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Megha Middha, is working as an Assistant Professor of Law in Mody University of Science and Technology, Lakshmangarh, Sikar (Rajasthan). She has an experience in the teaching of almost 3 years. She has completed her graduation in BBA LL.B (H) from Amity University, Rajasthan (Gold Medalist) and did her post-graduation (LL.M in Business Laws) from NLSIU, Bengaluru. Currently, she is enrolled in a Ph.D. course in the Department of Law at Mohanlal Sukhadia University, Udaipur (Rajasthan). She wishes to excel in academics and research and contribute as much as she can to society. Through her interactions with the students, she tries to inculcate a sense of deep thinking power in her students and enlighten and guide them to

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Mrs.S.Kalpana

Assistant professor of Law

Mrs.S.Kalpana, presently Assistant professor of Law, VelTech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi. Formerly Assistant professor of Law, Vels University in the year 2019 to 2020, Worked as Guest Faculty, Chennai Dr. Ambedkar Law College, Pudupakkam. Published one book. Published 8 Articles in various reputed Law Journals. Conducted 1 Moot court competition and participated in nearly 80 National and International seminars and webinars conducted on various subjects of Law. Did ML in Criminal Law and Criminal Justice Administration. 10 paper presentations in various National and International seminars. Attended more than 10 FDP programs. Ph.D. in Law pursuing.



Avinash Kumar



Avinash Kumar has completed his Ph.D. in International Investment Law from the Dept. of Law & Governance, Central University of South Bihar. His research work is on "International Investment Agreement and State's right to regulate Foreign Investment." He qualified UGC-NET and has been selected for the prestigious ICSSR Doctoral Fellowship. He is an alumnus of the Faculty of Law, University of Delhi. Formerly he has been elected as Students Union President of Law Centre-1, University of Delhi. Moreover, he completed his LL.M. from the University of Delhi (2014-16), dissertation on "Cross-border Merger & Acquisition"; LL.B. from the University of Delhi (2011-14), and B.A. (Hons.) from Maharaja Agrasen College, University of Delhi. He has also obtained P.G. Diploma in IPR from the Indian Society of International Law, New Delhi. He has qualified UGC - NET examination and has been awarded ICSSR - Doctoral Fellowship. He has published six-plus articles and presented 9 plus papers in national and international seminars/conferences. He

participated in several workshops on research methodology and teaching and learning.

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Promoting Electric Vehicle Mobility in India: Issues and Challenges

Authored by - Abhijit Anil More

Abstract

The faster means and modes of transportation play a significant role in the development of any country. The use of motor vehicles completely revolutionized the transportation of people and goods around the world. Road transportation being the most accessible mode of transportation allows a large section of society a right of movement. However, these vehicles are running on traditional sources of energy i.e., Diesel and Petrol. These traditional sources of energy used in vehicles lead to the emission of hazardous gases directly in the air causing human health hazards and respiratory problems. To overcome this problem governments around the world trying to develop an effective electric vehicles policy. The introduction of Electric vehicles on Indian roads faces several legal and technical challenges. The researcher would try to find out those issues and challenges in the legal framework causing hurdles in electric vehicle evolution in India.

Keywords: Means and Modes of Transportation, Road Transportation, Traditional Sources of Energy, Emission, Health Hazards, Electric Vehicle, Issues and Challenges

1. Introduction:

Transportation has made a significant contribution to any country's development through improving people's lives, whether the growth is in the economic, social, political, or cultural fields. Transportation is significant because it facilitates trade, commerce, and communication, all of which are necessary for civilization to thrive. The emergence of motorized vehicles powered by internal combustion engines has made transportation more efficient and effective.¹ The automobile sector is one of India's most important economic

* The author is the Research Scholar pursuing Ph.D. from Maharashtra National Law University Nagpur. Author can be reached at abhijitmorey95@gmail.com or Contact No. 7020667287

drivers, with a high level of participation in global value chains. Strong government support has aided this sector's expansion, allowing it to carve out a distinct path among India's manufacturing sectors. The country's automobiles are distinctive in that they cater to the needs of low- and middle-income sectors of the population, making it stand out among other automobile-producing countries.²

By 2020, India is predicted to be the third-largest automobile market in terms of volume. According to the Society of Indian Automobile Manufacturers, the Indian automobile sector employs more than 30 million people directly or indirectly. The automobile business in India is booming thanks to technological advancements, technology transfer, and rising customer demand. The Indian automobile industry is well-positioned economically to fulfil rising domestic demand as well as export potential. By 2026, India's vehicle industry might earn up to \$300 billion in yearly income, up from \$80 billion in 2018, and contribute up to 12% of the country's GDP.³

The fast growth of urban India has resulted in a massive increase in the number of vehicles on the road. In India, the car population is increasing at a rate of about 5% per year, with approximately 80 million vehicles on the road now. Vehicle expansion is the backbone of economic progress, and the Indian automotive industry is no exception (the second-fastest growing in the world). Approximately 7-8 million vehicles are produced annually in the country now. This has doubled in certain cities during the last decade. In recent years, urbanization and the expansion of motor vehicles have had a significant impact on human life and the environment. Automobiles are a major cause of urban air pollution and are becoming an increasingly important source of anthropogenic carbon dioxide, carbon monoxide, Nitrogen Oxide, Photochemical Oxide, Oxides of Sulphur, particular matter and many other greenhouse gases. The transportation industry is a key contributor, accounting for nearly 90% of total emissions. Air pollution is a severe threat to human health in the environment.⁴

¹ Tom V Mathew, K.V Krishnarao, *Role of Transportation in Society*, NPTEL, May 7, 2007, <http://nptel.ac.in/courses/105101087/downloads/Lec-3.pdf>, (Visited on September 30, 2021).

² Smita Miglani, *The Growth of the Indian Automobile Industry: Analysis of the Roles of Government Policy and Other Enabling Factors*, September 2019, RESEARCHGATE, <https://www.researchgate.net/publication/335670642>, (Visited on September 30, 2021).

³ Nabeel A. Khan, "*Changing auto industry landscape: Will India miss or catch the bus?*" *ECONOMIC TIMES*, May 4, 2019, <https://auto.economictimes.indiatimes.com/news/industry/changing-auto-landscape-will-india-miss-or-catch-the-bus/64029513>, (Visited on March 4, 2021)

⁴ Chetna Khandar & Sharda Kosankar, A review of vehicular pollution in urban India and its effects on human health, Vol.5, Issue 3, *JOURNAL OF ADVANCED LABORATORY RESEARCH IN BIOLOGY*,

2. Impact of Vehicular Emission on Human Health

Vehicle emission is one of the most significant causes of air pollution. India has 22 cities in the top 30 polluted cities in the world. With a reading of 999 on the Air Quality Index, Delhi has officially become the world's most polluted city.⁵ India's transportation sector emits 261 tonnes of CO₂ and accounts for 60% of all greenhouse gas emissions from diverse operations. Vehicles contribute to about 70% of total air pollution in India's main cities.⁶

According to WHO-supported research, around 154,000 individuals died in India as a result of ambient fine particulate matter (PM_{2.5}) in 2005. (NTDPC, 2014). Children suffer from cardiovascular morbidity, asthma, and other respiratory illnesses as a result of traffic-related air pollution. According to World Bank research from 2013, outdoor air pollution accounts for 29% of all pollution in India, resulting in the early deaths of 109,000 individuals each year. The study shows an unsettling fact: the health cost of air pollution, which is caused by vehicle activity, was almost 3% of GDP in 2013.⁷

Carbon monoxide (CO) is an odourless, invisible gas produced when carbon-containing fuels are burned inefficiently, and it is a major health hazard. At high levels of exposure, CO is known to cause death. Because carbon monoxide has a 200-fold higher affinity for blood haemoglobin than oxygen, CO obstructs oxygen delivery from the blood into the tissues. Even at modest levels of exposure, the effects of this gas on humans have been demonstrated. Angina (chest pain) in persons with coronary artery disease is accelerated by low levels of exposure. Even short-term NO₂ exposures have been shown to cause a variety of respiratory symptoms in schoolchildren, with cough, runny nose, and sore throat being among the most prevalent. Higher susceptibility to respiratory infection increased airway resistance in asthmatics, and poorer pulmonary function have all been linked to nitrogen dioxide (NO₂).⁸ Particulate Matter (PM) is a broad term that refers to a variety of chemically and physically

July 2014, <https://media.neliti.com/media/publications/279076-a-review-of-vehicular-pollution-in-urban-0f3926d1.pdf>, (Visited on October 2, 2021).

⁵ James Griffiths, "22 of the top 30 most polluted cities in the world are in India", March 5, 2019, CNN, <https://edition.cnn.com/2019/03/04/health/most-polluted-cities-india-china-intl/index.html>, (visited on March 12, 2021).

⁶ Anshuman Tripathy, Bharat Shanker, Kabilan P, *Future of Indian Auto Industry: Choices and Challenges*, <https://www.iimb.ac.in/sites/default/files/201806/Future%20of%20Indian%20Auto%20Industry%20Choices%20and%20Challenges.pdf>, (Visited on March 14, 2021).

⁷ Vijayalakshmi S and Krishna Raj, Income and Vehicular Growth In India: A Time Series Econometric Analysis, <http://www.isec.ac.in/WP%20439%20-Vijayalakshmi%20S%20and%20Krishnaraj%20-%20Final.pdf>, (Visited on September 13, 2021).

⁸ *Supra* 4.

varied substances that exist as discrete particles (liquid droplets or solids) in a variety of sizes. Particles can be discharged directly into the atmosphere or produced from gaseous emissions like Sulphur dioxide or nitrogen oxides. Premature death, worsening respiratory and cardiovascular disease, changes in lung function and increased respiratory symptoms; changes in lung tissues and structure; and alterations in respiratory defence mechanisms are just a few of the primary health impacts related with PM.⁹

3. History of Motor Vehicle Emission Norms in India

Automobiles used to emit a large amount of specific matter and gases into the air, but there were fewer vehicles on the road at the time. However, as the number of vehicles grows, there is a need for emission standards to push automobile manufacturers to improve their technology to produce fewer emissions. In 1999, India's central government implemented the EURO Norm in response to a Supreme Court judgement. The EURO Norm allows for carbon dioxide emissions of 14.3-27.1 g/km and hydrocarbon emissions of 2.0 g/km.¹⁰

In Europe, Euro norms were followed; however, due to the differences in driving styles, average speeds, and driving restrictions between India and Europe, India began its emission standard known as the Bharat Stage Norm. The gap between the norms in Europe and India is negligible. India does not adhere to the standard uniformly throughout the country. Large metropolitan cities such as Mumbai, Delhi, Calcutta, and Chennai adopt emission standards first, with the rest of the country following suit after some time.

In the Year 2000, Commercial Vehicle follows India 2000 norm which was equivalent to Euro I Norm. It used to emit 8.68-12.40 g/km of carbon dioxide and 3.00-4.36 g/km of carbon dioxide and Nitrogen dioxide.¹¹ When the rest of the country was following the BS-II norm in 2005, cities like Delhi, Mumbai, Calcutta and Chennai followed the BS-II norm in 2001. BS-II norm permits 2.2 g/km CO and 0.5 g/km of HC+NOx. Bharat Stage norm III reduced emission of CO + NOx to 0.5 g/km. BS III norm was implemented in the country in

⁹ Ibrahim Aslam, The Pollutant Emissions From Diesel-Engine Vehicles And Exhaust After Treatment Systems, CLEAN TECHN ENVIRON POLICY, June 11, 2014, file:///C:/Users/ABHIJIT/Downloads/Re%C5%9Fito%C4%9Flu2015_Article_ThePollutantEmissionsFromDiese.pdf, (Visited on October 1, 2020).

¹⁰ Official website of the Central Pollution Control Board, <http://cpcb.nic.in/auto-fuel-quality/>, (Visited on February 12, 2021)

¹¹ *Ibid.*

a staggered manner in October 2010 while big cities followed the same norm in 2005 itself.¹²

Bharat Stage IV reduced the emission of CO to 1.0 g/km and 0.18 g/km of HC+NO_x. The BS-IV norms were implemented in major cities by April 2010 and the country follows that norm in 2014. India lags behind European and American countries in emission standards so with the direction of the Supreme Court India Leapfrog BSV Norm and followed BSVI norm implemented on April 1, 2020. The implementation of the BSVI norm put India in the elite club of countries with the best emission norm.

4. The Benefits of Electric Mobility in India

One of the most significant advantages of driving an electric vehicle is the positive impact it may have on our environment. Because pure electric vehicles do not have a tailpipe, they do not release any exhaust gases, reducing local air pollution, especially in packed cities. Electric automobiles are a viable option for municipalities seeking to improve air quality and improve the health and quality of life of their citizens.¹³

Electric automobiles are substantially quieter than gasoline and diesel vehicles, which means noise pollution may be greatly decreased, benefiting both residential and city-centre locations. Living near busy roadways may no longer be a drawback when it comes to relocating in the future, but rather an appealing feature for those who want to take advantage of transportation options. Because electric cars are so quiet, they are now obliged by law to carry an Acoustic Vehicle Alert System (AVAS), which emits an artificial sound to alert pedestrians while reversing or travelling at less than 12 mph (19 km/h).¹⁴

5. Initiatives Taken by Central Government for Promoting Electric Mobility in India

The Ministry of Road Transport and Highways established three committees to provide advice on the execution of different provisions of the Motor Vehicle Act and Central Motor Vehicle Rule, as well as problems concerning safety and pollution regulation. The following

¹² SC issues final deadline for Bharat Stage IV cars, the clock begins ticking for India's carmakers, ECONOMICS TIMES, October 24, 2018, <https://economictimes.indiatimes.com/news/politics-and-nation/supreme-court-says-only-euro-vi-compliant-vehicles-to-be-sold-from-april-2020/articleshow/66343274.cms>, (Visited on October 30, 2021).

¹³ Benefit of Electric Car, EDF, <https://www.edfenergy.com/electric-cars/benefits>, (Visited October 4, 2021).

¹⁴ *Ibid.*

committees have been formed:

1. Technical Standing Committee on Central Motor Vehicle Rules
2. The Standing Committee on Emissions Legislation Implementation.
3. The Automotive Industry Standing Committee is a group of people that work in the automotive industry.

The committees' major responsibilities include providing technical explanation and interpretation of the requirements of the Motor Vehicle Act 1988 and the Central Motor Vehicle Rule 1989, recommending worldwide standards, providing effective emission standards, and suggesting modifications to the Automobile Industry. This Ministry has authority to make changes in MVA 1988 and CMVR 1989 leading to the introduction of Electric vehicles on Indian roads. It can compel the automobile industry to make and sell electric or hybrid vehicles in India.¹⁵

In January 2013, India's Prime Minister unveiled the National Electric Mobility Mission Plane 2020. The goal of NEMMP 2020 was to raise the number of electric and hybrid vehicles on the road by 6-7 million by 2020, improve charging infrastructure, and stimulate hybrid and electric vehicle use. FAME India Scheme 2015 (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) was announced under NEMMP 2020 by the Ministry of Heavy Industry to promote eco-friendly transportation technologies in India. The National Automotive Board is the administrative entity in charge of carrying out the FAME India Scheme and disbursing funds to various organizations.¹⁶ The FAME Scheme's main goals are to give fiscal and monetary incentives to encourage the development of an electric or hybrid vehicle market as well as environmentally friendly transportation infrastructure. Technical development, demand creation, pilot projects, and pricing infrastructure are the scheme's main priority areas. Under the FAME India Scheme 2015, the Karnataka government receives a 60% subsidy for the purchase of 40 electric buses, 100 four-wheelers, and 500 three-wheelers. The program provides funding for the procurement and development of hybrid and electric technologies, such as in-house hybrid/electric motors and biofuel. It

¹⁵ Official Website Ministry of Road Transport and Highways, <https://morth.nic.in/road-transport>, (Visited on September 12, 2021).

¹⁶ Report of Department of Heavy Industry. Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles India, <https://dhi.nic.in/UserView/index?mid=2418> (Visited on 13 March 2021).

also exempts consumers from paying sales taxes on electric and hybrid vehicles.¹⁷ The Fame Scheme was launched for 2 years from April 1, 2015, to March 31, 2017, with an outlay of 795 Crore. The scheme was extended for 6 months till Sep. 30, 2017, and it was extended further till March 31, 2018.

The FAME India portal has been launched at <http://fame-india.gov.in/index.aspx> as part of the digitalization of initiatives to provide efficiency, transparency, and effective monitoring. This Web Portal has digitalized the entire scheme's process life cycle. This scheme currently has thirty Original Equipment Manufacturers (OEM) and one hundred and thirty-seven models of all types of cars registered. The total incentive amount paid out so far is around Rs 359 crores for 2.8 million automobiles. The performance of the dashboard is displayed state-by-state. It also includes the post-benefit of e-vehicles purchased through the Scheme. The total amount of fuel saved due to electrification is estimated to be over 50 million litres, with 52,700 litres saved per day. CO2 Reduction each day is approximately 1.3 lakh kilograms, and overall CO2 Reduction is approximately 129 million kilograms. For monitoring and management, built-in MIS reports are also accessible.¹⁸

Phase-II of the FAME Scheme has been authorized by the government with a budget of Rs 10,000 crore for three years beginning April 1, 2019. A total of 86 per cent of the budgetary support has been set aside for the Demand Incentive, to increase demand for electric vehicles (xEVs) throughout the country. This phase will support 7000 Electric Buses (e-bus), 5 lakh Electric Three Wheelers (e-3W), 55000 Electric Four-Wheeler Passenger Cars (including Strong Hybrid) (e-4W), and 10 lakh Electric Two-Wheelers to generate demand (e-2W).¹⁹ Vehicles that are equipped with exclusively advanced chemistry batteries, meet minimal technical criteria, and are registered as "Motor Vehicles" according to the CMVR are eligible for the scheme's incentive. The scheme will be applied primarily to cars used for public transportation or those registered for commercial reasons in the-3W, e-4W, and e-bus segments, with a greater emphasis on providing economical and environmentally friendly public transportation options for the masses. However, as a mass segment, privately owned

¹⁷ FAME India Phase II Scheme Approved by Cabinet - Implications, Impact and Industry Reactions, NEWS18, <https://www.news18.com/news/auto/fame-india-phase-ii-scheme-approved-by-cabinet-implications-impact-and-industry-reactions-2052425.html>, (Visited March 12, 2021).

¹⁸ FAME India Scheme Phase I, Ministry of Heavy Industries Official Site, https://fame2.heavyindustry.gov.in/content/english/15_1_FAMEI.aspx, (Visited on September 30, 2021).

¹⁹ FAME India Scheme Phase II, Ministry of Heavy Industries Official Site, https://fame2.heavyindustry.gov.in/content/english/15_1_FAMEI.aspx, (Visited on September 31, 2021).

registered e-2Ws are also covered by the scheme.²⁰

Mr Nitin Gadkari, Union Minister, introduced the first Draft of the Voluntary Vehicle Fleet Modernization Program (V-VMP) in May 2016, intending to reduce air pollution generated by outdated trash vehicles. However, the Ministry of Finance has raised concerns about the number of vehicles to be scrapped, as well as other issues such as the amount of excise duty exemptions and the establishment of vehicle scrapping infrastructure. The proposal requested that 15-year-old or BSIII-compliant vehicles be retired and replaced with new vehicles. The Ministry of Finance opposed the concept, claiming that providing exemptions or rebates to such a large number of vehicle owners (28 million) would be problematic.²¹ The complete process of depolluting, dismantling, segregation of material, safe disposal of non-reusable parts, and issue of a "Certificate of Vehicle Scrapping" to the registered owner of a motor vehicle is referred to as "scrapping."

Finance Minister Nirmala Sitharaman announced a new voluntary scrappage policy in her Union budget presentation for 2021, in which 20-year-old private cars and 15-year-old commercial vehicles will be scrapped after failing a fitness test at a recognized automated fitness centre in India. Once enforced, this strategy will phase out outdated cars that pollute the environment. With the aid of rebates and incentives, the centre will encourage customers to purchase new vehicles, allowing the car sector to expand even more. This policy could help bring an electric vehicle on Indian roads as Government is willing to provide much more rebates on the purchase of an electric vehicle.²²

The GST Council has cut the rate of GST on lithium-ion batteries, which are an important component of electric vehicles, from 28 per cent to 18 per cent. The GST rate cut would aid the local manufacture of lithium-ion batteries in India for a variety of uses.²³ The lithium-ion battery in an electric car cost roughly a third of the overall vehicle cost. The

²⁰ Ibid.

²¹ Voluntary Vehicle Fleet Modernization Programme, THE ECONOMIC TIMES, <https://economictimes.indiatimes.com/topic/Voluntary-Vehicle-Fleet-Modernisation-Programme>, (Visited on March 16, 2021).

²² *Union budget 2021: Vehicle Scrappage policy announced by Finance minister*, AUTOCARINDIA, February 1, 2021, <https://www.autocarindia.com/car-news/union-budget-2021-vehicle-scrappage-policy-announced-by-finance-minister-419810>, (Visited on February 12, 2021).

²³ Keep GST rate on lithium-ion battery same as electric vehicle, says SMEV, THE ECONOMIC TIMES, July 23, 2018, <https://energy.economictimes.indiatimes.com/news/power/keep-gst-rate-on-lithium-ion-battery-same-as-electric-vehicle-says-smev/65104508>, (Visited on March 12, 2021).

lower cost of an electric car's battery will lower the overall cost of the vehicle, making it more accessible to the general population. The GST on electric vehicles has been lowered from 28 per cent to 12 per cent. Even back then, India's electric car market was small. As a result, the manufacturing and acceptance of electric vehicles will be accelerated.²⁴

Separate efforts for battery swapping standards for Light Electric Vehicles and buses have been launched. There will be two sets of standards papers addressing the battery pack form factor, interoperable connection methods, communication between the battery management system (BMS) and the EV and charging station, and network management. Any EV can use a battery pack that meets these specifications. The rechargeable battery packs can be charged using AC or DC systems. The BIS is still working on developing Indian standards for EV roaming and grid management activities.

A large number of low-power charging stations in an EV charging network is preferable to a small number of high-power charging stations. For EVs, any parking location where the vehicle is stationary and has access to an EV charging station may be utilised to replenish the battery. This is often referred to as destination charging, as opposed to "on-the-go charging," which occurs when automobiles charge their batteries quickly to continue driving to their destinations. As a consequence, rather than establishing new sites for EV charging hubs, EV charging infrastructure should be installed in regions where vehicles are often parked. This charging infrastructure implementation plan promotes a distributed network of EV charging points for customers to connect to in a variety of places, such as homes, apartment complexes, business campuses, retail malls, metro and railway stations, bus terminals, and so on. A strategy for a distributed network offers several advantages for both consumers and operators.²⁵

6. Challenges for Promoting Electric Mobility in India

6.1 Electric Vehicles are Costly

Mostly due to what goes into them. An electric vehicle (EV) utilizes the same rechargeable lithium-ion batteries that power your laptop or smartphone; they're simply

GST Council slashes tax rates on electric vehicles, chargers, July 27, 2019, LIVEMINT, <https://www.livemint.com/>, (Visited on December 7, 2019).

²⁵ Handbook of Electric Vehicle Charging Infrastructure Implementation – Version 1 By Niti Ayog.

larger and can offer a lot more power. The cathode, one of the two electrodes that stores and releases a charge, is the most expensive component in each cell. This is due to the high cost of the materials used in cathodes to store more energy, such as cobalt, nickel, lithium, and manganese. Mined, processed, and transformed into high-purity chemical compounds are all required.²⁶ The battery pack of an electric vehicle accounts for about 40%-50% of its cost and this cost is the largest single factor in the price differential between electric vehicles (EVs) and internal combustion engine (ICE) vehicles.²⁷

The materials used to make EV batteries must maintain a specific level of quality, which results in a high cost. High-performance batteries are produced, but the cost rises as well. Lithium-ion (Li-ion) batteries are utilised in many electronic devices. Electric vehicles pose a serious threat. Child labour has been related to the extraction of cobalt, which is a crucial component of rechargeable Li-ion batteries. With laws and policies in place to promote ethical mining practices, the supply of the mineral will decrease while demand remains high, resulting in a further increase in cobalt prices. According to Li and Ouyang, lowering the cost of an electric vehicle's battery will lower consumers' overall spending and allow them to pay a higher battery charging fee. Even with government purchase subsidies, the price of EVs will remain high due to the high cost of batteries.²⁸

6.2 Inadequate Charging Infrastructure

According to a 2019 white paper by the World Economic Forum, the Indian automobile industry is one of the fastest-growing markets, even though it accounts for only 0.5% of the global EV market. According to a MarketWatch study, India would require about 4 lakh charging stations by 2026 to meet the demand for 20 lakh electric vehicles on the road. As of March 2021, the country had 1,800 charging stations. According to an independent analysis conducted by the CEEW Centre for Energy Finance, about 29 lakh public charging stations would be required by 2030 to enable EV adoption under the NITI Aayog's base case

²⁶ Why are electric cars expensive? The cost of making and buying an EV explained, HDAUTO, October 26, 2020, <https://auto.hindustantimes.com/auto/news/why-are-electric-cars-expensive-the-cost-of-making-and-buying-an-ev-explained-41603419957680.html>, (Visited on October 26, 2021).

²⁷ Shalini Priya, EV and ICE vehicle price gap to close soon as battery cost is to be about USD100/kWh by 2023: BNEF Report, ETAUTO, December 17, 2020, <https://auto.economictimes.indiatimes.com/news/auto-components/evs-to-close-in-on-ice-vehicles-in-few-years-as-battery-costs-expected-to-plummet-to-100/kwh-by-2023/79764942>, (Visited on October 12, 2021).

²⁸ ELECTRIC VEHICLE CHARGING INFRASTRUCTURE, RMI India, NITI AAYOG REPORT, PP. 17-18, https://rmi.org/wp-content/uploads/2020/07/EV-Readiness-Guide_Haryana_Lighthouse_Discom_Programme.pdf, (Visited on February 21, 2021).

objective. About 21 lakh (71%) of the chargers would be low-capacity chargers for two- and three-wheelers. The charging of electric vehicles at home is difficult as current urban planning doesn't support charging at home. Lots of cars are parked in driveways and unplanned parking lots don't support charging infrastructure.²⁹

6.3 The Technology of Electric Vehicle is Nascent and Underdeveloped

Charging an electric car is a difficulty since most of them take 8 to 9 hours to get fully charged, such as the eVerito, which takes 8.75 hours to charge up to 100%. E-vehicle batteries, on the other hand, are both expensive and ineffective. The improvement in electric battery technology is insufficient to persuade consumers to choose electric vehicles that rely on traditional fuels such as gasoline, petrol and diesel. The new electric automobiles are quite expensive, ranging from 18 lakhs to 22 lakhs. Even for a short run, those vehicles take 2-3 hours of charge. so, people need to wait till they get a new affordable electric vehicle effective enough to replace traditional vehicles in India.³⁰

6.4 Lack of EV Awareness

The majority of dealers and consumers are unaware of electric vehicles and their manufacturers' plans to develop them. Because of this lack of understanding, there have been fewer inquiries and sales of electric vehicles. Only 5% of total inquiries in the showrooms are for electric vehicles, yet 20% of those inquiries result in sales.³¹ The social component is especially important since it indirectly encourages customers to embrace EVs while also impacting consumer emotions and EV performance. Consumers' cost and benefit judgments, as well as their attitudes about new technology and societal effect, are all psychological factors. Range anxiety is a syndrome in which electric car owners are always afraid about being stranded with a depleted battery due to the vehicle's limited range. Consumer attitudes play an important influence in deciding whether or not to invest in electric automobiles.³²

²⁹ Chandan Bhavani et. al., *Electric Mobility Paradigm Shift: Capturing the Opportunities*, February 28, 2019, https://www.yesbank.in/pdf/electric_mobility_paradigm_shift, (Visited April 4, 2021).

³⁰ *The road ahead for electric cars in India*, FINANCIAL EXPRESS, January 24, 2021, <https://www.financialexpress.com/auto/industry/the-road-ahead-for-electric-cars-in-india-tesla-model3-modely-range-features/2177506/>, (Visited on March 11, 2021).

³¹ Subhash Dhar, A Study of Electric Mobility for City of Hyderabad, URBAN MOBILITY INDIA CONFERENCE & EXPO 2017, https://backend.orbit.dtu.dk/ws/portalfiles/portal/141857029/UMI_Electric_Mobility_Hyderabad_Final.pdf, (Visited on October 10, 2021).

³² Menonjyoti Kalita & Golam Imran Hussain, Opportunities and Challenges of Electric Vehicles in India, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT),

6.5 Dependence on Thermal Energy for Electricity

The major goal of encouraging electric vehicles is to minimize pollution; but, if we charge our EVs with electricity provided by coal-fired thermal reactors, which emit more pollution than allowed, the entire EV strategy would be rendered useless. Creating renewable energy to recharge our EV batteries, on the other hand, will eliminate air pollution from transportation.³³

6.6 Original Equipment Manufacturer needs huge investment with risk involve

The original Equipment Manufacturer to obtain electric mobility requires heavy investment in research and development. The shift to electric vehicles requires a huge understanding of future needs to avoid huge financial risks.³⁴

6.7 Inadequate Financing for Electric vehicle to Consumers and Manufacturers

Consumers and manufacturers face a lack of or insufficient financing for electric vehicles. Another source of worry is the availability of finance for both manufacturers and customers when it comes to EVs. Bansal, whose business designs and runs EV charging stations, believes that financial re-engineering is required for the sector to prosper. Personal buyers should expect to pay anywhere between Rs 12 lakh and Rs 20 lakh for a car. Financiers anticipate that the exorbitant prices will induce the consumer to fail, making it impossible for them to sell the linked automobile.³⁵

6.8 Issues with the supply chain infrastructure in India

In India, there is a chance to improve logistics and supply chain infrastructure, reducing inefficiencies, delays, and excessive costs. The country's integration of roads, railways, and ports may be improved, even more, resulting in an integrated logistics network. The presence of dedicated facilities and sophisticated infrastructure can potentially help the electric vehicle

file:///C:/Users/ABHIJIT/Downloads/opportunities-and-challenges-of-electric-vehicles-in-india-IJERTCONV9IS11033.pdf, (Visited on December 11, 2021).

³³ Anshuman Tripathi, Bharat Shakar and Kabilan p, FUTURE OF INDIAN AUTOMOBILE INDUSTRY: CHOICES AND CHALLENGES, Working Paper no. 566, p.16, March 2018.

³⁴ Chandan Bhavani, Himanshu Shekhar and Arnesh Sharma, Yes bank and Teri Report, ELECTRIC MOBILITY PARADISM SHIFT: CAPTURING THE OPPORTUNITIES, February 2013.

³⁵ Lijee Philip, Financing may not come easy for purchase of high-priced EVs, January 22, 2020, <https://economictimes.indiatimes.com/industry/auto/auto-news/financing-may-not-come-easy-for-purchase-of-high-priced-evs/articleshow/73514294.cms?from=mdr>, (Visited on April 22, 2020).

business expand and increase global competitiveness.³⁶

7. Conclusion

Road Transportation is the most accessible mode of transportation that allows a large section of society a right to movement. The growth of the Automobile industry and the need for people leads to an increase in the number of vehicles on roads. This increase in a vehicle on congested roads in India cause huge Air pollution from vehicular exhaust leading to hazardous respiratory diseases. To overcome this issue, the need was felt to bring electric vehicles on Indian roads. Attempts have been made by Central Government to encourage electric vehicle evolution in India. However, there are many issues the central Government is facing for promoting electric vehicle mobility in India. The issues like the high cost of an electric vehicle, which could potentially create demand for the second-hand vehicle market. This will only increase pollution further.

The person is not going to purchase the new electric vehicle until and unless he gets satisfied with the supportive infrastructure. Lack of an Electric charging station will not encourage a person to even think about purchasing an electric vehicle. In India, we have very a much smaller number of electric charging stations and the cost of an electric vehicle is very high causing hindrance in the adoption of this technology. Many automobiles manufacturers are scared to invest big in this technology as it is a nascent and evolving technology. Consumers only choose the finest and most inexpensive products, therefore any new improved electric car technology developed by any automotive manufacturer would result in a significant loss to other automobile manufacturers that have previously invested much in R&D. Similarly, charging vehicles is a major problem because India's primary source of energy is thermal energy from coal. The production of thermal energy necessitates the combustion of coal in a reactor. As a combustion product, coal-burning generates a large quantity of CO₂. As a result, operating an electric car on thermal energy renders the policy ineffective. As a result, the government must concentrate on renewable energy sources to power our electric automobiles in the future.

³⁶ National Auto Policy Draft Version 2