International Journal for Multidisciplinary Research (IJFMR)
E-ISSN : 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Opportunities and Scope for Electric Vehicles in India

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Abstract:
The vehicle industry has advanced due to the introduction of new technology. Alternatives to internal combustion engines include electric automobiles. Demand for electric vehicles is rising globally due to their lower CO2 emissions. The Indian government also intends to boost the production of electric vehicles in the automotive sector. This essay discusses the commercial prospects and difficulties for electric automobiles in India. This study discusses the economic, social, technological, and environmental variables influencing the electric car industry in India. The development of the infrastructure and batteries is influenced by the aforementioned economic and technological considerations.
Over the past ten years, the global market for electric vehicles has grown at an unparalleled rate. In this essay, we first go over the potential and reach of electric vehicles in India. We also talk about the many frameworks and policies that the Indian government has put in place. Then, we research different adoption case studies for electric vehicles from throughout the globe. Finally, we discuss how India could put these tactics into practise and profit from them both locally and nationally. The India Electric Vehicle Market has a market size of USD 5 billion in 2020 and is projected to grow at an astounding CAGR of over 44% to reach USD 47 billion by 2026. (2021 – 2026).
The market for electric cars (EVs) is expanding quickly on a global scale. The EV market has now experienced tremendous growth in India as well. As the Ministry of Heavy Industries and Public Enterprises implemented the FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) initiative in 2015, the market is expanding further. Sales of all electric vehicles reached 365,920 units in 2018 and are projected to increase by 36% CAGR through 2026. In India, the market for EV batteries is anticipated to reach US$ 520 million in 2018 and increase at a CAGR of 30% through 2026.Electric cars provide ways to be self-sufficient and independent of foreign energy sources. One of the biggest producers of crude oil in the world is India. India might undergo a significant transformation towards self-sustainability thanks to electric automobiles. Alternatives to reduce carbon dioxide gas include electric vehicles (EV). Air pollution is a serious issue in large cities like Delhi and Mumbai. One of the sources of air pollution is the carbon dioxide produced by cars.
Electric cars operate smoothly, emit little pollutants, and are highly efficient. According to research on the energy use and greenhouse gas emissions of plug-in hybrid electric vehicles in China, they consume 37.5% less energy and emit 35% fewer greenhouse gases than gasoline vehicles. Government financial policies to promote EV adoption have already been established, but for them to be effectively implemented, decision-makers must have a long-term perspective.
India's history of EV has been disappointing so far. Lack of loading infrastructure, inconsistent government support and early product failures have all led to the stagnant growth in recent years.

REVIEW OF LITERATURE:

The Indian auto industry is the fourth largest in the world and is expected to become the third largest in 2021.The Indian government wants to: It is anticipated that this number would reach 12%. By 2026, the Indian car sector (including component manufacturing) is anticipated to increase at a rate of 5.9% annually and reach INR 16.18–188 billion (251.4–282.8 billion US dollars), making it the nation's fastest-growing industry.However, the government has set a clear and ambitious goal of adopting 100% electric vehicles by 2030, and the country's leading think-tank, NITI Aayog, outlined the outlines of a long-term global mobility strategy.Due to the increasing number of Indians using buses, trains, and other forms of public transportation, The nation's primary means of transportation has been railroads. The Ministry of Statistics and Program Implementation's 2016 study, Key indicators of household expenditure on services and durable items, revealed that buses are the most often used mode of transportation in both urban and rural regions. Almost 66% of households in rural regions and 62% of households in urban areas spend the most money on buses, according to the survey. This has revolutionised the mobility sector and is a complete solution. Yet, in the long run, the country need an effective public transportation system, with cars that operate on electricity or other fuels, making this form of transportation efficient, convenient, pleasant, and safe, and encouraging people to use it. The Indian electric car sector is making considerable achievements in this direction.

Aiming to create seven million electric cars by 2020, the National Mission Plan for Electric Mobility (NEMMP) 2020 was introduced by the national government in 2013 to encourage the production of hybrid and electric vehicles in India. Rapid Adoption and Manufacture of Hybrid and Electric Vehicles in India, or FAME, is a government programme that has complemented this drive by offering demand-side incentives. Private automakers rose to the occasion and made investments in new R&D centres and factories for producing electric vehicles.

Also, the government has agreed to cover up to 60% of the expenses associated with research and development for the creation of low-cost local electric technologies, and major global companies in the automotive sector substantially invest in the research and development of energy technology. India's electric car market should undoubtedly undergo a transformation. The key difference will be how automakers provide distinctive, specialised services to various market segments while maintaining the required levels of quality, innovation, and standards. Some organisations will be propelled to the next level as a result, while others will collapse.

Fig.1 an electric vehicle car

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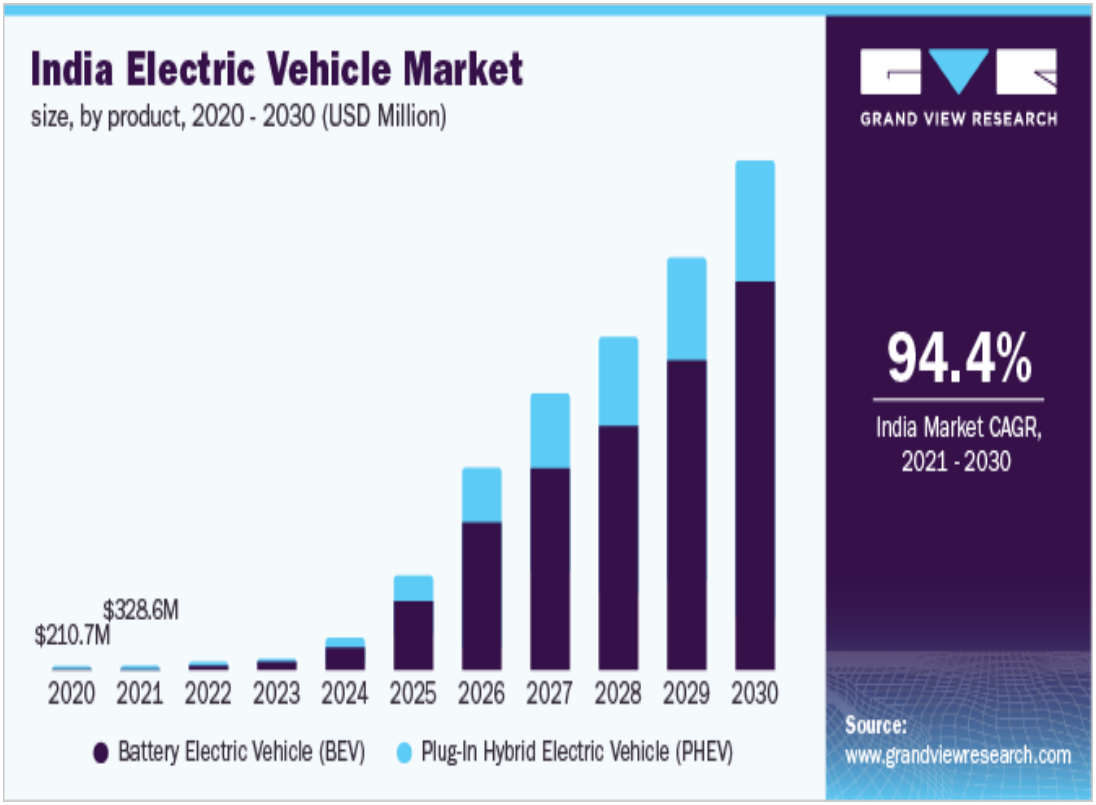

Fig.2 Increase in EV in Indian market

INDIA EV SCENARIO

- National Electric Mobility Mission Plan (NEMMP) 2020
- To deploy between 5 and 7 million electric vehicles in the country by 2020
- Stresses the importance of government incentives and coordination between industry and academia
- The target of 400,000 passenger battery electric cars (BEVs) by 2020 ~ avoiding 120 million barrels of oil and 4 million tons of CO2.
- Reduce vehicle emissions by 1.3% by 2020
- The total investment required of 20,000 to 23,000 notches (approximately 3 billion USD) Sales of electric vehicles fell substantially between 2012 and 2015 before beginning to increase. More than 90% of the two lakh electric cars in India are two-wheelers, which dominate the country's electric vehicle.

TECHNOLOGIES

This pattern has been influenced by a number of factors, including infrastructure, tactics, and early product failures. Notable among these:

• Government support has been uneven thus far, with reduced funding and delays in implementing EE policy;

• Charging facilities are essentially nonexistent;

• Charging station installations have recently started modestly thanks to recent efforts by organisations like Tata Power and NTPC;

• Local component manufacturers are few in number and heavily dependent on Chinese imports. Two-wheeled and four-wheeled vehicle prototypes both had difficulties.
For instance, Chinese electric mopeds with low power and poor endurance were the initial rivals in India's two-wheeled electric vehicles.

Electric Vehicle Charging Methods:

The effectiveness of a battery charger gauges how well the power electronics convert the mains AC power source to a controlled DC voltage across the battery terminals.
The battery charger's efficiency ranges from a low of 70 to a high of 90 percent based on the latest technologies that are now accessible on a global scale. The three primary charging techniques that are now supported by technology are:
1: An onboard charger and alternating current (normal charge) - With this charging technique, an on-board station charger is powered by an AC power source (typical 16 A plug, domestic load) via a connection to the vehicle.
The charger's job is to transform AC power into DC power and provide the generated current to the Li-ion battery.

Thus, it takes 6 to 8 hours (in the context of India) to fully charge an electronic vehicle using this way of loading, which may be done based on the monthly residential electricity usage. It is a little less expensive charging source than the quick charging technique.

2: DC power and external charger (quick charge) - For this type of load, a fast charger or an external charger is used to convert the network's alternating current directly into direct current for usage by the battery.

3: The wireless charging technology- transmits electricity through connected systems' magnetic fields without using any physical wires. There are three different kinds of wireless charging technologies: those that deliver electricity utilising radio frequency waves, electromagnetic resonance, or electromagnetic induction.

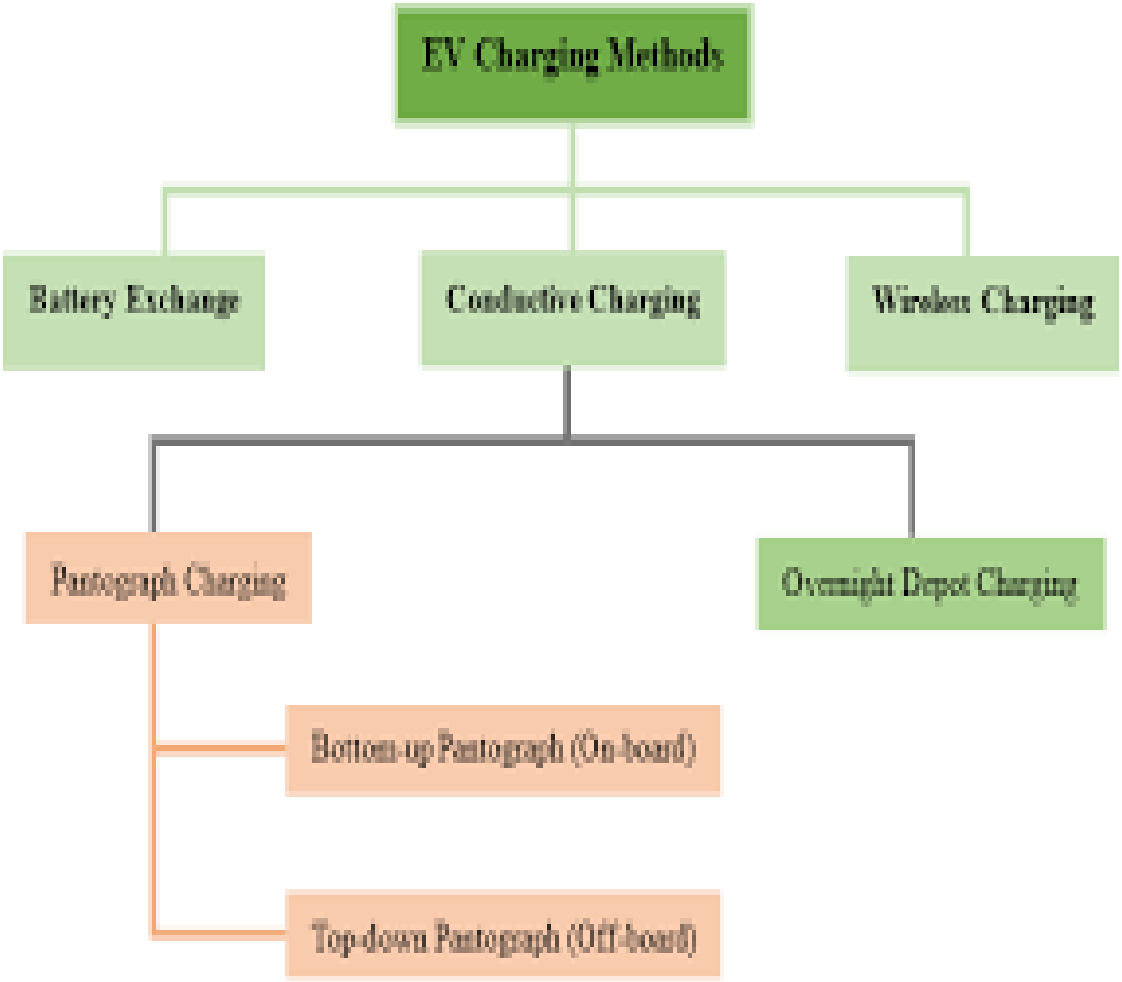

Fig.4 Comparison between electric vehicles and I.C engine vehicles

VEHICLE

Feature	Battery Electric vehicles	I.C. Engine vehicles
Prime mover	Electric motor	I.C. engine
Powered by	Charged battery, ultra capacitors	Diesel, Petrol
Self weight	High due to battery bank	Low as compared to EV
Power Transmission	Both mechanical as well as electrical	Mechanical only
Braking system	Regenerative braking	Friction braking
Efficiency	High	Low
Eco friendly	Yes	No
Initial cost	High	Average
Running cost	Low	Very high

Challenges for the transition to Electric Vehicles:
The following issues must be resolved if we're to transition to electric vehicles by 2030 as the Modi government has pledged.

INFRASTRUCTURE FOR CHARGING E-VEHICLES:

In the present situation, if a person needs to travel a long distance because his electric vehicle's battery is low. His options for recharging are quite limited. In India, there are 70,000 gas stations spread throughout around 718 districts. There is a gas station within 5 to 6 kilometres. Yet, there are barely 300 EV charging

points in existence. A driver of an electric car would experience a challenging voyage in such a situation. The government is acting to address this issue, although its progress is fairly slow.

HIGHER COST:
Let's imagine a person wishes to get a tata nexon automobile in India as their medium car. The vehicle's on-road cost in the fuel version is between 10 and 12 lakhs. On the other hand, the entry-level Tesla electric vehicle costs 60 lakhs in India. India is a price-sensitive market, therefore switching to electric vehicles must be feasible.

LACK OF TECHNOLOGY:
India has a significant technological issue. The gasoline tank capacity of a standard Maruti Suzuki Swift Petrol automobile is 40 litres. The automobile can travel up to 600 kilometres at 15 km per litre. In the same way, will a fully charged car travel the same distance in terms of technology? Ather is a well-known electric vehicle business in India. According to the business, it can travel up to 120 kilometres on Indian highways after a full charge.

IMPORT OF EV COMPONENTS & MATERIALS:
India must import the majority of the components for electric vehicles due to a lack of technology. An EV's battery is a highly important component. At the moment, Lithium-Ion technology powers every battery. Once more, India's lithium reserves are in doubt. India must thus import the majority of its battery and electric vehicle (EV) electrical components from China, resulting in a strategic dependency on that country.

Lack of a Skilled Workforce:
In terms of electric cars, India has a personnel shortage. Because the technology is new and the world's EV technology is evolving, prominent educational institutions are unable to adapt.

What steps have been taken for an EV transition?
National Electric Mobility Mission Plan 2013: The government already has a strategy in place and has stated that it would begin operating in India. Electric scooter production has already begun in India by numerous businesses. Uttar Pradesh, Madhya Pradesh, and Gujarat are the Indian states that are actively engaged in e-vehicle research and development. This study will assist India in reducing its reliance on Chinese Lithium-Ion batteries.

FAME INDIA:
: In the year 2015, Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India was first started. Its second phase has already been started. With this, the government is focusing on four major aspects of EV, such as-

Technology Development
Demand Creation
Charging Infrastructure

INDIA'S STRATEGY AND POLICY FRAMEWORK:

- 3 WHEELS: The government already has a strategy in place and has stated that it would begin operating in India. Electric scooter production has already begun in India by many businesses. Uttar Pradesh, Madhya Pradesh, and Gujarat are the Indian states that are actively engaged in e-vehicle research and development. This study will assist India in reducing its reliance on Chinese Lithium-Ion batteries.

- BUSES: The government permits the exchange of 50-kilometer bus batteries. One of the biggest difficulties in replacing batteries for buses will be the effort needed to charge the batteries.

- Public Chargers: The implementation of the Public Call Office Model (PCO)/Standard Toll Numbering (STD) for battery exchange would provide commercial involvement in the acquisition of batteries and the management of public battery exchange stations. To achieve the size and penetration needed in load infrastructure, this paradigm will be essential. The usage of Bharat AC-001 and DC-001 chargers for 2- and 4- or 4-wheel vehicles is subject to regulations laid forth by the government.

- E-Rickshaw: The government of India announced the following schemes:

1) ***Deen-Dayal scheme***, which would aid in financing and the purchase of electric rickshaws across the nation, was launched in June 2014.

2***) The Motor Vehicle (Amendment) Law:*** which recognised electric rickshaws powered by batteries as a legitimate mode of commercial transportation, was adopted in March 2015.

3) The number of battery-powered electric rickshaws in Delhi increased from 4,000 in 2010 to more than 1,000,000 in 2014, and they are now a crucial component of the state's transportation ecosystem. Battery operated 3-wheeled vehicles with a maximum power of 4,000 watts. 4 passengers, luggage of 50 kg, and a single journey of less than 25 km.

CASE STUDY:

NORWAY: In Norway, electric cars (EVs) are given far greater latitude. This offers a number of tax breaks as well as other driving rights, such the use of city buses and lanes, a waiver of parking costs in downtown areas, and sometimes free battery charging. Sales of electric cars have surged dramatically in recent years as a result of this legislation. Although there were just a few hundred electric vehicles on Norwegian roads up until 2005, they made up 1.4% of all new conventional car sales in 2011. From 2011 to 2013, this ratio increased five times, to 5.5%, while the number of electric cars on the road nearly doubled. During the course of the last 10 to 15 years, the liberal Norwegian policy on electric cars has been gradually implemented and is now a crucial component of the so-called "Klimaforliket" climate accord between the parties to the Norwegian Parliament. The Norwegian Ministry of Finance and the Norwegian Ministry of Transport were primarily responsible for developing the legislation and regulations that form the basis of the policy. The Norwegian policy on electric cars is comprised of laws, rules, and

regulations as well as the policy measures put in place in some of the largest cities. Essentially, it comprises of a number of tax deductions together with certain driving and financial rights for owners of electric vehicles. He is now aware of the following things:

Parking in public lots is free. Electric vehicles may use most toll highways and a number of ferry lines without paying. Electric vehicles are permitted to use bus lanes and collective lanes. Electric vehicles are exempt from VAT and other taxes on automobile purchases and sales.

• The yearly tax on motor vehicles/road tax is also cheaper for electric vehicles, and the tax on corporate automobiles is reduced by 50%.

• A constantly expanding number of publicly subsidised charging stations offer free battery charging.

CONCLUSION:

Our analysis leads us to three main conclusions about the future of EV adoption in India In the upcoming years, public procurement is anticipated to play a significant role in driving growth through the acquisition of three- and four-wheeled vehicles for public transportation as well as buses for government offices. It is also anticipated that investments made by certain operators of food delivery services, together with fleet operators like Ola and Uber, will accelerate the early rise of two- and four-wheeled electric cars. Yet, due to declining battery prices and increased battery availability, the adoption of private four-wheelers and two-wheelers may potentially reach a turning point in the next five to six years. charging technology. The clientele should be divided into the following categories, with the following variables serving as the criteria for each:

4-wheelers: Public markets and fleet operators will be the main drivers of this. Up until 2023, when there may be a turning point for adoption by low-mileage private owners, public contracts should be 30,000 cars. To accommodate rising demand from the private sector and government contracts, Mahindra and Tata will continue to expand their footprint. In the upcoming years, multinationals like Nissan, Hyundai, and Honda are also anticipated

➢ 2 wheelers: This market sector will be privately owned, subsidised, and characterised by a shift from lead-acid to lithium-ion batteries as well as from low-speed to high-speed cars. For instance, all significant equipment producers, including Hero, Ampere, TVS, and Lohia, have two extremely potent electric wheels. Several firms, such Ather, Tork, and Emflux, that are specialising in higher-performing vehicles are also emerging and will start selling in 2018. Yet, the majority of these producers will keep importing electrical parts.

➢ 3 wheelers: Electric rickshaws are undoubtedly the category with the quickest rate of growth; producers like Mahindra, Kinetic Green, and Autolite have introduced models or will launch models in 2018, strengthening the application of standards and registration and resulting in the development of a strong driver market. The entry of OEMs like Bajaj and TVS is also anticipated to boost sales of electronic cars, but they will still make up a relatively tiny portion of the overall market for three-wheeled electric vehicles. Early adoption is anticipated to be significantly influenced by the aggregation of demand through public procurement and battery exchange.

➢ Buses: Leading Manufacturers will keep testing in the upcoming years, including Ashok Leyland,

Tata, and BYD. The battery swap will save startup costs and boost sales to EESL and STUs.Nevertheless, compared to 3-wheeled vehicles, the rise in load could be slower. An electric car boom in India is unavoidable in the long term due to the country's inherent economic and social attraction. Initial costs will drop dramatically as lithium-ion battery prices keep falling. EVs will become more efficient and more economical thanks to advances in battery technology. Demand relating to the aforementioned will probably determine private infrastructure investment. Manufacturers of electric vehicles will expand their domestic purchasing in order to maintain cost competitiveness and enable quicker ramp-up.

➢ After taking into account a certain level of batteries, India might, if the government's 2030 objectives are realised, save 8 lakh crore rupees (a 20% saving over a BAU scenario) on the importation of gasoline and diesel for the industry throughout the time taken into consideration. Hence, moving to electric cars won't always lessen our need on imports. The effects on the ecosystem, however, will be profound.

Two scenarios might occur: Business as Usual (BAU), in which the automobile sector relies on fossil fuels, and scenario two, in which the nation meets its 2030 EV ambitions.

Suppose India achieves its goals for 2030:

At least 3,500 GWh of batteries, with a total cost of US $ 300 billion, or over 20 Cr crore, will be needed to meet the government's objectives by 2030. If they assemble packaging in the local market, Indian producers might capture 25 to 40 percent of the industry's value. Hence, the overall cost of cell imports will be 12–15 lakh INR. An opportunity to save 8 INR lakh Cr will result from lowering gasoline and diesel imports to 17 INR lakh Cr. Electric vehicles are an unavoidable change that is altering how we move across the planet.

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