

Hybrid Vehicle: A New Era of Transportation

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Abstract

With arrival of the 21st century the human civilization has come across new problems. The problems they have never faced before and the seeds of these problems were sown a long time ago. It was the dependency of humans on the fossil fuel that led us to the problems like Global Warming, Climate change and energy crisis. But as said necessity is the mother of all invention. With the problems and the lack of fossil fuel the hunt for new source of energy began. With all the green sources of energy discovered the fact was clear that we know to convert most of them into electrical energy. So a new system of transport had to be developed that uses electrical energy. Here in this paper we will have a look on the history of the transportation, the need for the electrical vehicles, their working, the innovations and their impact around the globe along with the challenges they will face ahead. The paper will also discuss the working and function of “Electrical Vehicles” and “Plug in Hybrid Vehicles”. The paper will conclude the advantages and disadvantage of hybrid and electrical vehicles, regenerative braking, Hydrogen fuel cell, types of propulsion system and how it will change our way of living in the future.

Keywords: *Global Warming, Climate change, Electric Vehicles, Plug in Hybrid Vehicles, Regenerative Braking, Hydrogen Fuel cell, propulsion system*

INTRODUCTION

The invention of the first internal combustion engine in 1876 by Nikolas Otto brought a revolution in the Automobile and Transportation industry. Due to the ease of transporting the goods and people from one place to another at such a fast pace and less effort vehicles using IC engine flooded the markets and open new opportunities for the people and the market itself. As the petroleum was easy to transport and store it soon become the main source of fuel for these vehicles [1]. With the Ford Motor Company introducing the Model T in 1908 and making these vehicles affordable to common man the streets were soon filled with these vehicles and increasing the demand of the fossil fuel. Soon the other side of the technology was to be revealed.

These automobile were dumping huge amount of CO₂ (Carbon Dioxide) and CO (Carbon Monoxide) into the atmosphere. Also it was soon clear the fact that the reservoirs of these fossil fuel won't last long and development in the IC engines were made along with it research were conducted in search of alternative to fossil fuel [2].

Many clean source of fuel were identified such as solar energy, tidal energy, Wind energy etc. By the technology we are

having now we know to convert these into electrical form. The invention of electric motor by William Sturgeon in 1832 has also made its way through time and it's highly advance from having high efficiency was now available. Electrical energy has also been available for long time and a grid to transport this energy was developed since 1882. All these lead us to develop a vehicle which will run on electric power supply and produce zero emissions [3].

The technology which will play significant role in changing the face of the automobile will be "Hydrogen Fuel Cell" and "Lithium Ion Battery". Where the Lithium Ion Battery takes more time to charge and travels less distance the hydrogen fuel cell can travel more distance but it is not easy to store hydrogen and also it is not economical to produce hydrogen [4].

To increase the range of these vehicles the companies were forced to reduce the weight of these vehicles and design them aerodynamically so as to create less drag when travelling against wind. Developments were made to reduce the charging time and ways to produce and store hydrogen were developed [5].

Hybrid Vehicles

A hybrid vehicle is one which uses more than one means of propulsion system. That means combining a petrol or diesel engine with an electric motor. We broadly classify these vehicles into 3 types. They are as follows

Electric Vehicles

These are the vehicles that completely run on electric power supply only. These are not hybrid vehicles. They use only electric propulsion system that is they use an electric motor along with a lithium ion battery to run. The battery is charged at the power stations and in many cases is also interchangeable.

ADVANTAGES

- 1) These types of vehicles produce zero emissions.
- 2) As there is no IC engine they running is noise less.
- 3) These vehicles have high acceleration.
- 4) 4) These vehicles use regenerative braking technology.

DISADVANTAGES

- 1) These vehicles do not have long range.
- 2) Lithium Ion batteries can easily catch fire.
- 3) They require long time to charge.

- 4) The capacity to store charge decreases with time.

Hybrid Vehicles

These vehicles use a combination of two or more propulsion systems to run. Like for example a car with an IC engine running on diesel and also a battery that stores the charge to run the electric motor. Generally in these vehicles initially the vehicle runs on the battery but if the system detects that the battery is low it will start the diesel engine and along with running the vehicle the diesel engine will also recharge the battery and when the battery is fully recharged the system will again cut off the diesel engine and the car will run on the battery again.

ADVANTAGES

- 1) The vehicles provide better economy than the regular IC engine vehicles.
- 2) These vehicles have better range than the completely electric vehicles

DISADVANTAGES

- 1) As these vehicles uses IC engine they produce some amount of emission.
- 2) As they use more than 1 propulsion system the no of components involved are more thus increasing the cost.

Plug in Hybrid Vehicles

These vehicles as that of other hybrid vehicles uses more than 1 propulsion system. But these vehicles unlike the other hybrid vehicles can be charged through external source. These vehicles use a lot of sensors and a program that decides the propulsion system to be used for the maximum efficiency. Like the hybrid vehicle when the battery is completely charged the vehicle will run on electric battery and when the battery is low it will start the diesel engine and will charge the battery simultaneously.

If the vehicle is climbing on a hill the sensors will detect the load and would start

the diesel as well as the electric motor to give the maximum power. These vehicles also use regenerative braking technology to save energy and charge battery thus increasing the efficiency.

ADVANTAGES

- 1) Has a lot more range than any other hybrid car and is lot more efficient.
- 2) The battery can be charged using an external power source and even can be replaced in some cases.

DISADVANTAGE

These vehicles are very sophisticated and complex. They require software integration with hardware and thus increase the cost.

Table 1: Types of Hybrid Based on Power

	Micro	Mild	Full
Power(KW)	2.5	10-20	30-50
Voltage Level(V)	12	100-200	200-300
Energy Saving (%)	5-10	20-30	30-50
Price Increase (%)	3	20-30	30-40

CLASSIFICATION OF HYBRID VEHICLE BASED ON STRUCTURE

Series Hybrid

In series Hybrid the IC engine is directly connected to the generator. The generator converts the mechanical energy in to electrical energy and this electrical energy is sent to the electric motor which is coupled to the transmission, from the transmission the power is sent to the wheels.

CONCLUSION

The above research is carried out to review the latest technological development in hybrid vehicles. The paper also focuses on the working of these vehicles along with the challenges the technology will face in the future. The promising fuel of the future the hydrogen fuel cell or Lithium Ion Battery. The ways to increase the range of these vehicles and increasing their efficiency and also making them economical.

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