



COMPARISON OF ELECTRIC VEHICLE TO THE INTERNAL COMBUSTION ENGINE VEHICLE AND ITS FUTURE SCOPE

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ABSTRACT

Internal combustion engines are run on fossil fuels and it causes so many problems on environment and people. Electrical vehicles have many advantages over the gasoline engine vehicle. Therefore automotive industry is moving towards Electrical vehicles (EV). Solar energy is clean and inexhaustible energy and is a universal source of energy. Therefore the usage of solar energy is increasing and thus batteries of the Electrical vehicles are re-charged using solar radiation. Solar vehicles started developing before many years, and still the researches are going on to make it more effective. This proposed paper shows the comparison of the Electrical vehicles to the internal combustion engine vehicles. Advantages and Disadvantages of the Electrical Vehicles are also shown in the paper. In addition, the overview of the history of the Electrical Vehicle and the future technology is also discussed.

Keywords: *Comparison, Effective, Electrical Vehicles, Future scope, Internal combustion Vehicle*

I. INTRODUCTION

This paper discusses the better option of Vehicles in future, for the same purpose; Electric Vehicles are compared to the gasoline powered vehicles with their functions and operations. Advantages and the future scope is also discussed in following sections. Last few years of 90's saw the need of alternating fueled Vehicles due to increasing emission of the hazardous gases. The most Emissive gases are carbon Dioxides, carbon monoxides etc. These gases affect tremendously on environment and even on humans. During 1960s many attempts were made to create Electrical vehicles, to reduce importing crude oils from foreign.

Electrical Vehicles (EV) are eco-friendly which produce negligible pollution. Electrical Vehicles are considered as 97% cleaner than the gasoline vehicles. Electrical Vehicle is beneficial to the people in many ways. The cost of the EV is initially high but the maintenance cost is very low. Gasoline powered Vehicles are contributing hazardous gases to global warming and green house gases. While the electrical vehicles are comparatively cleaner.



II. HISTORY

The first Electric vehicle was built in between 1832 and 1839 in Scotland. Robert Anderson was the person, who built first crude electric carriage. Afterwards, Professor Stratingh of Groningen, Holland had started to design small scale electrical cars. In 1835, Electrical Car was produced by his assistance Christopher Becker. Those were the electrical cars based on the battery. American Thomas Devenport and Scotsmen Robert Davidson had used non-rechargeable electrics cell. They built electric road vehicles in 1942.

Storage battery based cars were produced till then, but the storage capacity of the battery was not so good. In 1965 Frenchmen Gaston plante made a new battery, which storage capacity was improved. Countrymen Camille Faure had further improved the capacity of battery in 1881. In 1964 GM's Engineering staff invented an Electrovaair. That car had a very good function and elements, were described as follow;

Motor: Three phase induction motor(oil cooled), 115 HP, 1300 rpm

Battery: silver-zinc battery pack, 512v

Inverter: DC to AC inverter using SCRs

Top speed: 80mph

Range:40 -80 mph

Vehicle weight: 3400 lbs

After that, GM's staff were joined to Union Carbide Corporation and demonstrated propulsion with fuel cells. They invented a new 'Electrovan'. The specifications are described as follow;

Motor: Three phase induction motor, 125HP

Battery: it was based on Hydrogen-Oxygen fuel cell system. Power capacity of 32kw and 160kw

Inverter: DC to AC inverter based SCRs

Top speed: 70mph

Range: 100-150mph

Acceleration: 0-60 mph in 30 seconds

Vehicle weight: 7100 lbs

In 1881, America was having a good supply of cars, they had electric, gasoline and steam based cars. Electric car had an advantage over gasoline and steam engine car; like no vibrations, smell and noise associated with gasoline cars. Electric car is having no gear facility. As we all know that changing gear is most difficult part of driving, it provides you no changing gear facilities. Even steam engine does not have changing gear, but they have very long start-up times on cold mornings. Despite of having these many benefits, somehow they appeared in 1935. From 1935 to 1960s were the dead years of the electric vehicles developments and for using as personal transportation.

The 1960s and 1970s saw a need for alternate the fuel vehicles to reduce problems of exhaust emissions from internal combustion engines. And to reduce the dependency on imported foreign crude oil. Many attempts were occurred from 1960s to the present.



There were two big companies who became leaders to produce Electric vehicles in 1973 to 1983. One of those was 'Sebring vanguard' and another was 'Elear Corporation'. From then wards, many companies had started producing and designing of Electric cars. In 1998 'Toyota' had invented 'RAV4 sport Utility', Chrysler EPIC minivan, Honda EU plus sedan. They all were equipped with advanced nickel metal hybrid battery packs.

III. DESCRIPTION OF ELECTRIC VEHICLE

Electric Vehicle is mainly run by electric motor. Battery packs are used to provide sufficient supply to the motor. Battery packs are usually rechargeable; which can be charge by renewable energy. Most of the electric cars same as gasoline cars, but rechargeable packs are used rather than internal combustion engine. Electric cars are considered as the silent cars. Electric Vehicle mainly consists of three elements.

- Electric motor
- Rechargeable battery packs
- Control system

Electric motor gets power from the controller of the vehicles. Motor is further connected to the wheels, due to which wheels rotate. The system is shown in figure 1. Controller of the Vehicle is connected to the battery packs, potentiometer, and DC motor. Controller is operated from the current coming from battery packs. The power is finally provided to the dc motor and which transmits it to rotate the wheels.

- **Operation of EV:** As shown in figure 1, when the driver accelerates the vehicle; resistance change occurs in the potentiometer. Potentiometer is directly connected to the controller. Therefore, potentiometer gives signal to the controller. Controller will decide how much power to provide, according to program stored. Proper power regulation has done by controller only. Appropriately controller gives the signal to the battery to get the power to deliver to the motor. The power then transmits to the wheels through the motor. The main importance role is played by the controller only, which decides how much power to take from battery to deliver. If one presses full pedal, controller will take full voltage from the battery to the motor. And if one takes off his/her leg from pedal, controller will take zero voltage from the battery. Thus, EV is running.

IV. COMPARISION OF ELECTRIC VEHICLE TO INTERNAL COMBUSTION ENGINE VEHICLE

Now, electric vehicle is compared to the internal combustion engine vehicle in table 1. Mileage, speed, range, efficiency, maintenance, cost are compared in the following. Following abbreviations are used; EV(electric vehicle), ICE(internal combustion engine).



	ICE	HV
Cost (on average)	\$14000 to \$ 17000	\$6000 to \$100000
Mileage	19.8 miles per gallon(mpg), it can go up to 300 miles before refueling the tank	Can go 100 to 200 miles before re-recharging
Efficiency	Converts 20% of the energy stored in the fuel to power the engine	It converts 75% of the chemical energy stored in the battery to power the vehicle
Speed(on average top speed)	120 miles per hour(mph)	30-95 mph
Acceleration	0-60 miles in 8.4 seconds	0-60 miles in 4-6 seconds
Maintenance	<ul style="list-style-type: none"> • Engine • Bodywork/painting • Electrical • Lights • Fuel/gas • Wheels 	Does not require as much maintenance

Table 1: Comparison of ICE To EV

V. ADVANTAGES OF ELECTRIC VEHICLE

- Electric vehicle is run on battery packs, therefore its main advantage is, energy can be harnessed from any source of energy to the battery. Solar panels and wind also can be used to recharge battery of the vehicle. Thus renewable energy is also used on the electric vehicle.
- Internal combustion engine vehicles take gasoline fuels to power up vehicles. Thus the emission of the hazardous gases like carbon dioxide, carbon monoxide, sulfur dioxide, sulfur monoxide etc. whereas electric vehicle uses electrical energy to run, so they don't emit any gases. Thus they reduce the environmental problems by 98%. Therefore, Electric vehicles are called cleanest vehicles.
- They even reduce pollution.
- As they do not produce any pollution, they are most suitable for the urban cities, where clean air is needed. They do not affect to human health.
- Global warming and green house effects also reduce, because they do not exhaust any harmful gases.

VI. DIADVANTAGES OF ELECTRIC VEHICLE

- EV run on battery packs, so one needs to charge it again and again. After short distance battery gets discharge. Therefore EV are limited to the short distances.
- If one uses accessories like air conditioning and radios, battery gets discharge soon.
- The weight of the car is high compare to other cars, as they consists of electric motor, controllers, battery packs.
- The cost of the Electric vehicle is so high compared to the internal combustion engine vehicles.

VII. FUTURE SCOPE

- In future, Lithium-ion phosphate (LiFePO₄) battery will mostly use in electric cars. Lithium-ion phosphate (LiFePO₄) battery is rechargeable, powerful and having a good capability to store energy, which is widely used in electric bikes and scooters nowadays. So if LiFePO₄ battery will use in Electric cars, efficiency and range will also increased.
- Researchers are going on to increase efficiency, range and top speed of the EV. Photovoltaic plates or wind power capacity can be installed with the EV, which can produce electric energy from renewable energy and that also can be used to re-charge the battery again. By this we can increase the range also.
- Photovoltaic plate is having 13-17% efficiency, but research is already going on to increase efficiency up to 42%, which is major advantage to the Electric vehicle.
- In future, super capacitor or ultra capacitor can be used to store high amount of energy; which is so helpful to increase range. Super capacitor and ultra capacitor have high capacity of storing energy.

VIII. FIGURES

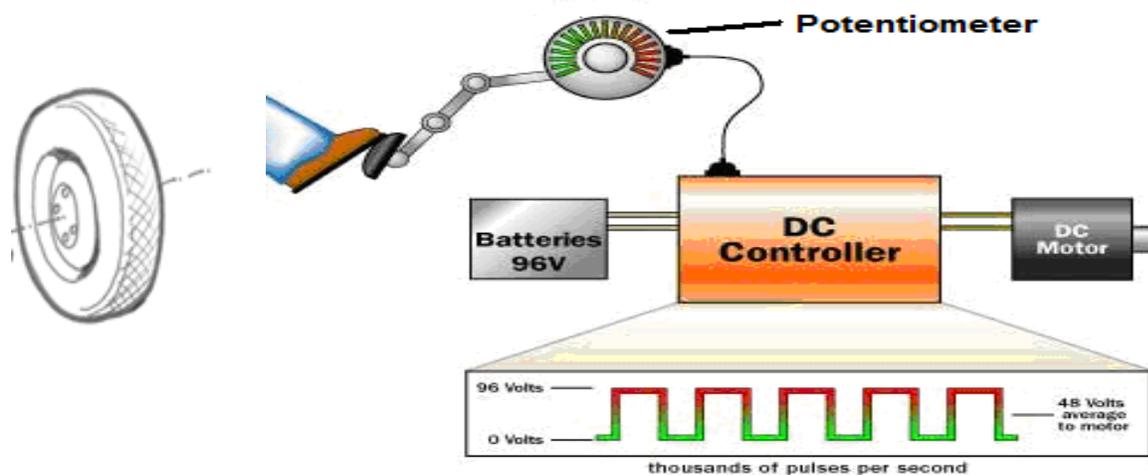


Figure 1; Electric vehicle system



IX. CONCLUSION

As the paper showed the history, future scope of the EV and comparison with the ICE; Electric Vehicle's is promising. EV is so reliable vehicle. It is beneficial to the humans and more efficient. It is a clean vehicle so it does not affect to the environment or human life. Although it has so many disadvantages, many researches are going on to overcome this disadvantages. Thus future of Electric vehicle is so bright.

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