MARKET OPPORTUNITIES OF ELECTRIC VEHICLES – A LITERATURE REVIEW

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ABSTRACT

Global warming and its contemporary environmental concerns like pollution, increasing oil demand contributed the adoption of electric vehicles (EVs) globally. Many governments all around the world are implementing policies to promote the adoption of EVs. This paper reviews on electric vehicles industry, the market opportunities of the EVs in and the role of EVs in environmental sustainability. It is identified that many big companies started to enter into the EV market and there is an increased growth of startups based on EVs and the government also provided many incentive schemes for the EV consumers. Even though, many consumers are not aware of the EVs and so it seems to be difficult to adopt to the new technology.

Keywords: *Electric vehicles (EVs), EV industry, EV market, environment, government.*

INTRODUCTION

Owing to global warming and its contemporary environmental concerns like pollution, increasing oil demand contributed the adoption of electric vehicles (EVs) globally. Transport sector holds the second largest in emitting CO_2. Thus, sustainable transportation is adopted globally in every automobile industry. India's automobile industry holds the fifth place in the world. It accounts about 22% of total manufacturing output and has been rapidly growing in the motorization curve. Hence urban traffics throughout the country grows and leads to high CO_2 emission. Indian government is trying to advance the alternative fuel-based vehicle technology and found that the EVs would be the best alternative for the fuel combustion vehicles. As a result, Indian automobile manufacturers have revolutionized in producing EVs as best alternatives for fuel vehicles.

ELECTRIC VEHICLES

An electric vehicle (EV) uses one or more electric motors for propulsion of the vehicle. An electric vehicle may be powered through a motor system by electricity from both external and

internal sources, or may be self-contained with a battery, solar panel or an external generator to convert electricity from the fuel. EVs are not limited to road and rail vehicles they have extent in many ways. EVs first came into existence during the middle of 19th century, when electricity was the most preferred methods for the propulsion of motor vehicle. In the 21st century, EVs gone to upturn due to technological innovations, and environmental concerns on renewable energy.

CLASSIFICATION OF ELECTRIC VEHICLES

Modern technologies and innovations have paved the way for increased production of EVs across the global automobile industry. Taking account of the power supplement and propulsion devices EV could be classified into Four different types: Battery electric vehicle (BEV), hybrid electric vehicle (HEV), Fuel Cell Electric Vehicles (FCEV) and Plug-in Hybrid electric vehicle (PHEV). The BEV energy storage capacity fully depends on the battery technology. HEV works with combined battery and fuel where the energy source depends on both fuel and electricity. PHEV battery can be recharged by plugging it to an electric source through generator or charging stations. FCEV type of vehicles use fuel cell instead of battery can be charged using Hydrogen and compressed oxygen and hence provides zero emission.

Type of Vehicle	Energy Source	Emission Level
BEV	*Battery*	*Minimum*
HEV	*Battery & Fuel*	*Maximum*
PHEV	*External plug-in*	*Zero*
FCEV	*Fluid Cell*	*Zero*

GROWTH OF ELECTRIC VEHICLES

However, high the manufacturing cost of EVs the low fuel economy and high CO_2 emissions have restrained the EV market growth. Moreover, technological innovations in EVs and proactive government initiatives are expected to unfold various opportunities for the growth of the stakeholders of the electric vehicle market, such as system integrators, battery manufacturers, electric vehicle manufacturers, engine manufactures, and component providers, in future.

GLOBAL STOCK GROWTH OF EVS

According to statistical data from the EV volumes, over 1 million EVs were sold in the first half of 2019, which showed a 46% increase from 2018. In addition, after the global sales volume of EVs exceeded 1million in 2016 and 2million in 2017, the global stock of EVs have exceeded 500 million in 2019, which showed a 46% increase from 2018. The demand for EVs is governed by increase in demand for fuel-efficient, high-performance, and low -emission vehicles. In addition, the trend of reduction in vehicular emission due to strong rules and regulations in several

countries and growth of infrastructure in China, France, Norway, and the other developed countries is modelling the market growth.

MARKET POTENTIAL OF EV

Considering the strong government push towards the EV, globally it has a greater potential to grow in the EV market. EVs thrusted into the global market from in the past decade, due to the technological advancements and environmental concerns. Now every market players of automobile industry are rushing towards EV. Apart from investments government is trusting the importance of EV adoption. Growth is also anticipated due to increasing number of research and development efforts by various leading automobile companies to develop more advanced, affordable and advanced EVs.

EV MARKET GROWTH IN INDIA

Reports said that there are 10 states and union territories have been potentially developing the production, infrastructure and services in a momentum for EVs in India. The states and union territories are Andhra Pradesh, Bihar, Delhi, Karnataka, Kerala, Maharashtra, Tamil Nadu, Telangana, Uttarakhand and Uttar Pradesh. According to Tech Sci Research report electric vehicle market in India is estimated to reach nearly $2 billion by FY2023, on the extent of increasing consumer awareness towards EVs doubled with growing concerns associated with rising air pollution levels across the country. There are different electric vehicles launched in developed countries like Fully electric cars, Motor cycles, Buses, Mini-Trucks, Heavy trucks, Locomotives and hybrid cars. Many startups are also thrusting the EV industry globally.

GOVERNMENT INCENTIVES ON EV

Moreover, with increasing number of government initiatives to encourage adoption of EVs, thus the demand for EVs in the global market is expected to grow at a rapid pace. National and Local Governments in Europe and other world regions like china are focused on reducing the transport carbon emissions through campaigns and incentive schemes. Likewise in India, Faster Adoption and Manufacturing of (Hybrid and) Electric vehicles (FAME) is a scheme by the government of India which provides incentives for customers purchasing electric vehicles. The vehicle is covered under Government of India's FAME-India (Faster Adoption and Manufacturing of (Hybrid and) Electric vehicles) scheme offers incentives for the customers who buy the hybrid and electric vehicles. FAME scheme is a part of National Electric Mobility Mission Plan 2020 by Government of India revealed on 2013.

REVIEW OF LITERATURE

Goswami, R., & Tripathi, G. C. (2020) Have estimated the growth of the adoption of the electric vehicles and the charging infrastructure and the required power to run those charging stations.

Stock, J. H. (2019) Compare the climatic change with the macroeconomics and also investigated the effect of global warming around the world and its environmental concerns. Also, the to develop the energy sources to overcome the sustainability.

Zhili, D., Boqiang, L., & Chunxu, G. (2019). Discussed about the car ownership and the forecast of China and also the growth trend of the electric vehicle in the china automobile industry. Li, Z. (2019) have calculated the predictions of the charging infrastructure in Korea. And also, the upturn of the people awareness in the adoption of the electric vehicles and they have concluded that the whole Korea would be totally electrified in the year of 2035.

Susan Shaheen, Elliot Martin, Hannah Totte (2019) analyze the exposure of the Zero emission vehicles in people and also criticized the market barriers such as knowledge, feature, design, driving range, brand image. Yubo Chen, Mrinal Ghosh, Yong Liu, Liang Zhao (2019) reviewed that the sales volume of the electric vehicles can be improved by media coverages and ad campaign and hence that pushes the consumers towards the electric vehicle adoption globally. Because the whole automobile industry depends on the media and promotion, likewise the promotions towards the electric vehicles can boost the EV market.

Xiaoli Sun[1], Zhengguo Li[1], Xiaolin Wang[2] and Chengjiang Li[2] (2019) provided inclusive review on the emerging technologies and technical development of EVs and for the future. Key technologies regarding batteries, charging technology, electric motors and control, and charging infrastructure of EVs are summarized. The paper also highlighted the challenges in adoption of EV and emerging technologies for the improvement of efficiency, reliability, and safety of EVs in the coming stages as another contribution.

Shanjun Li, Lang Tong, Jianwei Xing, and Yiyi Zhou (2017) have discussed about the policies of the buying EVs and also the network integrations of buying the EVs. Daga, A., Miller, J. M., Long, B. R., Kacergis, R., Schrafel, P., & Wolgemuth, J. (2017). Discussed about the commercial advantages of the electric vehicle and the understanding with respect to technological advancements, charging systems and EV infrastructure, EV components.

Lingzhi Jin, Peter Slowik (2017) Reviewed that the actions like consumer campaigns, non-financial incentives and high model availability by Government at national and local levels, Stakeholders helps to increase the consumer awareness. Fuad Un-Noor[1], Sanjeevikumar Padmanaban[2], Lucian Mihet-Popa[3], Mohammad Nurunnabi Mollah[1] and Eklas Hossain [4] (2017) conducted a focused review on EV configurations, battery sources, emerging trends, and technological developments in EV market.

Burgessetal (2016) Did a qualitative research on EV adoption and found that the major factors influencing Electric Vehicles purchase are the technological, financial, individual and socio-economic factors. And concluded that both internal and external factors affect the consumers in adoption of the electric vehicle. Paul Wolfram and Nic Lutsey (2016) Have explored the role of governments in thrusting the EV adoption and also examined the types of electrical vehicles like BEV, PHEV, HEV, FCEV through technological advancements.

A.K. Digalwar & Ganneri Giridhar (2015) identified that the EVs are one of the best alternatives to overcome environmental crisis. But EV market is at a budding stage in India compared with other developed countries. Through Interpretive structural model (IST) it is identified the critical factors of implementing EV in India such as driving power, range and features. Also, the commitment government to create awareness among Indian consumers. Zhou, Y., Wang, M., Hao, H. et al (2015) addresses about the growth of PHEV across the Japanese regions due to the incentives provided by the Japanese government.

Chau & Wenlong Li (2014) gave an overview on the electric vehicles and hybrid vehicles and also criticized the alternative of PM vehicles and finally integrated the future EVs and Hybrid vehicles.

Carley et al (2013) measured the advantages and disadvantages of electric vehicles beside the other factors like price, range, speed, and the environmental aspects.

CONCLUSION

Electric vehicles have been in a growing curve since the consumers are aware of the increasing air pollution, CO_2 emissions, oil demand. The government and the automobile manufacturers are thrusting to build the infrastructure and components for the electric vehicles. Typically, it is found that proper campaigns and promotional activities can induce the sales volume of the electric vehicles throughout the world.

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