

Review on History of Electric-Vehicles in India

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Abstract:

In this fast-growing world where technology is everything as it keeps improving. The electric vehicles also have improved a lot comparatively. The improvement occurred at a faster pace from the beginning of 21st century. Although the first invention of model electric vehicle in 1829 existed it was more of an early type of electric motor and the first known electric locomotive was built in 1837. The actual practical electric vehicle was built in 1881 and it was a tricycle. Electric vehicles with high cost, low top speed and short range of battery compared to internal combustion engine vehicles led to a worldwide decline in their use. However, from 19th century they were continued to be used in the form of electric trains and other niche uses. At the onset of 21st century fascination in electric and other alternative fuel vehicles has expanded due to swelling concerns over the problems associated with hydrocarbon fuelled vehicles, encompassing damage to the environment caused by their emissions and the

sustainability of the ongoing transportation infrastructure as well as improvements in electric vehicles technology. Since 2010 the sales of electric cars and the sales of utility vans has expanded 1 million units delivered globally in September 2016, also the combined sales of light duty electrics and plug in hybrids crossed 5 million in December 2018.

Keywords —Electric-Vehicles, Sustainability, Technology, Hybrid Vehicles, Environment

I. INTRODUCTION

Electric-Vehicle is propelled by an electric motor, rather than traditional diesel or petrol engine. These vehicles are powered by rechargeable batteries mostly Li-ion batteries for better performance. They can be charged through the EV charge point at home or a more powerful Electric-Vehicle charge point. In Hybrid vehicles, the same technology is used, along with the motor small petrol or diesel engine that also connects to the turning wheels. So, when the battery is drained or when extra power is required the vehicle uses the engine. Hybrid technology causes less pollution and can save you money. There are two types of Electric-Vehicles: all-Electric Vehicles (AEV's) and plug-in Hybrid Electric-Vehicles (PHEV's). Often PHEV's uses a battery for shorter distances and switch to the engine for greater speed and to travel longer distances. There is a Third category: Conventional hybrid vehicles, which are installed with a petrol tank and a battery that gets charged every time pressure is applied on the breaks. Electric-Vehicle charging stations are of two types Alternating Current (AC) and Direct Current (DC). AC powered Electric-Vehicles offer ranges from 8 to 24 km on charging about 30 min. Batteries are the main fuel source for the Electric-Vehicles, and they are not only the source of fuels for EV's. Alternatives have been developed such as Fuel cell or Supercapacitors which are not used in any commercial vehicles.

II. HISTORY OF EV ON GLOBAL CONTEXT

Only in a few rich markets, Electric-Vehicles have been successful. But over the past decade, there was a huge war against internal combustion

engines and EV's to find their place in the daily lives of mankind.

The first-ever built Electric-Vehicle achieved a speed over 62mph in the all-electric La- Jamais Contente in 1899, driven by famous Belgian racer Camille Jenatton. The only reason people chose internal combustion vehicles over EV is because of the short travel ranges with EV's. In 1912 electric started motor was developed for petrol cars, eliminating the drawback of having to use a hand crank to get the car moving. There have been several attempts to revive the initial success of electric vehicles over 100 years before 1870.

There are few things which opened the market for the Electric-Vehicles. They are:

1. Climatic change
2. Rapid Urbanization
3. Improvements in Renewable energy sources
4. Data science
5. Battery efficiency
6. Security of energy

The developed countries such as EU, USA, Japan, China and India have included in their policies to lower the carbon emissions while providing cost-efficient Electric-Vehicles.

III. INDIAN CONTEXT

The EV vehicle was started in the year 1839; a small locomotive was developed by Thomas Davenport. In India, the country made its first concrete decision to incentivise EVs in 2010, under a Rs 95-crore scheme approved by the Ministry of New and Renewable Energy (MNRE), the government announced financial incentives for manufacturers of electric vehicles sold in India.

A. NEED OF E-VEHICLE IN INDIA

In India many cities environment is filled with air and noise pollution, also the India is the second most populated country the use ICE vehicles is more and the pollution released by those vehicles are huge and harmful gases into air. In India the availability oil and natural is very poor so the crude oil is imported from other countries hence the price of the petroleum products is higher. To over all these problems E-vehicles are the best alternative. Till now there are nearly 400,000 registered electric vehicles run in India.

B. INDIAN AUTO-INDUSTRY TODAY

India has many things to learn from other countries that have done their e-vehicles successfully. To reduce carbon emissions by 2030, India is determined to accomplish its Intended Nationally Determined Contribution, and make itself an energy-sufficient economy. India has an opportunity to take a leadership role in the electrification of small vehicles a key difference between India and other countries is the type of vehicles being used.

India has over 170 million two-wheelers. If we assume that each vehicle uses about 200 litres per year, the total amount of petrol used by the vehicles is about 34 billion litres. At 73 per litre, this would cost about 2.4 lakh crores. If we considered that 50% may cost for importing the crude oil and gas tax and other may be 50%. By using E-vehicles one may save 1.5 lakh crores worth from imported crude oil. There is a real possibility of getting this done in the next three to eight years. This would require innovations and new technologies, a policy that encourages to latest technologies and to make effort by the Indian industry to achieve global competition through acquiring the necessary scale and innovative technology.

IV. INDIAN POLICY ON ELECTRIC-VEHICLES

India is also adopting its own Electric-Vehicle policy as the other countries are doing the same. Electric-Policy is something which is unique for

each country and it is not shared between the nations. The growth of Electric-Vehicles in India has increased from 53 in 2001 to 167 in 2015. Auto-Segments of India are quite different from other nations. Based on past years data, the vehicles on Indian road consists of

1. Motor-Cycle: 80 percent
2. larger goods vehicles: 3 percent
3. four-wheelers: 12 percent
4. Premium four-wheelers: 2 percent

India should adopt to new technology advancements are other nations are ahead of India. The manufacturing leadership and technological establishment should be the next priority. India has a chance to take the leadership role in electrification of small vehicles. Our Indian market is supportive for electrification and its high-level sharing. Sharing mobility has increased very drastically and changing the way India travels.

A. Policies launched by Government:

- 1) 2011 March - National Board for Electric Mobility and National Automotive Board were approved
- 2) 2013 January -National Electric Mobility Mission plan 2020 future roadmap was made
- 3) 2015 April -FAME India Scheme was launched
- 4) 2016 March -Govt Declared that it aims to attain 100 percent E-mobility by 2030
- 5)2017 April -NBEM was introduced to formulate and propose the short-term and long-term plans
- 6)2018 August -Approx. Rs. 5,500 cores were released for second phase of FAME scheme

V. INDIAN SCHEMES ON ELECTRIC-VEHICLES

A. NATIONAL ELECTRIC MOBILITY MISSION PLAN 2020

This scheme was launched in 2013 with the aim of achieving national fuel security and promoting EV and Hybrid Vehicles. NEMMP scheme is a road map to 2020 was Government is planning to deploy 5 to 7 million EV in the

country. If this scheme goes according to the plan by 2020 the vehicle emissions in India will be reduced to 1.3 percent. Around INR 20,000 – 23,000 Crores will be invested by then.

B. FAME INDIA SCHEME

Faster Adoption and Manufacturing of Electric and Hybrid Vehicles in India is popularly known as FAME India scheme. This scheme launched subsidy to 11 cities for launching electric vehicles. These cities include Ahmedabad, Bangalore, Delhi, Hyderabad, Jaipur, Lucknow, Indore and Kolkata. These nine cities we given subsidy to launch 40 buses each while Jammu and Guwahati will get 15 buses.

C. E-RICKSHAW SCHEME

Government introduced this scheme in 2014, which will help in financing and development of battery rickshaws in the country. E-Rickshaw count from 4,000 in 2010 has increased to 1,00,000 in 2014 which makes this scheme as huge success.

VI. MAKING ELECTRIC VEHICLES AFFORDABLE

Around the globe when people hear about EV's they over-estimate the price of the vehicle. But, in fact shifting from gasoline-powered vehicles to Batter powered save us a lot of money and it decreases the amount of carbon emission. Many middle-class and lower-middle-class families can save money for healthcare. The Indian government has to make sure that EV's are at affordable prices by providing subsidies and many other schemes. India is famous for its entry-level affordable cars and the only market without a genuine electric vehicle. EV's market share is around 0.06%, compared with over 30% in the number of developed nations and government. Our nation has to start adopting new technologies in building EV's and to develop more efficient batteries at affordable prices. There are few countries where the vehicle manufacturers 40% all-in subsidies.

EV battery costs are dropping and they will keep falling. The financial analysts predict that the purchase of EV will be the same or less compared to gasoline cars by 2030. The manufacturers in India has to start building the EV's production and the government has to take measures to provide better infrastructure for them. If they follow this automatically the EV's will gain economic scale and will be more affordable in India.

India adds 4000 Crore to boost the infrastructure and manufacturing units. If this goes accordingly India will not depend on China by 2030 and make sure that EV's are at affordable prices for everyone.

VII. BATTERY DEVELOPMENT IN INDIA

The battery is device which converts chemical energy contained in it active materials directly into electric energy by means of an electrochemical oxidation-reduction (red ox) reaction. The electrons generated by this reaction flows from one material to another via electric circuit. In the year 1800 Alessandro Volta invented first battery. Which made a revolutionary around the world supplying power to electronic devices to the E-vehicles. The electrical energy developed is used as the fuel to run the electric motor. Firstly, the lead-acid is used in e-vehicles, in modern Li-ion batteries are in use.

A. DEVELOPEMENT OF BATTERIES WHICH ARE USED IN E-VEHICLES

- Lead acid
- Nickel cadmium (Ni Cd)
- Nickel Metal Hydride (Ni Mh)
- Lithium-ion

B. LITHIUM-ION BATTERY

The new and modern battery used in E-vehicles is li-ion battery, its features are the main reason for selection of these batteries by companies.



Fig.1 Li-ion Battery Pack

Fig.1 shows an Li-ion battery pack.

- Maintenance free.
- Longer life cycle service.
- High charge acceptance for rapid recharge.
- Improved thermal management and higher efficiency with minimum wastage and balancing cells.
- Indicates battery percentage and damage of battery.
- Designed for parallel and series operation.
- To produce the same energy by batteries li-ion are lighter in weight.
- Faster charging and discharging rates.
- Easy to charge.
-

C. BATTERY MANAGEMENT SYSTEM

The BMS is an electronic device which controllers all the single Li-ion cell in maintaining it to perfect balancing and to manage every cell produces same amount of output. Functions of BMS are:



Fig. 2 BMS

Fig. 2 shows an Batter management system.

- It monitors voltage, temperature, state of charge or depth of discharge, state of power, health of battery, coolant flow etc.. .
- Thermal management.
- Computation (calculating the charge current limit (CCL), discharge current limit (DCL), total operating timing, total no. of cycles).
- Communication The central controller of a BMS communicates internally with its hardware operating at a cell level, or externally with high level hardware such as laptops or High-level external communication
- Protection from over loads, over current, over flow, over temperature.
- Optimization and load circuit.

List of Few Lithium ion Battery Manufacturers in India:

- ISRO
- AMAR RAJA BATTERIES LTD
- HBL POWER SYSTEMS
- EON ELETRIC LTD
- EXIDE INDUSTRIES
- TATA CHEMICALS
- SUZUKI MOTOR CORPORATION & TOYOTA MOTOR CORPORATION
- BHEL
- ADANI GROUP
- National Aluminium Company Limited (NALCO), Bhubaneswar and more..

VIII. MOTOR DEVELOPMENT IN INDIA

The motor is electronic machine which converts electrical energy into mechanical energy by batteries in E-vehicles. In E-vehicles motors are the engine to drives the vehicles. First electric motor was invented by Thomas Davenport of Vermont in the year 1834, Joseph Henry and Michael Faraday have created early motion devices by using the electromagnetic fields. The early motors created by using spinning disks or levers that rocked back and forth. The efficiency of IC engine is 50 to 65% where as in electric motor efficiency is 90% even may up to 97%. A DC motor is usually supplied through a slip ring commutate. AC motors commutation can be achieved by using either a slip ring commutation or external commutation, can be fixed-speed and/or variable-speed control type, and can be synchronous or asynchronous type. Universal motors can run by either AC or DC. E-vehicles can be finely controlled and provide high torque from resting position, unlike internal combustion engines they do not need multiple gears to match power requirements. In E-vehicles the use gearboxes and torque converters can be eliminated.



Fig. 3 MotorwithAxle

Fig. 3 Shows an picture of motor attached to the axle.

A. MOST COMMONLY USED MOTORS IN EV

- AC motor

- DC motor

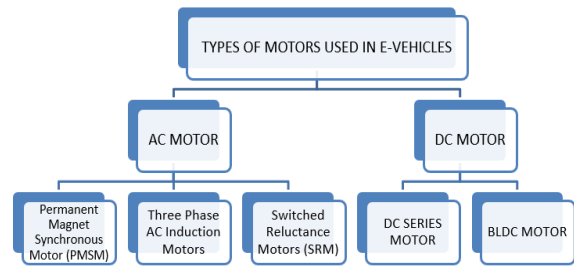


Fig. 4 Motor Classification

Fig. 4 shows the classification of types of motors used.

B. MOTOR WITH CONTROLLER

The modern companies are manufacturing the motors along with their compactable controller. The controller is used to control, monitoring, feed backing the entire vehicle. The use of controller is must in the modern E-vehicles since all the vehicles are manufactured to run at high speeds. The advantages using controller along with motor.



Fig. 5 Controller

Fig. 5 shows an picture of motor controller.

Advantages of using a motor controller:-

- The speed of response is relatively steady.
- Closed loop electric circuit can obtain.
- This is to avoid the rash driving on roads.

- The vehicles will be moved according to speed limit of locating roads.
- System can be modified with GPS to identifiers the zones

C. MOTORS MANUFACTURING IN INDIA

In India till now there is no manufacturing company that produces the only electric motors for e-vehicles. Till now there are only company that produces e-vehicles but all the electric motors are imported from other Countries. In India there are huge demands for such motors if one could start such industries then Indians can get these motors at better price and also it is a good scope in manufacturing industry. In India there more than 4,00,000 registered E-vehicles and till there so many people which are converting IC vehicles into electric vehicles, all of them are purchasing the motor from other countries mostly from China at higher prices. If these motors and controllers are manufactured in India the people can get the product at lower price, fast time and economy of India and person of the company can be increased.

IX. CONCLUSIONS

India has so much to acquire in the EV industry. Its oil import gets reduced. EV's will decrease air pollution and helps a lot to retain the nature that is lost. The main thing which India can reduce is its gasoline usage and which can reduce so much of investment for trading in oil from gulf countries. This is the real responsibility of the government and the start-ups to make sure that this thing happens by the end of 2030. Central govt has to try it's best in implementing this ev technology for more affordable amount which is suitable for all categories of population

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