily tracked by blockchain. This creates a market as well as demand for urban mining.

9.4.11 *Centralised Authority to Spearhead the Electric Mobility Initiatives of Government of India*

There is an urgent need for a centralised authority to spearhead the mobility initiatives of Government of India. Currently, there are various organisations engaged in different aspects of mobility at state and central level. A concentrated effort by a dedicated institution to coordinate with a wide variety of stakeholders, namely ministries, state governments, industry associations, manufacturers, technocrats, civil society, etc., is required.

India has immense potential to become leader in electric vehicles if challenges associated with adoption are addressed immediately. Electric vehicles are picking pace in India with increase in incentives, proper central and state government policies, with improving charging infrastructure and with announcement of manufacturing hubs and giga factories, with multiple industry players and start-ups entering EV market, with evolution around charging infrastructure and swappable batteries, etc. Government of India is making immense efforts to promote electric mobility.

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