



E-VEHICLES MARKET IN INDIA – ANALYSIS ON GROWTH PERSPECTIVES

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Abstract

As the demand for the oil prices is increased the demand for the raw materials of crude oil the prices are increasing so that there are fluctuations in prices. Due to the uncertainty of the demand and price of the crude oil government want to make some alternatives. Electrical vehicles may be one of the best alternatives which is good for the environment. Now everyone is cautious about the environment how it is getting polluted so some of them are concentrating about the alternatives to reduce the pollution by using the renewable energy sources such as Electrical vehicles. Government of India has initiated to work on the charging stations for the electrical vehicles. Government has suggested for every 3 Kilo meters there may be charging slots available. By using the Hybrid power train (HPT) can reduce the fuel consumption mostly used in the commercial vehicles. By applying the Regenerative braking system on electrical vehicles has impact on the overall efficiency. The study focuses on how electrical vehicles are helping to reduce the pollution, advantages and disadvantages of electrical vehicles and the challenges that are faced by the usage of the electrical vehicles, future of the electrical vehicles in India and we can discuss what would be the future sales for the electrical vehicles.

Key Words: *BEV, Electrical vehicles, HPT, Government, PHEV.*

1. Introduction

During the last few decades impact of the petroleum products has brought change in the electrical transportation infrastructure. Electrical vehicle differs from the fossil fuels. Electrical vehicles can be generated from the sources like nuclear power, tidal power, solar power. Electrical vehicles include the Electrical cars, Electrical trains, Electrical Lorries, Electrical aero planes, Electrical boats, Electrical Scooters, Electrical space crafts.

Electrical vehicles came into existence in the mid-19th century. When the electricity was one among the preferred methods for electrical vehicle propulsion. Providing the level of the comfort could not be achieved by gasoline cars. Hybrid electrical vehicles are the combination of power train with electrical propulsion. Some of the examples of hydro electric cars is Toyota Prius, mopeds, electrical bicycles, kick starter scooters and Chevrolet is one of the examples of the plug-in electrical vehicles.

The power of the electrical vehicle is measured in the form of the KW. 1 KW= 134 Horse power. An electrical vehicle is also called as EV, it uses one or more electric motors or traction motors which are used for the driving forces. An electric motor may be self-contained with the solar panels, batteries which are used to convert fuel to electricity. Electric vehicles came to existence in the mid-19th century when electricity was preferred as motor vehicle propulsion. Electric vehicles are expected to increase from 2% of global share in 2016 to 22% in 2030.

Some of electrical companies in India are

1. Tesla
2. BMW
3. Nissan
4. Chevrolet



5. Ford
6. Volkswagen

2. Significance of Electric Vehicles in India

Electric Vehicles in India will make a definite impact on Grid Background Road EVs include a large range of vehicles from electric two-wheelers, three-wheelers (rickshaws), cars and electric buses. In addition, plug-in electric vehicles can be classified into two types: battery electric vehicles (BEVs), and plug-in hybrid electric vehicles (PHEVs). BEVs have an electric motor in place of combustion engine and use electricity from the grid stored in batteries. Plug-in hybrid electric vehicles (PHEV) use batteries to power an electric motor and liquid fuel such as gasoline or diesel to power an internal combustion engine or other propulsion source. EVs can go beyond the above-mentioned technology-based classification, and can be classified on the basis of their attributes such as i) charging time, ii) driving range, and iii) the maximum load it can carry. Of these attributes,

The Two most important characteristics of an electric vehicle of concern to the consumer are: -

1. Driving range (i.e. the maximum distance an EV can run when fully charged)
2. Charging time of batteries (i.e. the time required to fully charge the battery) and Charging time depends on the input power characteristics (i.e. input voltage and current), battery type, and battery capacity.

3. Objectives and methodology

The main objective of this paper is used to predict the future of electrical vehicles. More specifically, the objectives of the study are:

1. To study utilities of e-vehicles in Indian market.
2. to examine the pros and cons of Electrical vehicles.
3. to study the Government measures towards promotion of e-vehicles.

The main purpose of the study is how the future of the electrical vehicles would be rather than the combustion engine vehicles. The data is based on existing literature obtained from the journals, Articles, Newspaper and reports of select e-vehicle manufactures.

4. Analysis on Utilities of E-Vehicle

The power of electric motor is measured in kilowatts (KW), 100KW which is equivalent of 134 horse power. Electric motors can deliver maximum torque. During the process of conversion of electrical energy to mechanical energy the energy is lost more.

Usually Direct current (DC) electricity is fed into a DC/AC inverter where it is converted to alternating current (AC) and this AC is connected to the 3-Phase supply.

Electrical vehicle runs with an electric motor uses the batteries rather than the traditional way. Electrical vehicles get charged by using the charging stations which can be placed in the private place or at where we live. Batteries are manufactured by lithium-ion batteries. Lithium-ion batteries manufacturers are china in which it is pioneer. To reduce the lithium-ion battery cost India is manufacturing these batteries in bhel.

Electrical car is a car which moves forward by one or more electric motors by using energy stored in the rechargeable batteries instead of burning petrol/diesel.



There are 3 few types of the electrical vehicles technology they are

1. Battery electrical vehicles: In this electricity is stored in the batteries which is used to rotate the wheels. It is similar to the smart phone batteries. After the death of the battery, we may again charge the battery
2. Plug in hybrid electric vehicles: It is similar to the traditional way of technology in the traditional way we use to fill the vehicle either with petrol or diesel similarly in this we will recharge it with the charging. Batteries can charge by themselves when car runs with less than the speed.
3. Solar powered electrical vehicles

How electric car works

1. Electric car works with the help of electric motors in which energy is stored in the form of the batteries.
2. 3 different types of electric cars are present now
3. Solar powered electric cars and vehicles
4. Hybrid electric cars combination of internal combustion and batteries
5. Electric cars with on board battery packs also known as Battery Electric Vehicles (BEV)
6. In India automobile manufacturers announced four-wheeler electrical vehicles such as Hyundai Kona electric, Mahindra e-verito, Mahindra e2o, Tata Nano etc

5. Pros and cons of Electrical vehicles

Challenges faced by the electric vehicles in India

1. Due to the lack of the infrastructure of charging facilities.
2. Mostly depends on the battery imports.
3. Mostly depends on the imported components and parts.
4. Prices of electrical vehicles are high
5. Due to the insufficient electricity supply over all the parts of the India.
6. Due to the lack of options of high performance of electrical vehicles.
7. Due to the inadequate repairs and quality maintenance.
8. Faster adoption, manufacture of the electrical vehicles (FAME) policy flip flops
9. Supply and demand gap
10. Creating the closed loop mobility ecosystem

a) Types of the batteries

Previously lead acid batteries are used in the electrical vehicles. Due to less efficiency lead acid batteries are replaced by the Lithium-ion batteries. Due to the more efficiency and more rechargeable Electrical vehicles use LI-ion batteries.

b) Battery in EV

The choice of batteries depends on the energy density, weight and costs. Electric cycles and low range mopeds have simple battery units while electric cars deploy a large number of batteries. Traditionally, most electric vehicles have used lead-acid batteries due to their mature technology, easy availability, and low cost. However, since the 1990s battery technologies have evolved significantly and several new types of batteries have been developed. More recently, batteries using combinations of lithium ion and its variations are gaining widespread acceptance due to better efficiency, reduced weight, lower charging time, better power output, longer lifetime, and reduced environmental implications from battery disposal.



The following four types of batteries are commonly used today in EVs

1. Lead Acid,
2. Nickel Cadmium (NiCd),
3. Nickel Metal Hydride (NiMH), and
4. Lithium-ion (Li-ion).

Lithium-ion batteries have higher specific energy relative to the other battery types. In the future, technology innovations with Li-ion and other battery technologies are expected to result in batteries with much higher specific energy and lower costs.

Battery Charging In low power applications the power conditioning which includes the AC to DC conversion, the power control unit which delivers a variable DC voltage to the battery, and various filtering functions are all carried out within the charger and can be implemented at a relatively low cost. The Battery Management System (BMS) is tightly integrated with the battery. It monitors the key battery operating parameters of voltage, current and temperature and controls the charging rate to provide the required constant current / constant voltage (CC/CV) charging profile and it triggers the protection circuits if the battery's operating limits are exceeded, isolating the battery if needed. Market Technical Policy Infrastructure 5 Policy related challenges include choosing and instituting policy instruments to promote EVs, setting up infrastructure, incentivize automobile manufacturers to produce EVs, and induce consumers to switch to EVs. Should the infrastructure be ready before penetration of EVs could go up? Or should the penetration of EVs reach a 'tipping point' before the required infrastructure is rolled out? The dilemma confronts policymakers, automobile manufacturers and the related businesses. The deployment and scaling up of EVs in urban areas greatly depend on the quality and access of charging infrastructure, and facilitation of a supply chain for charged batteries. Charging infrastructure includes low speed charging stations in homes and workplaces as well as fast charging points located in public areas including shopping malls, petrol pumps, public parking and mass transit stations. Globally, several city governments have introduced plans and policies to improve EV infrastructure

c) Charging facilities

1. In India in the year 2018,650 charging stations are been produced whereas china in the same year 4600 charging stations can be produced. Due to inadequate of charging stations and lack of private parking facilities are becoming barriers for the electrical vehicle's adoption.
2. According to some of the researchers,60% of the Indians don't have parking space so, that it would become difficult to recharge their vehicles so, it is difficult to adopt the electrical vehicles.
3. They are 2 types of Charging facilities available
4. Slow Chargers: It is having capacity of 1.2-3.00 KW
5. In this charger's supply convert Alternating current (AC) to Direct current (DC) which charges battery it takes 5-6 hrs. to charge completely
6. Fast chargers: It has capacity of 15-50KW
7. These chargers send direct current (DC) to the EV's battery through a port and can charge a vehicle in half an hour to 90 minutes. These are mostly useful for cab companies and corporate users who have fleets of electric cars.

d) Charging time

1. In present scenario electrical vehicles can travel about 100-130 miles per charge which is basic model while for the expensive model 335 miles per charge



2. If charging stations are installed in our homes, it is the part of our electricity bill in the case of the combustion vehicles the cost is calculated separately
3. Charging of vehicles is more similar to the charging of the mobile phone's vehicles can be charged at our home places but while charging outside will be somewhat expensive.
4. "If people were incentivized to wait until evening and charge their vehicles in the slow-charge mode, which takes hours, the power load could take advantage of wind energy available during off-peak hours," said Chris P. Nielsen, Executive Director of the Harvard China Project and co-author of the study.
5. Acceptable battery charges:
6. 8 hrs – 24%
7. 4 hrs. - 27%
8. 2 hrs. 30 mins – 49%

e) Lack of Battery cell manufacturing

1. There is an absence manufacturer of primary batteries in India
2. Most of the manufacturers depends on the batteries which are imported from Japan, China, Korean and Europe.
3. Even if we manufacture the cells here in India — the foreign exchange loss for procuring raw materials (lithium, cobalt and others) would be significant and the dependency would be on China primarily.
4. In Lithium ion batteries more energy is stored rather than the lead acid batteries, longer life time and higher efficiency due to this power can be used for the longer time.
5. Mostly Lithium ion Batteries are imported from china, Taiwan, South Korea

f) High Price Facility

1. The average cost of the electrical vehicles is approximately 13 lakhs. It is costlier compared to the economic cars which consumes fuel. It may be advantage if the price of the electric vehicles may come down all the customers will show the interest in buying the electrical cars.
2. 40% of electrical vehicles are having more battery cost. Many of battery and electrical vehicles manufacturers are working on developing Lithium ion battery technologies In addition to start-ups such as Log 9 Materials, RACEnergy, Cell Propulsion and ION Energy, the likes of ISRO, BHEL, Amara Raja Batteries and Naval Science & Technological Laboratory (NSTL). Among the big-name players in the market are Okaya, Coslight, Exide, Hero Electric, Suzuki, Exicom, Samsung, Tata Chemicals, Denso, Panasonic and others the competition in the EV battery market is more.
3. Faster adoption, manufacture of the electrical vehicles policy flip flops:
4. Indian Government initially focusing on the adoption and manufacture of the electrical vehicles and giving policies to the customers and also attracting them to purchase the product by imposing less tax on the electrical vehicles.
5. Creating closed loop mobility eco system:
6. At some point of time batteries would get discharged and these batteries can be recyclable by recycling stations for batteries used to recover the metals used in the electrification to create a closed loop required to shift electric cars to be environmentally Sound decision.
7. Recently implemented by FEMA-II, 2700 charging stations should be installed by 2024 at every 25 kms



8. Energy Efficiency Service Limited is used to build electrical vehicles charging stations it is installing 84 fast charging stations, where top up of their vehicle batteries in 15 mins is for Rs.30.

Government incentives:

- <4% - 32%
- 4 to 7 - 33%
- 7 to 9 - 12%

Build gap between Supply and demand

1. At present scenario there is a huge difference between the supply and demand
2. There is more supply but less demand but for this government is taking some measures.

Advantages of electric vehicles over the fuel based electric vehicles

1. Electric vehicles offer less operating costs compared to combustion engines
2. Maintenance cost of electric vehicles is very cheap because of material is cheaper to charge a battery.
3. Electric vehicles possess high performance and driveability.
4. In electrical vehicles fuel is very low while compared to combustion engines. In electrical vehicles charging depends on the battery size of the car.
5. Electrical vehicles are low carbon emissions and fossil fuels
6. Electrical vehicles don't have car

6. Government measures to take actions of electric vehicles

1. Slashing of GST on electric vehicles is reduced to 5% whereas Combustion engine is 28%
2. 1.5 lakhs are deducted on the loan to buy electric vehicles
3. Nirmala Sitharaman has announced 12% to 5% reduction in Electrical vehicles to attract the customers to buy the electrical vehicles.
4. According to the Anand Ayyadurai who is chief executive of startup Vogo which 2-wheeler "With electric scooters available on rent, India's shift to e-mobility will be much faster and smoother, thereby, enabling us to kick-start a clean mobility revolution in India,"
5. Union cabinet has exempted excise duty on the electrical vehicle's parts such as electric drive assembly, onboard charger, e compressor and charging gun to cut down the costs.
6. According to Niti Aayog CEO, Amitabh Kant "Government is pushing to set up of bigger factories for manufacturing of batteries.
7. As Indian customers are more conscious about quality and cost of the vehicles and also want lesser maintenance cost
8. Government is trying to increase the adoption of solar power and energy storage markets by 2025
9. By this we can reduce the coal imports from other countries
10. Government is trying to subsidy to install charging stations.

7. Conclusion

Most of the alternative technologies are un aware to the people. The current Electrical vehicles don't meet the customer expectations to large extent. Government should take initiatives to make the awareness of the electrical vehicles through the agencies. Customer prospective should be changed while buying the electrical vehicles. By increasing the price of the crude oil there may be increase in the price of the petrol so, it is better option for opting the electrical vehicles. So, to make our environment free from the pollution opting electrical vehicles are one of the better options. The government of India has undertaken multiple initiatives to promote the manufacturing and adoption of electric vehicles in



India, to reduce emissions pertaining to international conventions and to develop e-mobility in the wake of rapid urbanization.

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