

“THE PROGRESS OF ELECTRIC VEHICLE”

Rishabh Jain¹

¹PG student, VelTech University, Avadi, Chennai, India

Abstract - The development of electric vehicles (EV's) has been chosen as the strategy for the solution of rising air pollution and the energy consumption all over the world. The electric vehicles initiative (EVI) is the multi government policy which is totally focused on accelerating the introduction and adoption or implementation of the electric vehicles all over the world. EVI the multi government policy includes the different members from different continents of the world with the total of 15 members from Asia, Europe, Africa and North America as well. The progress made by EV's all over the world was done and the reviews were evaluated. The technological roadmap of traction battery, fuel cells, battery types, battery life, and electric motor was made for EVs in past few years was concluded. Now based on the reviews made, the different technological roadmaps were evaluated and all the existing problems with EV's and the upcoming future challenges were proposed out. We found out the present scenario of the electric vehicles and the market scenario of the electric vehicles all over the world.

Key Words: Electric vehicle, Electrically operated vehicle, EV.

1. INTRODUCTION:

Electric vehicles for the use in the transportation has boosted up the energy efficiency, so now it requires no direct fuel for the combustion and can fully depend on electricity – this is the most important energy carrier, which is contributing to a wide range of transportation policy goals. These include the great amount of energy to be secured, much better air quality, reduced noise or very less amount of noise, and also have reduced the greenhouse gas emissions. Electric Vehicles can create and have created the great competitiveness in the industry of automotive sector, so this EV's have the great potential of attracting the investors from the market which could lead to develop the future of automotive industry towards the electrification.

The electric vehicles have recently occupied the demand of customers in the recent years with the growing market in the automotive industries. With the great support of market and investors, the development of electric vehicle is not going down in coming decades. But the increased sales and demand of market, the manufacturing cost of batteries can go very down, which is the major cost effecting area of the electric vehicles. The reduction of cost in the electric vehicles will also increase in the competitiveness with the internal combustion engine vehicles. This will also lead to the more investment in shares of the all modes of electric vehicles in all domains.

The recently developed reports have shown the influence of electric mobility and its rapid evolution which has future

aspects of the electrification and implementation of the policy developments. Also the electric vehicles will make a great impact on the transportation sector by reducing the harmful emissions which are produced currently due to the use of petroleum products. The recent reports show that there were more vehicles running on petroleum products in past years, but now since last couple of years the reports have been changed with the increase in hybrid & electric vehicle. The current scope is towards the hybrid vehicles but the future is based on electrification.

2. LITERATURE REVIEW:

Kaushik Rajashekara [1] in his paper he has described the current automobile status divided among the electric vehicles and other vehicles. He has discussed and compared the different components of electric vehicles like the electric motor, powertrain in electric vehicles, power electronics systems and these all based on the lithium air cells and battery

Rui Xiong [2] has discussed about the huge investment made by the market on the development of electric vehicles to reduce the use of the petroleum products which cause the huge reduction in the air pollution. But still we are working on the development of lithium ion batteries which have the huge impact on the storage of energy and also about the management of energy which has to be used via lithium-ion batteries. He has also discussed about the motor control system and the wireless charging issues faced or will be upcoming in the future. He has covered his interest in the topics like: power electronic system and the development of electronic motor drives, the heat management, the battery packing and spacing, improving the traction control, wirelessly transferring the power in the electric vehicle, introducing the electric drive in the heavy-duty and off roading vehicles, also the electrification in the vehicles used for transportation

Ramesh C. Bansal [3] from the BITS Pilani has discussed briefly about when was the first electric vehicle introduced to the current trends and progress made. The main area which is consistently been improved and upgraded is the component which is the heart of electric vehicle, which stores all the energy i.e. the battery pack. As he has mentioned that the introduction of electric vehicles has created the impact on the internal combustion engine vehicles as the electric vehicle are also known as the zero emission vehicles. These electric vehicles don't have the tail pipe as there is no combustion taking place in the vehicle so they are also called as the environment friendly vehicles. As discussed in his paper the new progress which is made is electric vehicles is on the battery management system (BMS), new technologies in the batteries, the improvement

in the aerodynamics and also the safety as these electric vehicles will be rolling around the streets of the city.

Naoki Shinohara [4] has briefly discussed about the wireless power transmission system in the electric vehicles. He has discussed about the different technologies used in wireless transmission like: inductive coupling, resonance coupling and also some wireless power transmissions through the microwaves.



Fig - 1: The live field experiment carried out for the inductive coupling used in the wireless power transmission system for electric vehicle.

In his paper he has discussed about the previous done research and development and the current research and development going on the wireless power transmission system.

Su Y. Choi [5] in his paper he has classified the wireless electric vehicle into two different parts and those are: vehicles powered roadways and the other is stationary charging of the electric vehicles. These two are the main emerging trend for the future transportation. The power transmission depends upon the capacity, efficiency of the vehicle, electro-magnetic flux, present air gaps, size, also weight of the vehicle, and the wireless transmission system so these have been improved by the virtue of innovatively developed semiconductor switches, better design of the coil, construction of the roadways and with the higher operating frequency.

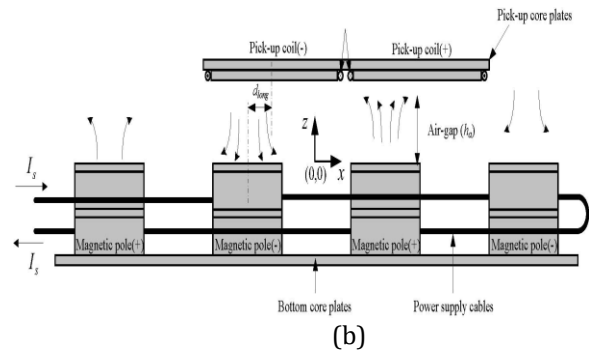
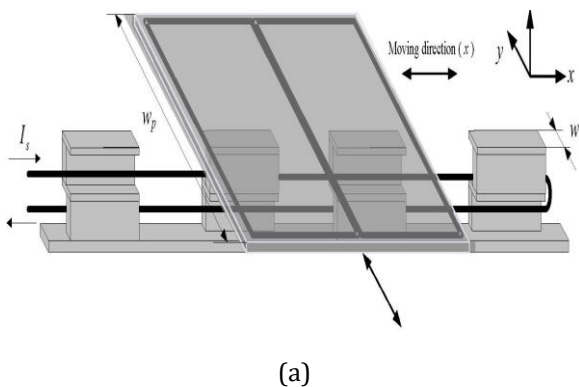


Fig - 2: Given is the ultra-slim S-type power rail and the coil is flat pick-up for the inductive wireless power transmission system.

(a) : Bird's eye view.

(b) : Side view.

These are the technologies discussed for improvement in the roadways powered electric vehicle. This image shown is of the S-type power supply rail used for the development of roadways powered electric vehicle.

Dr. CHOKRI MAHMOUDI [6] the author describes about the power management in the electric vehicle. Today the electric vehicles can be driven and powered by different sources given as: single source or combination of multiple sources with different algorithms to find the optimum results. In his paper he has described about the power management in all the sub-category and the future research direction.

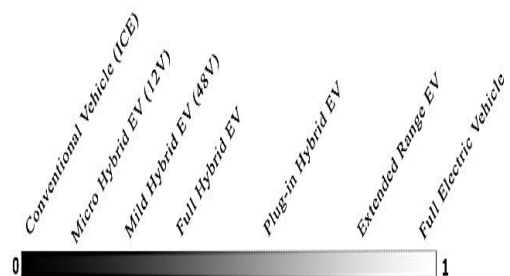


Fig - 3: Degree of electrification

The electric vehicles are classified into three types:

- Battery electric vehicle & All electric vehicle: these uses high capacity batteries and also uses the electric motor for the propulsion.
- Hybrid electric vehicle & Plug-in hybrid electric vehicle: (HEV) in this the low speed mechanical electric motors are used specially for the in-city traffic. (PHEV) it comes with the external charging system.
- Range extended electric vehicle: the high capacity motor drives the vehicle propulsion. It's very less consumption of fuel gives it the name of range extender.

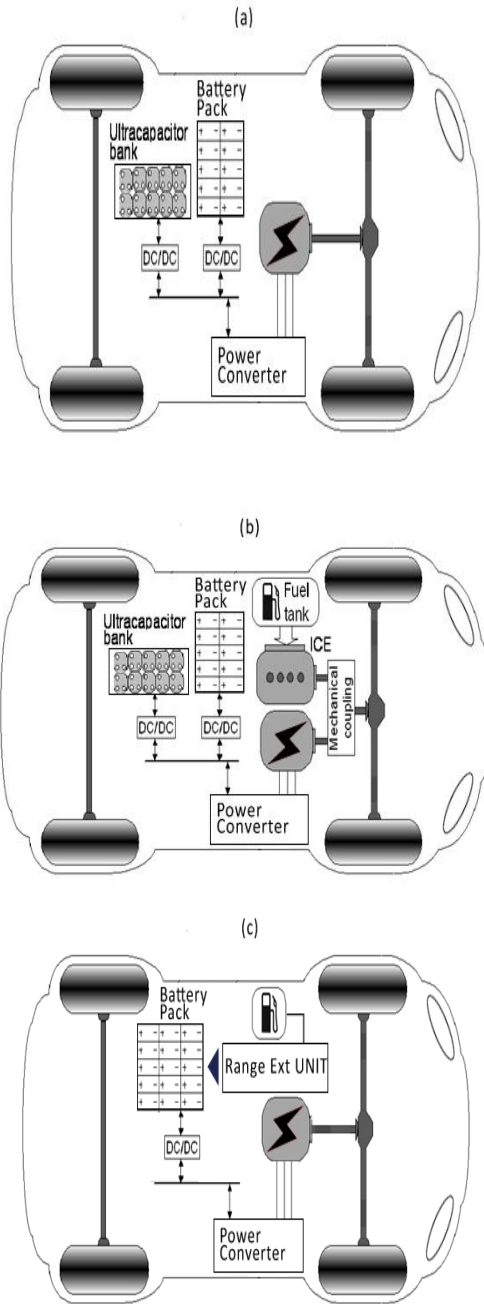


Fig - 4: these are the simplified drivetrains of the electric vehicles given as follows:

- (a): Battery electric vehicle
- (b): Hybrid electric vehicle
- (c): Range extended electric vehicles

He has also discussed about the future research on the power management.

Sergio Manzetti [7] has described about the battery technologies associated with the electric vehicles. Green technologies name itself is associated with the electric vehicles, as the electric vehicles are the zero greenhouse gas emission vehicles also the fuel economy is better than the petroleum based vehicles. Also discussed about the issues and problems which came in the recent reports that says that the disposals and waste management of these batteries requires huge investment so currently stated as not a feasible option.

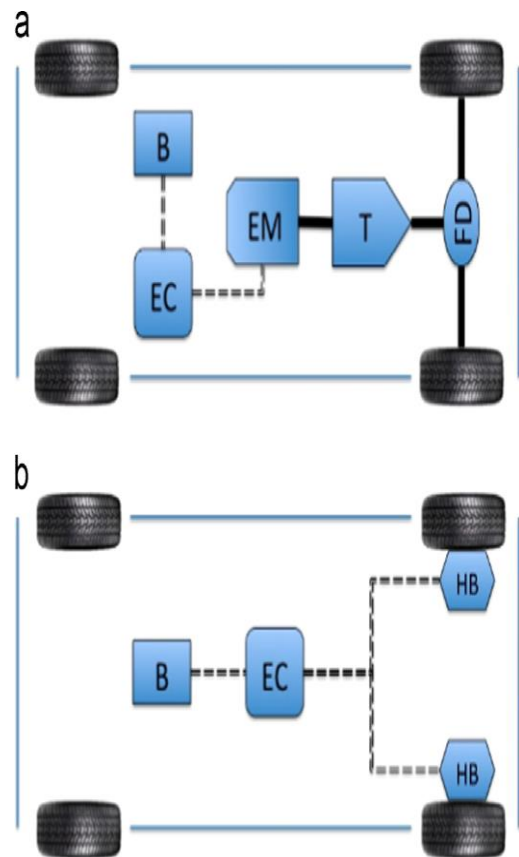


Fig - 5: Types according to the construction of 2 wheels drive battery electric vehicle. Notations in figure are mentioned below:

- (a): vehicle with single electric motor
- (b): vehicle with the hub-motors
- (B): Battery
- (EC): Electronic control
- (EM): Electronic motor
- (T): Transmission system
- (FD): Differential
- (HB): Hub motors in the electric vehicles.

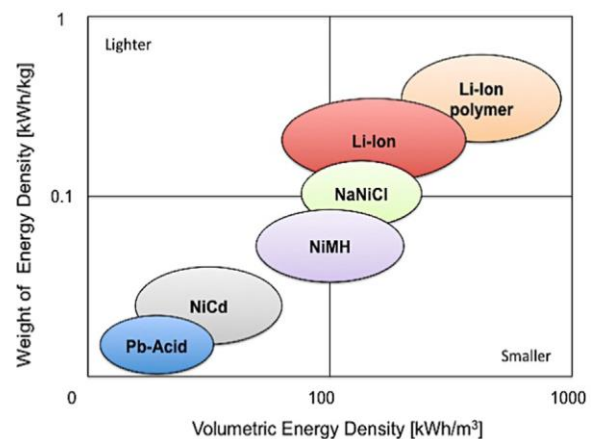


Fig - 6: the shown diagram is of the types of battery and energy density efficiency (Weight / Volume).

Ryan Sprague [8] in the paper he has discussed about the best usage of the battery technology in the all types of

vehicles like: internal combustion vehicle, hybrid electric vehicle and fully electric vehicle. He has also discussed about all the benefits and the challenges arriving in the electric vehicle adoption. The advancement in the battery pack design and the improved and upcoming technologies for the charging of batteries with the better infrastructure has led to the better driving experience of drivers with the awareness of technologies and the potential of the vehicles. He has also discussed about the different batteries and their storage levels.

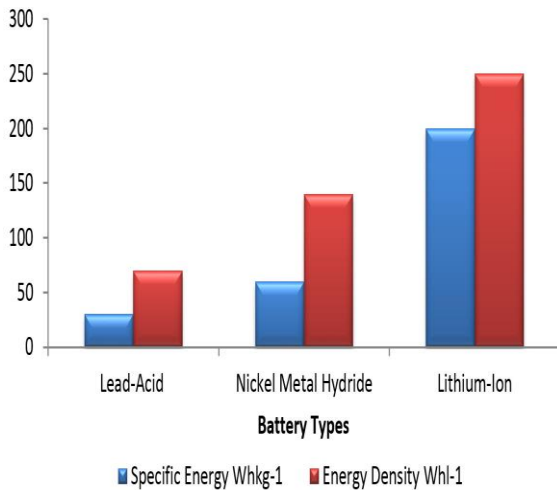


Fig - 7: Comparison between the different storage level of lead-acid battery, nickel metal hydride battery, lithium-ion battery in two parts: specific energy and energy density of these batteries.

In the image above the different energy storage levels of different batteries are shown.

Qianqian Zhang [9] discussed about the rapid increase in the growth of electric vehicle due to the exploitation of the oil resources in the world. The battery technologies is the vast area of improvement in the electric powered vehicle, so the author discussed about all the batteries and their structures and UC technologies.

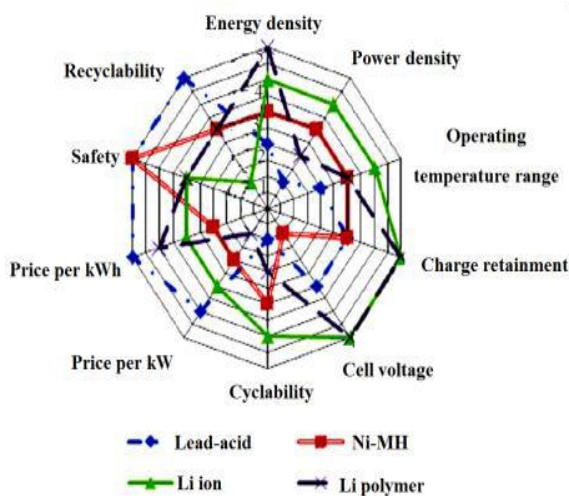


Fig - 8: comparison of different batteries attributes and the UC technologies.

In the battery powered vehicle the portion of patent are shown in the figure by the author given below:

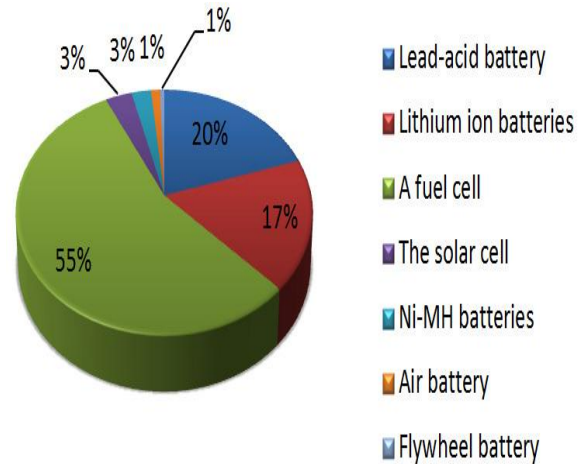
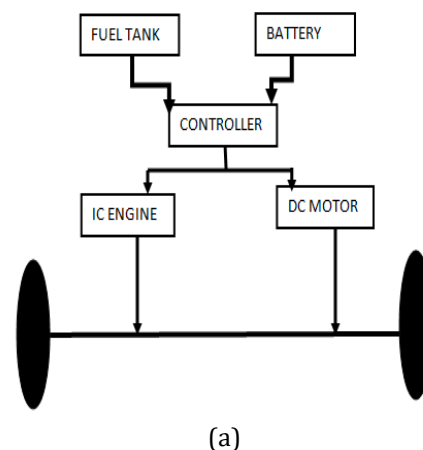


Fig - 9: comparison of batteries.

Laurence Kavanagh [10] in his paper he has discussed about the use of lithium in industries and the electric vehicles. We all know that the most important component of the electric vehicle is the battery pack so it is very important to know about the battery which is used the most i.e. lithium ion battery, this is also considered as the green energy storage. The increasing cost of the lithium powered battery is the major concern of the feasible energy resource. Lithium powered vehicle has the very low carbon economy and also has developed the wide field of research. He has also discussed about the lithium source developed country and the developing countries for the lithium source in the electric vehicle.

Yash Lethwala [11] in his paper he has described about the current progress in hybrid electric vehicle and also to move towards the electrification in the automobile vehicles. He has made the two-wheeler converting it to the hybrid electric from the petrol vehicle and also he has discussed about moving from hybrid to the electric vehicle. His experimental setup is shown below:



(a)



(b)

Fig – 10: in the figure shown above (a) the flow chart developed by the author, (b) experimental setup of the author

The author has developed his data for making the setup and the successful working model.

3. RESEARCH AND ANALYSIS:

The development and progress of the electric vehicles has been the major concern and the need of an hour. This is important as the increasing pollution and effects of the greenhouse gases has made the real concern to shift from the petroleum products to the electrification in vehicle. The electrification in the automotive industries has made the huge impact on the market for attracting the investors to take up the market of electric vehicles.

According to the current research we saw that the main areas of development was the heart of the electric vehicles i.e. battery of electric vehicle. The first electric care came in 1830 invented by Joseph Henry with the DC motors and developed the first car in the Dutch town. Till date there are many research work conducted on the battery technology, which included the BMS battery management system, battery technology, types of batteries, etc.

There is different classification of electric vehicles and these are classified into the following:

- Electric vehicle
- Hybrid Electric vehicle
- Range extended electric vehicle
- Mild electric vehicle
- Plug-in hybrid vehicle, etc.

In all over the world rate of use of electric vehicle has been increased from the very low percentage to good percentage. The Electric car stock all over the world has reached to 3.2 million, which is huge figure.

In 2013 the stock was 0.4 million, 2014 it was 0.7 million, 2015 it was 1.25 million, 2016 it was 1.99 million, 2017 it was 3.2 million and in all these the major contributors were

China, Europe, United states of America. China is globally ranked number 1 for its highest sales of the electric vehicles then comes is United States. If we talk in terms of market shares Norway is the world leader.

The progress made till date is the advancement in the battery pack, battery technology and the types of battery to be used for the automotive purpose. The types of battery are: lead-acid battery, nickel cadmium battery, lithium air battery, lithium-ion battery, etc. the most widely used in the electric vehicles is the lithium ion battery. Today the companies are manufacturing their own lithium ion cells and battery packs according to their needs and their vehicle design for example: Tesla motors have designed its own battery pack for its vehicles. And from the current sources we have come to know that the Ashok Leylands are also designing their own battery pack for their upcoming electric vehicles. The Ashok Leylands is also working towards the electrification of automobile industries.

The use of nano-technologies has played a major role in developing the battery pack design and also by adding up the numerous years to the battery life.

4. CONCLUSION:

After going through the many research papers of different authors I came to know the major progress made in the electric vehicle. The most of the research work done was on developing the battery and battery pack design for the best use of the electric vehicle and also delivering the best of mileage and efficiency to the costumer. We saw the rapid increase in the sales of electric vehicle in last few years. Also in future the progress which has to be made will be going on to improve the lifetime of battery and also the waste management of the battery. So I conclude will saying “The Electric Vehicles will take on the future of Automobile”.

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