ISSN No.: XXXX-XXXX
Volume X, Issue X, XXXX, pp. XX-XX

website: www.ijoetr.com

International Journal of Emerging Trends in Research

A REVIEW ON CHALLENGES FOR ADOPTION OF ELECTRIC VEHICLE: ECONOMY AND ENVIRONMENT ASPECT IN INDIA

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Abstract

The rapid use of fossil fuels causes an increase in carbon content in the environment, due to which India has planned to reduce carbon emissions by 2030.To protect the environment from these carbon emission electric vehicles are the future of automobiles. The motivation of this review is to find the challenges screened during the adoption of an electric vehicle in aspect of Environmental and Economy. The electric vehicle is one of the best solutions for reducing carbon emissions. As we know that the cost of electric Vehicle is more than Internal Combustion Engine which is not much affordable by everyone, so the government is giving many offers, subsidies, low tax payments, etc. By reviewing the economic and environmental aspects of electric vehicles it has been seen that the growth of electric vehicle adoption is very slow in Indian market.
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Keywords: Electric vehicle, Carbon emission, Economic and Environmental aspect.

1. Introduction

Globally the oil and gas demand and usage are increasing rapidly which cause-effect on the environment, while the assumption is made that petroleum will not sustain more than 2050, Due to which it causes cries and also affect their economy. By taking priority to the environment one of the biggest sources of ozone-depleting is caused by carbon dioxide from the combustion of fuel Therefore, the only alternative is that the eco-friendly fuels and renewable energy which gives good impact to the environment. In India, the major cause of greenhouse gases is roadways transport. More than 200 million vehicles are run in India as the quantity of ICE vehicles is increased which caused the increased rate of air pollution The GOI has taken the action to control the cause of GHS and replace it with eco-friendly vehicles. The best solution is the adoption of Electric vehicles and Hybrid vehicles which are non-petroleum vehicle and cause zero-emission of toxic gases and also decreases sound pollution. Because of these benefits, there is a high demand for EVs nowadays. [2, 3]

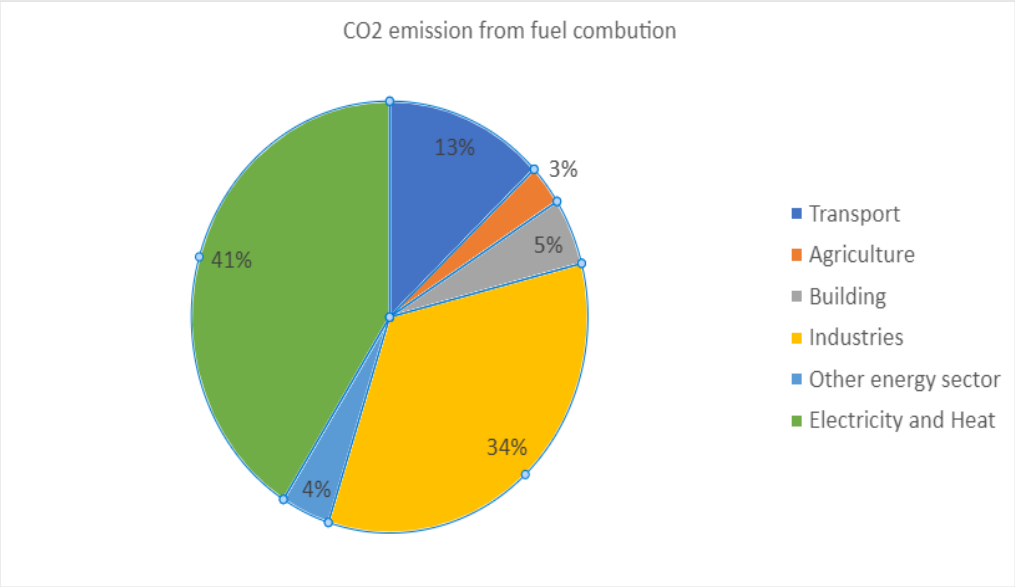

Fig-1 represents the total carbon emission from the combustion of fuel.

In the transport sector 13% of carbon emissions are produced, while in the agriculture, buildings and other energy sectors produced only 3%, 5%, and 4%. And in the Industry sector and electricity and heat production sector they produced the most of the carbon emission about 34% and 41%. Fig.1 Source- By the G20 Transition Towards a Net-Zero Emissions Economy 2019 report, Indian government proclaimed a five-overlay procedure — named the Pancha Mirta — to accomplish this. Soon India will be able to decrease the use of fossil fuel to 501 Giga Watts (GW) near about 2030. India gets 51% of energy from sustainable power by 2030. The carbon strength is decreased by 46% in India. India will accomplish its objective of net Zero- carbon- emission of gases around 2070. The environmental changes are caused all over the country because of mean business and causing the ozone layer depletion — from 1871 to 2019, which is about 4.1 percent. In 2019, India is the 3rd most polluter with 2.87 (GT) of emission and when it compared to the most polluter 1st is China having carbon emission of 10.6 GT and 2nd most is the United States at 5 GT of emissions. According to the Central Electricity Authority (CEA), India was getting 9.2 % of electricity generation from renewable energy in 2019. We need to develop the economy in such a way that the energy needed by the millions of people must be fulfilled. Thus, the world needs to focus on decreasing carbon emission and this is not only for India yet it is a challenge for the World.[4]

2 Literature Review

The literature review is based upon the electric vehicles adoption which is discussed in two phases. Phase one discussion is related to the global adoption of EV, especially in a developed nation like China, the US, Norway, and the second phase is based on the Indian perspective of adoption of EV

I. Global Point of view

Most of the countries have forcefully used eco-friendly fuels to run the transportation sector [5]. Researchers have suitable explore the distribution of EV innovation. According to the government point of view the procedure motivation, incentives, and awareness drive [6].

Researchers have also investigated the aspects affecting the adoption of EVs like the cost of EVs, range, charging infrastructure, TCO (Total cost of ownership, etc. [7]. In recent years, the world's most impressive advancement in the EV sector is done by China. They have investigated the strategy for the adoption of EVs at the national level. Based on this strategy, they identify the 10 cities for the experiment of adoption of EVs. Later they extended it into 25 cities. Further, China government declared various subsidies to boost the sale of EVs in the industry as well as in the commercial sector. They also face some the barriers like cost and charging infrastructure. So, they introduce some innovative strategies like battery swapping, fast charging, etc. The government of China gives support to the researchers to develop new technology for the benefit of EVs like fuel cells and traction motors. All these efforts of developing innovation made China not only the largest market of EVs but also the largest battery procedure of EVs. [7, 8, 9, 10] In the US the growth of EV is done by the various strategy given incentives (rebates), commercial motivation, etc. All these strategies play important role in promoting EVs. They have worked in setting up a fast-charging infrastructure. Additionally, the nation has promoted research and projects in battery technology to reduce the cost of battery upto150/Kwh. [7, 11]. In Norway, more than 58% of EVs are sold in 2019. The Norway government has used various strategies for the adoption of EVs like EV customer has a lot of benefits in road taxes, sale tax, etc. As the gasoline customer have to give 25% VAT for the road transport. [12,13] The above discussion on a successful nation for the adoption of EVs leads to a conclusion that infrastructure, incentives, and sharing economy plays important role in increasing of interest of customers. Apart from taxes incentives, the increased price of gasoline also affects the adoption of EVs from ICE vehicles.

II. *Indian Point of view*

In India, the EV sector is still in arising stage. Currently, there is more than 4 lakhs of 2-wheeler and a few thousand electric cars are running on the road. The Indian government has targeted the adoption of EV and improvement in EV technology and also in infrastructure will be completed more than 50% in 2030. The GOI claims that there is no deficiency of electric power but it is efficient to distribute for better usage. In 2019 India is one of the excess power nations of electric power. However, the recent condition is to manage the power needed for the EV adoption and charging infrastructure. In the world economy, there is a push of adoption of EVs with a high demand for a battery. While in India, there is limited work for and need to more investigation is necessary. There are fewer plans and projects regarding the charging infrastructure, the cost, and the road map for EVs. Although the fossil fuel vehicle is more in quantity and still running in Indian street which may cause less sale of electric vehicles.

3. The Objective and Overview

The objective of this study is to provide information regarding the current Indian EV status. This review is focused on the challenges for the adoption of electric vehicles with two aspects that are the economic and environment. Due to certain changes in the environmental condition there is a critical need for India to plan for the implementation of renewable energy for the environment and economic reasons: India needs to make a plan according to increase the usage of renewable resource energy to full fill the demand for electricity in the future. This will help in improving the growth of the Indian economy. Fig. 2 shows the overview of my review paper.

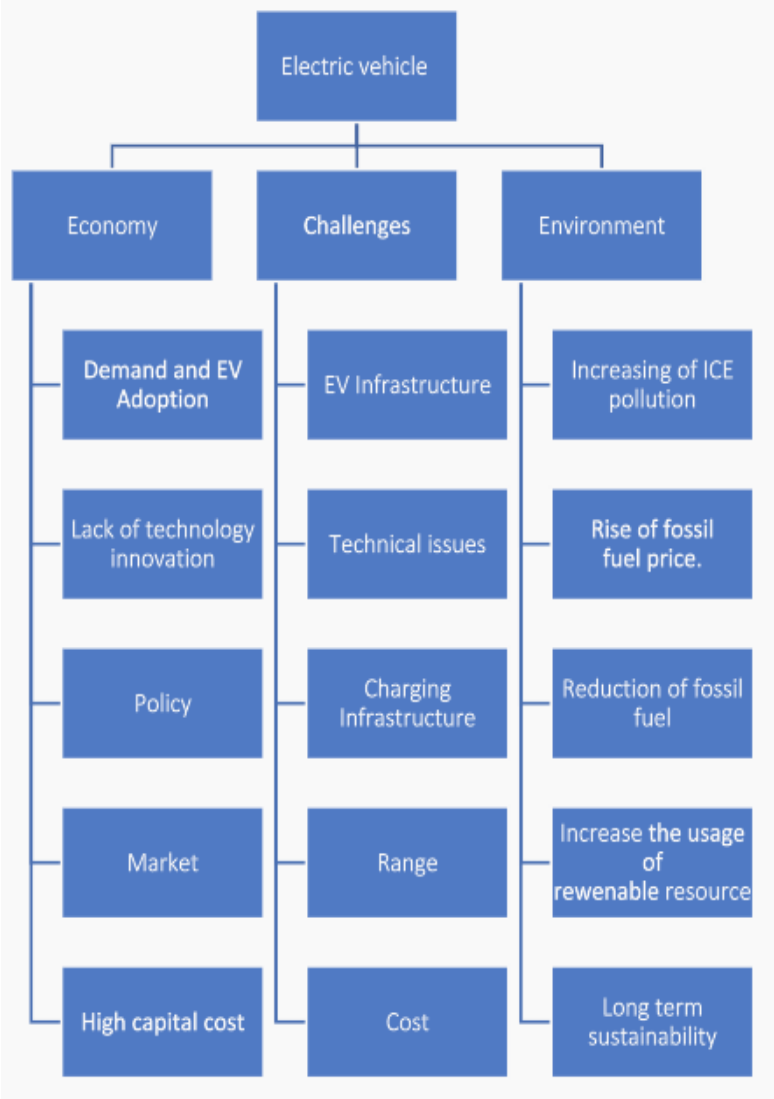

Fig.2 Structural Overview of EV

The discussion of this structural view representation is the difficulties, and opportunities faced by India in the adoption of the electric vehicle. The economy of India in the electric vehicle sector is in a growing stage. There are many challenges in the adoption of EV such as lack of infrastructure, of EVs, some of the technical issues like repairing, servicing, and high cost of spare parts. The overall cost of electric vehicles is also high which causes a major problem in adoption. The charging infrastructure is not much available. The electricity powers are not much available to satisfy the demand of the customers for of charging stations, due to availability of few charging stations; it also gives effect on the range (distance covered) of the electric vehicles. Electric vehicle and Battery India's first electric vehicle companies “The Reva Electric vehicle" launches its vehicle in the 2000s to create vehicles by high-level innovation. The main BEV producer, Mahindra Electric portability Ltd is starting in the market of India. Other major HEV producer organizations working in Indian markets are Volvo Car Corporation, Toyota Kirloskar Motor Pvt. Restricted, BMW AG, and Honda Motors Co. Ltd. In the 21st century, once more EVs have huge demand, with the new kind of battery that is a lithium-ion battery. Significant stages in the turn of development of EVs. The utilization the lithium-ion batteries have been incredibly more and more versatile electronics to the most recent EVs, like the Tesla Roadster, Nissan Leaf, and Chevy Volt. In electric

vehicles, the lithium battery is the most convenient apparatuses due to its many potential benefits. Also, among all battery-powered electrochemical methods, Li-particle innovation is the best option and competitor source of power for EVs. [14, 13] Battery swapping charging technique getting worldwide attention in which an exhausted EV battery is taken out from the vehicle and replaced with a completely energized one. The innovation is being done for different EV systems, including-2Ws, e-3Ws, e-vehicles, and even e-transports [15]. Thus, innovation is needed in the various systems like security issues, cost recycling, and charging infrastructure [16].

4. The EV Market in India

I. Economy aspects

In global, India has 4th biggest automobile industry. The compound annual growth rate (CAGR) is more than 6.99%. It includes more than 4.01 million units (not included two-wheeler) in 2018. The production of the vehicle is more than 24 million units. Currently, India has a small Electric vehicle market. The electric vehicle sale has become less than is 2000 units each year throughout the previous two years. Yet, there is an idea that by 2030 for 100% electric vehicle, the yearly growth development rate is 28.10%. The role of the economy is to the promotion of EV utilization but, due to high cost of EV and lack of infrastructure causes poor involvement of purchasing the EV by the Indian customer. The increased source of EV provides opportunities to the government for the betterment of the economy. The national capital of India, Delhi (NCR) has installed more than 5000 E-buses in 2019 and 4000 charging units due to the increased demand for EVs. The CO2 emission could be brought down to 1.4% in 2023 because of this new arrangement. As per this arrangement, 5–7 million EVs can be used before 2025 [17, 18, 19]. Relatively, In India EV shows slow growth for example US and China have sold more than 168,000 and 335,000 units of EV in 2016. However, India has only 450 units sold in 2016. The increasing trend of two wheelers has been increased, for example, only 114,000 units were sold in 2018 by force adoption of EV [20]. Many governments and the private sector have made the objective of achieving 100% EV adoption in India. The charging and battery swapping infrastructures projects have been launched by the Transportation network company (TNC). Currently, 4000 charging units system was launched in Delhi and Noida. [28] As per research is done by the Lawrence Berkely National Labounty. If the objective of EV is accomplished, the net power demand would be accomplished. To fulfill the demand for electric power, A study was carried out on the cost of EV charging and estimated about approximately US 11 billion (70,000 crores) by 2030 [21]. The industry researchers claim that the EV battery demand would be increased by 1,300 kWh/ year by 2030. The Indian confession is to acquire about 800 GWh/y that would expand the battery market up to 60% [22]. The Government of India planned to make charging points for the EV by the usage of solar power electricity [23]. By 2021, renewable power ability to 102 GW had expanded to around 12% thus; it implies that we want to build this up to 50% power generation by 2030. We focus to meet 50% of our needs from renewable, then, at that point, the capacity is arranged 450 GW to 700 GW. India's objective and plan for 2030 likewise hydroelectricity is renewable energy that can be used to expand the energy up to 630 GW as coal-based energy is limited.

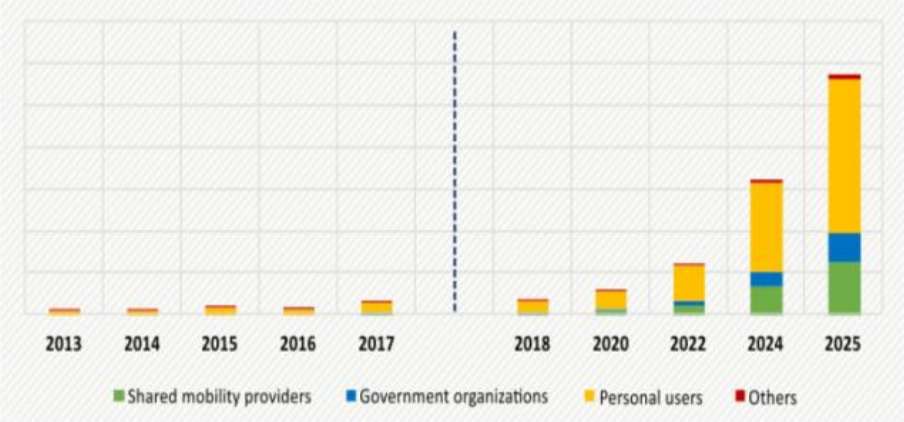

Fig. 3 India electric vehicle market users (2013-2025)

As the users of the EVs are getting increased from 2013 onwards, it was estimated that the market size of EV was valued at about 7.1 million in 2017 and the assumption was made that it will reach more than 700 million in 2025. The government schemes, policies, and subsidies are very helpful to encourage and motivate the people for the adoption of the electric vehicle. This will also help in increasing the growth of the market. [24]

II. Challenges in the adoption of EVs in India

Probably the greatest obstacle in the way of the adoption of EVs is the high cost. India is a value delicate market. Based on the automobile data 66% of vehicles purchased in 2018 were below then 7 lakhs, as a normal EV cost is more than 15 lakhs which is not affordable by the middle-class customer as compared to conventional fuel-based vehicle cost about less than 7 lakhs which is affordable [34, 25]. The charging infrastructure and the range (distance covered) are the challenges in the economy of the electric vehicle sector in India. Since lack of charging facilities affects the customer in India for switching of ICE to EV. As for ICE, the refueling station is located everywhere in the short range (distance) because of this people prefer to adopt ICE vehicles instead of EVs, due to this it causes more usage of fossil fuel and increases the GHG, and decrease the economy of EV sector. Because of this investor are not willing to invest in the EV sector in India [26, 27]. The next challenge for India's economy is the adoption of 30% of EVs by 2030. The adoption is not the major problem; the major problem is the power growth which means the electricity used for charging the EVs. The power capacity of India in 2018 is 345 GW and it is growing at the annual rate of 7%. [28] Most of the power generation is came from the Thermal contribution i.e., coal burning. By taking a reminder of GHG, Renewable energy is the best solution for reducing carbon growth and also gives huge profit in increasing the economic growth. Still, India is a rising stage, which causes an impact on the decision of the customer due to limited Maintenance and repair options. [29] The next challenge is the way of adoption of EV by India about 30% will be deal with the tremendous amount of waste disposal of EV batteries and other components. The life of batteries is limited to up to 6-7 years. This will also cause the impact of customer decision for purchasing the EV. To encourage the customer, manufacturing provides a warranty of battery up to 8 years or 160,000km [30, 31, 32].

III. Environment Aspect

India has taken a late step towards the environmental issue as the accessibility of fundamental parts through companies is helping the EV market to create reasonable electric solutions. There is a push for changing the ICE into the EV that is lithium-ion cell battery in India; it is a long way to cover the targets and a huge scope of changing of climate condition and living around the environment. The targets are set by 2030 when the new Electric vehicles are enlisted in India would be operated by the electric current rather than fossil fuel. They will improve in maintaining the vehicle pollution across the country. The final objective is to decrease the use of fossil fuels and increase the use of renewable energy.[33] As time is passing the condition of the environment decreases day by day, till now the usage of fossil fuel is not stopped and the carbon content in the atmosphere is increasing day by day which affects nature causing many problems. Zero usage of fossil fuel is the only option to maintain the nature problem as it is impossible to maintain that though we still can reduce the usage of fossil fuel. The major source of pollution is the transportation sector. The usage of renewable energy is the only option to control the GHG and maintain the balance in nature. [34, 35, 36].

5. Discussion

Due to excess use of fossil fuels like petrol, diesel, etc. the carbon content in the environment has been increased due to which many ecological problems are created, to overcome these problems. The researchers have come up with the idea of increasing the use of renewable energy resources and decreasing the usage of fossil fuels. The Transportation sector is one of the major sources causing GHS. The world 3rd most polluter of carbon emission is India and second and first is US and China. At present, the adoption of Battery electric vehicles is the solution to these problems. At the global level, the growth of the EV sector is highly increased in many nations like China, the US, California, Norway, etc. If we talk about India, it is still in the growing stage because of many challenges and barriers like the Capital cost of EV infrastructure, high cost of Electric vehicles, range, electric power for charging, charging infrastructure, etc. Due to all these factors, the growth is slow in India. But the Government of India (GOI) has made many plans and strategies to help in improving the growth of the EV sector. Presently, GOI has launched many projects regarding the electric vehicles infrastructure and many others. Many policies are made like low tax, subsidies, etc. regarding EVs to encourage the customers to the adoption of EVs and the investors to invest in the electric vehicles sector to increase the growth of electric vehicles and well as the economy of India.

6. Conclusion

Because of the ecological issues, the interest in electric vehicle has expanded globally. Electric vehicle is available all over the world; the main reason for switching internal combustion engine into electric vehicle is to reduce carbon so that zero-emission is accomplished with the help of battery electric vehicle and fuel cell vehicle. The final objective is to decrease the use of fossil fuel in the transport area and increased the use of renewable energy; particularly the lithium particle battery has been the most widely recognized decision for environmental issues due to its many potential benefits. The reason for the slow growth of electric vehicle adoption in the India market is; -

I. Lack of infrastructure in India
II. High cost and poor purchasing.
III. Insufficient power accessibility.

IV. Inadequate battery technology and manufacturing system

Currently, India has a small Electric vehicle market. In the coming years, the Electric vehicle situation in India will get improved as new projects and policies have been launched by the government for the betterment of people as well as in the electric vehicle sector.

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