

Innovations in Electric Mobility Industry in India

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Abstract- India has population of 1.4 billion with nearly 326.3 million register vehicles on road. There is a shift towards electric mobility in India in urban areas due to increasing demand for transportation by the rising population. Mobility revolution is driver of our growth .electro mobility is also referred as emobility or e-mobility. India's manufacturing sector is growing sector especially in the automotive sector. Most of the vehicles running on the roads are fuel based releasing toxic pollutants and green house gas emissions, which is contributor of urban air quality. Need of the hour is to reduce green house gas emissions from vehicles as a step towards sustainable development. It is possible only with creation of an ecosystem for electric vehicles in India. India has digitally literate youth population. It possesses millions of educated minds and skilled hands to power the future. To prevent worst climate damage at global level, emissions of carbon dioxide has to be reduced to 45% from 2010 -2030, to net zero around 2050. Global warming is causing climate damage due to escalation of GHG emissions. There is 50%increase in worldwide consumption of electricity by 2050 due to use of electric vehicles. It highlights improvement in technical advancement.

Indexed Terms- Electric Mobility, Population, Global Warming

Objective –The aim of this article is to give insight of current e-mobility trends, practices and innovations required to encourage the growth of sustainable e-mobility in India.

Research methodology- the research conducted is exploratory to investigate the shift towards electric mobility in India. The study assesses the practices, innovative practices and challenges. The research design involves qualitative method only.

Limitation of the study-This study has divided the Indian Electric vehicle market based on product-battery electric vehicle.

I. INTRODUCTION

Indian automobile industry is good indicator of economic growth. Since new economic reforms of 1991, 100 per cent FDI is allowed through automatic route, the industry made significant growth. All categories of vehicles are produced in India itself. In recent program of MSME entrepreneurs in Madurai, PM Modi mentioned that 7% of country's GDP comes from automobile industry. In automobile market at global level, India ranks world's third largest manufacturer of three wheelers, passenger vehicles and tractors. India could be a leader in the industry by 2030, if focus shifted to electric and autonomous vehicles to reduce emissions. Indian government is also committed for sale of 305% of new vehicles to be electric. Automotive engineering offers 3 different types of vehicles-fully battery powered (BEV), or hybrid electric vehicles (HEV) or hydrogen fuel cell and plugged in hybrid vehicles (PHEV)

Overview of Indian electric car market

It is expected to reach 376,000 units in 2030. The industry is slowly gaining momentum with government support. The major factors contributing to its growth are increasing FDI, construction of manufacturing hubs and improvement in charging infrastructure. In india, majority of the electric vehicles are two and three wheelers. India's EV market is estimated to be fully electric by 2035. According to Vahan Dashboard data Main highlights are

- India registered EV sales for 12,43,258 units in 2022-23
- EV industry records 5.59% of overall automobile sales.
- Highest segment sales of high speed e-2 wheelers of 7,79,158 units

- 4,07,381 electric 3Ws sold in 2022-23
- 154% growth in sales of electric 4-wheelers of 53,843 in 2022-23
- Ola electric was the top seller in e 2-wheeler category followed by Hero electric of 165,589 units and 97,812 units
- Mahindra, Piaggio. Omega Seiki are top e3 wheeler sellers in country in 2022-23

Need for electric mobility in India-environmental concerns

At global level, due to depleting natural gas resources, the automobile industry is shifting to more alternative. The main concern is about environmental and climate change. India has taken Green initiative to produce and promote electric vehicles. Indian electric vehicle market size was valued at USD 3.21 BILLION in 2022. EV market is expected to grow at the rate of 49% from 2022-2030, according to NITI Ayog. Electric vehicles will help in reducing CO₂ and control air pollution and noise pollution. The transport sector contributes nearly 142 million tons of carbon dioxides emissions per year of which 123 million tones are only from road transport. To cut carbon emissions, it is essential to shift to e-mobility. They have storage source for renewable energy. The users and customers find them less maintenance cost vehicles. The Paris agreement is the main reason for India's EV strategy. Worldwide investments, incentives and policies are being introduced to propagate an adoption of electric vehicles.

PM visualizes 7 C's for EVs-PM MODI outline vision for the future Mobility in India based on 7 C's in Global Mobility summit. 2018.. they are as follows-

- Common-there is paradigm shift in mobility business. Focus must be on other vehicles besides cars like scooters and rickshaws. the developing world depends on these vehicles for mobility
- Connected-Internet enabled connected sharing economy is emerging due to the developments of mobility. People from villages should be able to bring their produce to cities easily and efficiently.
- Convenient-mobility must include safety, affordability and accessibility for women and elderly people.

- Congestion free-mobility is to check economic and environment costs of congestion. All the bottlenecks of networks must end.-less traffic jams.
- Charged mobility- India business leaders and manufacturers are trying to develop battery technology which is cost effective for electric cars. Policies are to be designed to enable better opportunities in the automotive sector. Investments are to be made in smart charging and electric vehicle manufacturing.
- Clean mobility and clean energy-It is an aid to fight against climate change. It leads to clean air and better living standards for our people. Investments are required in renewable energy.
- Cutting-edge-Mobility is the next big innovation sector of the economy. It is the cutting-edge

Electric mobility trends in 2024

1. charging infrastructure- swift expansion of EV supply equipment includes hardware, software and charging station. Fluctuating power causes distribution in the electric grids. It necessitates collaborations of charging point owners and grid operator on cloud platforms. Innovation from start ups are emerging.
2. Electric mobility as a service-(eMaS) it provides transport services. Joint digital channels allow users to plan and book rides. such shared e-mobility reduces pollution. Indian start-up Alt-mobility developed solution for electric fleet operation and contribute greener environment.
3. artificial intelligence-AI facilitates automation; refine routes and charging station usage. Battery management system (BMS) monitor battery health, detect cell damage. Advance Driver assistance system (ADAS) enhances driver monitoring.
4. Vehicle to everything V2X-EVs can transfer their excess energy to rids, building, houses and other energy devices.
5. Internet of things- IOT HELPS IN DATA COLLECTION and improve their management. It helps drivers about vehicle glitches. Sensors detect speed, battery temperature, battery health.
6. Micro mobility- electric bicycles, -ebikes, e-scooters help personalized transport for short trips. It helps to reduce carbon emissions. Indian

startup Strictly Electric offers easykit that changes any bicycle to e-bicycles.

7. Big data and analytics- it provides insights on charging station, battery status, vehicles speed usage, location, voltage and helps vehicle maintenance. It also Helps in autonomous driving and parking.

3D printing- it is used for product prototyping, hastening design finalization process. It helps to reduce costs.

Eco-system for electric vehicles in India

The entire ecosystem of manufacturers, central and state governments, dealers and investors are concentrating on knowledge of handling and maintenance of these automobiles. Using and maintenance of such vehicles requires behavioral change. Dealers try to educate customer/consumers how to use and operate battery models .EV transition provides an opportunity o create large, highly skilled and sustainable Indian jobs. From global climate perspective, India is fourth largest emitter of CO2, so it is imperative that India must take a low carbon development path. Emissions by EVs are less compared to that by Internal Combustion engines. The future of India is electric. Strong government thrust, cost-benefit in long run, lower pollution will drive transition to EVs. EV ecosystem in India includes following bodies/players

- Active government regulatory bodies like NITI Ayog, MoRTH, Ministry of heavy industries and Public Enterprise
- Charging infrastructure-charging technology like ABB, SUN mobility, Fotum. Electricity providers are TATA Power, NTPC Ltd, engie, Indian oil.
- Battery technologies- SUN Mobility, ION energy, NIPPO BATTERIES, DNSO India, su-kam power systems
- Digital technologies- charge now, Paytm, plugIndia, apps of mobility service providers
- Automotive manufactures- Mahindra and Mahindra, Ashok Leyland, Bajaj automotive, Ather energy, ampere vehicles private ltd., Hero Moto Corp ltd.
- Mobility sevice providers-Ola cabs Uber technologies, Zoomcar, DHL India, Lithium urban technologies

- Financers- Softbank group, TATA Sons, Hinduja group, Asian Development Bank, Hero Motocorp.
- Innovation in e-mobility in India
- Communications and sensors-IOT based communications, vehicle-to-vehicle communication, traffic management, mobile communication, battey swapping information improves car safety and red range anxiety ex siemens, charge point, Tom Tom.
- Smart grid-grid optimized charging or grid stabilization lowers charging cost and grid balancing services from EVs Ex ABB, UPS
- Autonomous driving-vehicles can self drive to charge points, improves car safety. user convenience, lower fuel cost, and maintenance costs, reduces accidents. ex TESLA, Mahindra and Mahindra, General Motors
- Block chain technology – enables secure vehicles charging and billing system, integration with energy generation networks ex Xain, emotor works, share and charge.
- New charging and battery technologies- they enables intelligent wireless charging, high power density, faster charging lowers weight ex Qualcomm. Panasonic, Fisker
- Battery management system- helps to monitor voltage/current, battery health and performance. It further lowers manufacturing costs and longer battery life ex Maxim, LG CHEM,byd
- Additive manufacturing-enables use of cheaper materials, better models and use of motors, less vehicle weight ex NRC, Porsche engineering, XEV
- nanotechnology- helps in fast battery charge and long battery life EX gold nanowire, Graphene

Electric 2 vehicles-it is divided into two segments

1. Low speed vehicles-top speed of 25km/hr and do not require driver's license.
2. High speed vehicles-top speed greater than 25km/hr need to be registered.

The major players are Hero electric, Okinawa, Bajaj, TVS, ather , Ola, Bounce, revolt.

Electric vehicles-major players are tata motors, MG, Hyundai, Mahindra

Electric cars-they are mainly low speed vehicles categorized as e-rickshaw or e-karts. Top players are Mahindra, YC electric, Saera

Electric buses – private users are less. They are used by state governments. The market main players are Tata motors, JBM, Foton PMI

Supportive infrastructure-charging station

There is an urgency to find viable alternative for sustainable mobility. It is mandatory for government to facilitate charging infrastructure in public buildings, standards for charging equipment, building laws to mandatory provision for charging outlets

Government initiative to promote mobility in India NCEM-IN 2017, Central government established National council for electric mobility to propagate electric mobility and manufacture of electric vehicles and their components at apex level. It includes Ministers from various departments' industry representatives and academia and is chaired by the Minister of Heavy industries and Public enterprises. NAB-National Automotive Board is the technical advisor and secretariat for NCEM and NBEM.

FAME-in April 2015, the Faster Adoption and Manufacturing of (hybrid) and electric Vehicle was started for promoting the hybrid and EVs in nation. In April 2019, FAME-II was started with budget of \$1.3 billion to support 55,000 e-passenger vehicles and charging stations.

TPEM- the Technology platform for Electric Mobility is joint initiative of the Department of heavy Industry and the Department of Science and technology to support R 7 D projects involving companies and academic. Tata Passenger Electric Mobility Ltd (TPEM), a subsidiary of Tata Motors and the pioneer of India's EV revolution. ON 17 Jan 2024 launched its first pure EV – the Punch.ev.

NEMMP-government started National Electric Mobility Mission Plan 2020 in year 2013. It aims to promote hybrid and electric vehicles for national fuel security

Government steps for adoption of electric vehicles Following government steps taken for adoption of electric vehicles in India

- On 12 May 2021 government production Linked Incentive PLI for manufacturing of advanced

chemistry Cell ACC to bring down prices of battery and cost reduction of EVs.

- On 15 September 2021 government incentive under PLI scheme for automobile and auto components for 5 years.
- Reduction of GST from 12% to 5% on EV and on chargers from 18% to 5%
- Battery operated vehicles are given green license plated and exempted from permit rules by Ministry of road Transport & Highways
- Waiving of tax on EVs by MoRTH

CHALLENGES IN E-MOBILITY

- Electric supply-lack of infrastructure
- Affordability of e-vehicles-consumer mindset
- Charging infrastructure
- Challenges in Battery technology
- Range issues-limited range of EVs

CONCLUSION

India has comparative advantages in mobility paradigm like big data, digital payments and internet-enabled shared economy. Government has planned to electrify all vehicles by 2030. It depends on entire ecosystem. Consistent policy framework with collaborative efforts of centre, state and city authorities will ensure the future of e-mobility in India. Holistic approach calls for collaboration among various stakeholders and long term commitment with long term objective.

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