INDIA'S PUSH TOWARDS ELECTRIC VEHICLES AND ITS TRANSITION PHASE IN THE TRANSPORTATION REGIME

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ABSTRACT

The importance of transportation system depends on various factors social, economic and political conditions of the economy. It depends on two types of methodologies they are mainly human and physical capital of an economy. Human capital refers to human being's levels of income and incurred education whereas physical capital refers to needs of human utilizes such as transport, communications, electricity etc. In country like India which mainly focuses on boosting economic growth at all levels. The development mainly comes forth from tertiary and secondary levels of economy they could be none other than the industrial and services areas of the economic structure. These economic developments and activities take place mainly in the urban areas of the country so there is a need to protect the transportation vehicle and industrial emissions. Due to these situations only many countries including India have adopted strategies to move towards energy efficient electric vehicles regime. The use of electric vehicles would provide a transition phase in the country like India as it would minimize the injury or harm that the transportation would cause to the environment and health of the people. The aim of the paper is to bring about the India's electric vehicle strategy for implementation and its method of initiation in the economy. It also deals with the various government schemes adopted by India in their push towards electric vehicle manufacture. The paper tries to bring out the appraisal policies of government in implementing electric vehicles in the respective states and union territories to analyze and address the needs of the state in implementing the regime of electric vehicles. The paper also brings about the various challenges and problems faced in bringing about the phase of energy transition in the transportation areas it also deals with the lack of awareness of people about the electric vehicles and its lack in the selling and manufacture of electric vehicles due to its system in gap of financial unavailability.

Keywords: transportation, electric vehicle, transition, economic, development, physical capital.

INTRODUCTION:

The usage of fossil fuels over the years would create a negative effect on change of climatic conditions because the emissions from the vehicle would release carbon dioxide, carbon monoxide, nitrogen dioxide gases as well as particulate matters which have major impact in the contribution of green gas emissions into the atmosphere. There are many negative impacts with regard to use of fossil fuels that are mainly required in meeting the energy needs of human activities which is done through natural resource depletion and fluctuations that are recurring often in crude oil market. In order to mitigate the hurdles, the various countries have switched on towards clean ways of technology like switching over to electric vehicles in place of fuel-based vehicles in order to promote clean energy transition in urban transportation in the countries. India is one among them in which the electric vehicle is been increasingly developing and its share in market is increasing largely. The electric vehicle would reduce the oil imports by 60 billion dollars by 2030. The electric vehicle manufactures have developed vehicle that would run on fuel as well as electricity.

AIM:

The paper aims to bring out the electric vehicle in India as the country stands on the urge of exhausting and available resources that are producing electricity. And how come the renewable energy sources are being implemented in the country. The paper also tries to bring out the electric vehicle schemes and implementation policies in India and the challenges been encountered in implementation of electric vehicle in India. It also brings out the present environment conditions in bringing about transition in urban transportation regime.

Literature Review:

The research conducted on electric vehicle by Biswas and Biswas, 1999 reveal that the developing country like India would be benefitted more than the developed country as there would be decreased dependence on the import of fossil fuels for their transportation, the electric vehicle market continues to grow taking into aspect of the consumer expectations, their choice of benefits in adopting these vehicles. There had been a research conducted in 2015 it had been found that past and previous experience of customers had identified factors that are taken into consideration while purchasing EV. The research conducted by Tahmasseby was with regard to vehicle restraint system that are taken into consideration while planning development of

highway roads to boost the transportation in a proper and safer way.

Methodology:

The paper tries to bring out the factors which influence adoption of electric vehicle by consumers in India. The method used in the research of this paper is the use of doctrinal method of research.

It is done through use of secondary available resources like books, articles, magazines, etc.

Research Question:

1. How are the clean energy promotion being promoted in transportation regime all over the world?

2. What are the schemes through which electric vehicle is implemented in India?

3. What led to the electric vehicle push in country of India?

4. What are the challenges faced by India in its electric vehicle implementation policy?

Background of the automobile industry:

The automobile industry is at the phase of transformation which mainly focusses on highlighting concerns of conservation of environment. The various advancements in technology of power electrifying plants, its digital and newer advancements in model of business promotions have led to the development of electric vehicle transformation in the automobile industry[1]. It has been observed that by 2026 the electric vehicle industry in India would emerge as the top producing country in the world of economies. Its larger development is due to different types of technology available and it is been used by high and semi-skilled workers in promotion of electric vehicle industry. Various types of Indian companies like Tata motors, Mahindra, Bajaj Auto are in the phase of transformation of their automobile industry into electric vehicle. These aspects have led to many different types of alliances with different types of industry. For example, TVS have collaborated with Suzuki, Jaguar Land Rover have

[1] Sriram K.V, Lidwin Kenneth Michael, Sumukh S. Hungund & Mabelle Fernandes, Claudio Cameselle (Reviewing editor) (2022) Factors influencing adoption of electric vehicles- A case in India, Cogent Engineering, 9:1, DOI: https://doi.org/10. 1080/23311916.2022.2085375

collaborated with Tata Motors and KTM have joined with Bajaj Auto etc. Different types of countries have developed long year term policy with regard to their countries ecological balance and developmental conditions. The various countries development is taken into account of its environmental conditions, their sustainable developmental goals and strategies with regard to their country per capita income flows and returns.

Types of electric vehicles in the market:

The three different types of electric vehicle are electric vehicle in battery form, then the plug-in type of electric vehicle which is termed as hybrid form and the last one would be electric vehicle which runs on electricity.

Electric vehicle in battery format:

These types of vehicles are purely based on power of the electric motor available in the vehicles. The power is drawn by the battery from the electric grid. The battery used in these vehicles are mostly lithium-ion batteries. These batteries posses' power from 20kilo watt per hour to 50 kilo watt per hour maximum to provide higher performance vehicle capacity.

Hybrid form of electric vehicle:

These types of vehicles charge their batteries through system of internal combustion engine which would use a method of regenerative brake system and they do not charge from the external available source of electric power.

Plug in form of electric vehicle in hybrid form:

These vehicles have combination of both internal combustion engine as well as lithium battery capacity of 40 kilo watt per hour. The vehicles can derive power directly from electric grid or from internal combustion engine. The electric vehicle can alone run at faster speed for a shorter time with the help of electric power. The use of internal combustion engine comes into power is when the battery power comes to its maximum range limits.

Autonomous electric vehicle:

There is a huge investment available and there is rise in this type of vehicle. Research reveals

that there had been tremendous effect with regard to cost, size and utility in the market. There are many benefits and disadvantages with regard to its implementations in developing countries. The various types of regulatory actions reveal how much would the autonomous vehicle make an impact on the planet earth.

India's Push on electric vehicle:

India is one among the top three car manufacturers in the world in the year 2022. With more than 50 crore population is dependent on the transportation[2]. The government has taken initiative to push India towards the adoption of electric vehicle generation to reduce the dependence on the use of fossil fuels in the conservation of environment. The strategy has been adopted by various countries to support and promote the campaign on electric vehicle @ 30. This means to achieve and promote electric vehicle sales by 30% by the year 2030. As a push to this initiative India has made investment through memorandum of understanding with Australia regarding partnership on critical investments on minerals. The use of critical minerals are mainly copper, lithium, nickel and cobalt. They are very important in production of electric vehicle , green technology products, various types of smartphones as well as electronic gadgets. Even they are useful in production of military parts and equipment technology. Prime minister Narendra Modi had addressed five concerns on climate change it is known as Panchamitra which was brought forth on 2021 at Conference of Parties United Nations Climate Change Conference.

The conference addressed that there has to be

1. Increase in usage of non-fossil fuels energy level capacity of more than 500 gigawatts by the year of 2030.

2. Then 50% energy capacity of India should be met through renewable source of energy.

3. There has to be decrease in carbon emissions by more than 1 billion capacity by the year of 2030.

[2] AUTO/ PRIYANKA DEO/ TIMESOFINDIA.COM/JAN 19, 2023, 20:57 IST, https://timesofindia.indiatimes.com/auto/news/rise-of-electric-vehicle-in-India-is-it-the-future-oftransportation/articleshow/97142406.cms

4. The level of intensity of carbon should be reduced to 45% by 2030.

5. There has to be net zero emissions by the year of 2070.

Promotion of electric vehicle in transportation regime:

The country of China had followed a major type of policy in 2009 which aims to promote and achieve electric vehicle generation[3] in the public transits services of the country which may be in format of electric vehicle subsidy purchases as well as through infrastructure investments. This policy was the first one which led to the electric vehicle generation in the public sector urban transportation instead of private sector. The results from this policy reveals there has been effects in lowering the level of emissions[4] by 17% on an average. The path of electrification of public transportation system had begun in India. In India on an average about 1.72 million buses are brought into the market in that about more than 50% vehicle run between various cities. While there is a push by the own board vehicles towards electric vehicle the government also is pushing towards electric vehicle in public urban transportation system in both personal as well as for commercial use. In a strategy to decrease the carbon emissions the heavy industry ministry had taken step to promote electric vehicle in urban transportation in eleven cities in India. The Centre had been also willing to promote[5] electric vehicles in 44 cities of more than 21 states like Bangalore, Indore, Ahmedabad, Kolkata, Jaipur etc. the electric vehicle introduction has been brought forth in all sectors of automobile industry like buses, two wheelers, three as well as fourwheeler autorickshaws and taxi cabs. The democratic alliance government needed electric vehicle to be part of India's road transportation system by the year of 2030 as a goal to reduce carbon emissions and reduce green house gas emissions in order to tackle the climate change problems. It also focuses to reduce dependence on oil imports from foreign countries in order to promote the country global domestic product.

Overview on the initiatives taken by Government:

The transition of conventional vehicle to electric vehicle was mainly adopted to reduce carbon emissions in order to limit the global warming, air pollution which leads to health problems. The Department of Heavy Industry which comes under the Ministry of heavy

[3] Exploring spatiotemporal pattern and agglomeration of road CO2 emissions in Guangdong, China,2023, Science of the Total Environment.
[4] https://doi.org/10.1016/j.tranpol.2022.06.002
[5] Centre approves electric vehicle public transportation for 11 cities, 28 Dec 2017, https://www.livemint.com

industries brought the idea of manufacturing hybrid and electric vehicles (EV) in India by launching the National Mission for Electric Mobility (NMEM) in the year 2012[6]. A board was also setup under this mission known as National board for Electric Mobility to provide recommendations to the matters related to electric vehicle. A scheme was introduced by the government under the NMEM known as Faster Adoption and Manufacturing of Electric vehicle (FAME) in 2015 with the aim to encourage electric transportation. Their target was to achieve 30% of vehicles should be electric vehicles by the year 2030.

The FAME – I commenced on April 1, 2015 and it was extended till 31st March 2019. This mainly concentrated on promoting the adoption of electric vehicles by creating demand in the market by reducing the cost of EVs, by promoting research and development in the EV sector, allocating funds for setting up more charging stations and investing in the EV sector by spreading awareness about the usage of EVs. After the completion of phase – I while assessing the result of phase – I, they found that there is a requirement for increasing the demand through promoting it which eventually led to introducing of phase – II on 1st April, 2019 - 31st march, 2024. In the FAME – II they focused on enhancing the EV sector and support the 2-wheeler, 3 wheelers, light commercial vehicles and electric buses. The FAME – II was about enhancing the demand for EVs by reducing its price and sell it to the customers. Those original equipment manufacturers (OEMs) were paid back by the way of incentives under FAME – II. The incentives under FAME – II will be provided only to those vehicles that are fitted with advanced batteries and registered according to the Central Motor Vehicle Rules, 1989. It also provided incentives for the establishment of charging infrastructure as per the "Charging Infrastructure for Electrical Vehicles- Guidelines and Standards, 2018", as revised and replaced by the "Revised Consolidated Guidelines and Standards" of January 14, 2022 issued by the Ministry of Power guidelines[7]. In phase – II there was a plan called National Electric Mobility Mission Plan (NEMMP), 2020 which is a roadmap for rapid adoption of EVs in India.

The NEMMP, 2020 came up with the following proposals to achieve their goal. They are:

[6] Rumi Aijaz, Electric Vehicles in India: filling the gaps in awareness and policy, 18th October, 2022, orfonline, Observer Research Foundation, https://www.orfonline.org/research/electric-vehicles-in-india-filling-the-gaps-inawareness-and-policy/

[7] Rachika Agarwal Sahay, Siddhant Satapathy, Aarvi Singh and Sakshi Sharma, Electric vehicle industry in India – a regulatory overview, 25th November, 2022, legal500, Argus partners, https://www.legal500.com/developments/thought-leadership/electric-vehicle-industry-in-india-a-regulatoryoverview/

- By providing tax exemptions to the buyers of the other vehicles and creating a demand by making the electric vehicle as a mandatory requirement for government fleet.

- Enhancing the electric vehicle ecosystem by providing tax exemptions to the domestic manufacturers, so it will minimize the dependence on imported oil and electric vehicle parts.

- Encourage and provide maximum support to the EV research and development for the technology advancement.

- Setting up more EV charging stations in public places, workplaces, homes in connection with private sector.

- To create awareness among the people about the benefits of using EV transportation.

Ministry of power guidelines:

The main objective behind framing the guidelines was to enable faster adoption of EV by charging affordable tariffs from charging station operators. This would result in creating employment opportunities[8], support infrastructure and promote energy security reduction. According to the guidelines it mandates Public Charging Stations (PCS) to comply with the provisions Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources) (Amendment) Regulations, 2019 and Central Electricity Authority (Measures relating to Safety and Electric Supply) (Amendment) Regulations, 2019. It is pertinent to note that these guidelines mainly facilitate any individual or entity is free to setup PCS which is inclusive of providing specific conditions as well as incentives for PCS. Each EV supply equipment must be type tested on a regular basis either by an agency/ lab accredited by National Accreditation Board for Testing and Calibration Laboratories by exempting private charging points for self-use for above mentioned requirement.

The guidelines provide an incentive in the form of land promotional rate provisions. The revenue sharing approach has been adopted on the basis of land available with the government public entities for PCS installation at a rate of Rs. 1/kWh. A revenue sharing agreement has

[8] Ibid 7

entered between land owning agency and charge operator on the basis of format provided under the guidelines.

Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources) (Amendment) Regulations, 2019:

By an amendment, the definition of "charging point"[9] and "charging station"[10] were added under Regulation 2.

Central Electricity Authority (Measures relating to Safety and Electric Supply) (Amendment) Regulations, 2019:

Through the amendment the definition of "electric vehicle"[11], "electric vehicle supply equipment"[12], "socket - outlet"[13] and "supply lead"[14] were added under regulation 2, in sub – regulation (1). It further stated safety provisions for the electric vehicle charging stations.

Model Building By-laws, 2016 for Electric Vehicle charging infrastructure:

The Ministry of Housing and Urban Affairs made few amendments in the by-laws through the town and country planning organisation, by adding provisions with regard to setting up more Public Charging stations (PCS) in the urban areas, bus depots for charging/ refuelling. They also added provisions for installing charging infrastructure in the building premises.

Central Motor Vehicle Rules, 1989:

In the year 2018, the government had mandated that every EVs should have green coloured license plate with yellow letters for commercial EVs and white letters for private EVs. They also made amendments in 2020 by stating that every EV must have tyre repair kit and Tyre Pressure Monitoring System (TPMS) and can exclude the additional tyre where extra space will be available to fit in larger battery. The Ministry of Road Transport and Highway has stated

[9] Refer clause (da) of Regulation 2.
[10] Refer clause (db) of Regulation 2.
[11] Refer clause (sb) of Regulation 2 (1).
[12] Refer clause (sc) of regulation 2 (1).
[13] Refer clause (zwb) of Regulation 2 (1).
[14] Refer clause (zxa) of Regulation 2 (1).

that the EVs can be sold and registered without batteries in order to sell it at a lower cost. But it should receive approval from the testing agency by issuing type approval certificate.

Charging Infrastructure for electric vehicles – the revised consolidated Guidelines and Standards, 2022:

These guidelines have included provisions for captive charging station and battery swapping station. Captive charging station means charging station exclusively for the EV transportation owned or which is under the control of the owner of charging station. It cannot be used for commercial purpose of charging another vehicle on paid basis. Battery swapping station means a station where any EV can get a charged battery by swapping their discharged or partially charged battery. It has authorised the "Bureau of Energy Efficiency" as the Central Nodal Agency to bring in the EV Public charging Infrastructure. The State DISCOM shall be the nodal agency for the State Government[15]. Every state in India has given its own policies on electric vehicle. The said guidelines have stipulated certain conditions for the charging infrastructure to follow such as to arrange enough space for the EV to enter, exit and to charge, should provide charging options according to their speeds, to establish kiosk for additional charger, etc.

Production Linked Incentive Scheme (PLI):

The PLI Scheme has launched in the automotive sector for the promotion of electric transportation and also for Advanced Chemistry Cell (ACC) battery. This was notified on 23rd September, 2021. The aim of this PLI Scheme is to encourage domestic manufacturing of cutting-edge automotive technology. The PLI Scheme aims to offer incentives to battery electric vehicles under its Champion OEM (Original Equipment Manufacturer) Incentive Scheme[16]. This scheme encourages the technological advancement and reduces the usage of fossil fuels in the economy.

PLI Scheme – ACC Battery Storage: the ACC battery is basically about converting the electric energy into chemical energy or electrochemical energy as and when required. It can also store it as chemical energy. This can be used not only in the electric vehicles but also in other

[15] Electric vehicle in India: Policy and challenges, 23rd February, 2022, Indian Law Offices LLP, indianlawoffices, https://www.indialawoffices.com/legal-articles/electric-vehicle-in-india-policy-and-challenges
[16] Ibid 7

electronic grids when it is needed. It was mainly to setup 50-gigawatt hour (GWh) manufacturing capacity in the batteries in order to enhance the EV sector by creating demand and also to reduce the pollution in the country. The incentive will be awarded over a time of five years. It will be paid out based on deals, energy proficiency, battery life cycle, and restriction levels.

Other measures:

Apart from the FAME and PLI Scheme, the government have implemented few policies to promote the usage of electric transportation.

The GST rates imposed for EVs have decreased from 12% to 5% and for charging infrastructure it has reduced from 18% to 5%. Consumers of EVs i.e., 2Ws, 3Ws and 4Ws are exempted from paying road tax and also the vehicle registration fee. To enhance the Research and Development in EV sector, the department of Science and Technology have established the Technology Platform for Electric Mobility (TPEM). In addition to this it also focuses on technological advancement in EVs. The concept of battery swapping was introduced in the guidelines which was later explained in detail by NITI Aayog in draft policy for battery swapping for 2Ws and 3ws. The Ministry of Power made a clarification with regard to Electricity Act, 2003 that the charging station does not require any license[17] for charging the batteries of EVs as it does not perform any such functions as mentioned in the above-mentioned act.

Challenges in EV's sector:

The number of people shifting from using conventional vehicle to electric vehicle is very minimum. The aim of achieving 30% of EV penetration in India is very difficult because the people are not aware of the benefits of usage of EV. The reasons for slower usage of EV in India are listed below. Such as,

Price: When compared to EV, conventional vehicle is available in the most affordable cost. The EVs are generally expensive because of the materials e.g., battery, technology involved in it. The main concern for a consumer to buy EV battery which mostly lasts only for a period of 4 to 5 years. When trying to strike a comparison between EVs & Conventional vehicles it is

[17] Anandini Sood & Kopal Kesarwani, Electric vehicles in Indian Legal Domain, 11th May, 2022, ijpiel, https://ijpiel.com/index.php/2022/05/11/electric-vehicles-in-the-indian-legal-domain/

understood that conventional vehicles seem usable for long-run. Although the government provides incentives which encourages buyers, they were only offered to certain buyers for a shorter period of time. Thereafter, the EVs are sold for higher price where the people can't afford it.

Safety: Recently, there have been incidents where many EVs caught fire. This made the people to think of whether buying EVs would be safe. There were many reasons for EVs catching fire such as poor quality of battery, overheat, production of deficient battery management system[18], underperformance, toxicity as well as logistics challenges. The Ministry of Road Transport and Highways have issued set of safety standards for EV manufacturers.

Charging: EVs are normally charged in two ways: by plugging into a wall attachment or an air conditioner wall box charger installed at home, or by plugging into a DC charger installed at public spots. The time taken in charging through both of these techniques varies and relies upon how much power provided by the charger. Home chargers take a more drawn-out time contrasted with those accessible at public spots for a full charge. Two issues compound the expense of time spent in charging. To begin with, in spite of the fact that India produces adequate electricity to satisfy the need, there is an issue in proficient transmission and distribution. This causes power outages, which are normal across India and can make challenges for EV proprietors. Second, there are less open charging stations in urban communities and along roadways, making purchasers reluctant to purchase EVs.

Availability: Many companies which sell conventional vehicle has begun to sell hybrid and EVs in many segments such as 2Ws, 3Ws and 4Ws as well. In urban areas we could find only two wheelers when compared to other segments. The availability of EVs in various segments such as 3Ws and 4Ws are less. This is why the consumers feel reluctant to choose EVs.

Battery disposal: The batteries used in the EVs are made up of substances such as manganese, cobalt, lithium and nickel. For disposing the expired batteries proper facilities and procedures should be brought so that it can be disposed of safely. Providing safe disposal facilities would be useful not only for the lithium-ion batteries but also for other electronic goods made up of lithium.

[18] Ibid 7

Financing: In spite of expanding public and private sector interests in EV sector, the offer of EVs is still lower than anticipated. One of the issues we could observe from this is that there is no proper finance loaning to help customers and organizations in supporting EVs. After seeing the risks involved in EV such as poor-quality batteries, underperformance, etc made the financial institutions feel reluctant in providing loans.

Manufacturing: Before selling the product in the market, they face many challenges during the time of manufacturing. The proper development and growth of India's EV industry is affected by a number of difficulties related to specialized expertise of workers, R&D capacities, ancillary auto parts, backward linkages (with metal industries, capital gear, trucking, warehousing and coordinated operations), linkages with dealership, retail, credit and funding, repair and support.

Conclusions and suggestions:

The paper tries to bring out the implementation policy and challenges with respect to electric vehicle as it contributes in increasing the overall capacity of energy flow in the economy because the country imports of about more than 80% of its crude oil from foreign countries. The push of India’s electric vehicle generation aims to create more job requirements to the general public. Then through its implementation EV are able to generate and provide more renewable energy capacities through its grid operation systems. It has also led to promotion of sustainable development in the economy through its manufacturing of battery technologies and its storage purposes through government schemes and policies in promotion of renewable energy capacity power by more than 450 giga watts by the year 2030. With advancements in per capita income the consumers have made vast demand in the electronic industry which would require advanced level of chemist battery. These factors would lead the economy to one of the top largest countries in terms of economic level of opportunity by the year of 2030. The next aspect would be with regard to charging stations it has to be set up within 3kms which would be helpful to people living in residential areas, commercial establishments, public utility service centres etc. In highways within more than 25 kms charging stations had to be set forth at both sides of the road. The ministry of housing and urban affairs have mandated to set aside 20% of parking space to charging stations in any residential buildings or any type of commercial establishments. The next aspect would be with regard to improvement in the research and development in promotion of older indigenous technologies that are best available

in economic as well as in policy strategy development. In increasing the local research development would help to bring down the price levels in promotion of electric vehicles in various industrial sectors and hubs. India should have partnership with various countries in electric vehicle generation and its development in the economy.

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