CHOICE OF BATTERIES FOR ELECTRIC VEHICLE APPLICATIONS

Battery powered Electric Vehicles are starting to play a significant role in today's automotive industry. There are many types of batteries found in the construction of today's Electric Vehicles, being hard to decide which one fulfils best all the most important characteristics, from different viewpoints, such as energy storage efficiency, constructive characteristics, cost price, safety and utilization life.

Due to the limitations of oil, automotive industries are developing alternatives to fuel vehicles. Out of all the possible solutions that don't use petroleum, electric vehicles have become the most viable option. When electric vehicles are concerned, the most important thing that comes to our mind is electric storage.

Energy Storage:

Simply, energy storage is the device in which it stores, delivers- in terms of discharge, and accepts- in terms of charging the energy.

Energy storage systems are essential for electric vehicles, which come in the form of different types of batteries. Battery type can vary depending on the types of vehicles whether the **vehicle is a battery-electric vehicle or a plug-in hybrid electric vehicle.** There are some requirements and factors which should be fulfilled in an automotive application such as an ideal battery like specific energy and power, energy density, self-discharging rate, operating temperature, number of the life cycle, efficiency, cost, and environmental adaption.

As we have seen, most electric vehicles use one type of battery but there are also other different types of batteries that have been proposed for electric vehicles. 4 Types of Batteries Used in Electric Vehicles in India. There are 4 types of batteries that are used as energy storage in electric vehicles, mainly including -

- Lithium-ion batteries
- Lead-acid batteries
- Nickel- Metal Hydride batteries
- Ultracapacitors

Lithium-ion batteries:

Over recent years, **Lithium-ion batteries** have rushed in popularity. Lithium-ion batteries are better than other batteries because

- of their high energy per unit mass relative to other electrical energy storage systems.
- They also have a high power-to-weight ratio, high energy efficiency, good high-temperature performance, and low self-discharge.
- Most components of lithium-ion batteries can be recycled.

Lithium-ion batteries have higher energy densities than lead-acid batteries or nickel-metal hydride batteries, so it is possible to make the battery size smaller than others while retaining the same storage capacity.

Lead-acid batteries:

Lead-acid battery technology is still in the development phase advancing. These batteries have a comparatively wide operating temperature range and have low energy density. They are easier to recycle. About 95% of the content of the battery can be reused, which is better for the environment. Lead-acid batteries have a relatively low depth of discharge so it directly impacts

their cycle life. These batteries tend to be expensive because they don't last as long so they often need to be replaced within 4 to 15 years depending on their type. Lead-acid batteries do not discharge more than 30-40%. Which typically go on to damage the battery.

Nickel- Metal Hydride Batteries:

In a Nickel-Metal Hydride battery, one pole has Nickel alloy whereas another pole has Nickel oxyhydroxide with the electrolyte of Potassium hydroxide. It is usually slower to charge and discharge the battery, and it contains less power per weight so it takes a longer time to charge the battery. In extreme heat Ni-MH batteries can deteriorate faster. This makes Ni-MH less ideal. These batteries have a wide operating temperature range. They are also reliable and safe. Ni-MH batteries have a typical cycle life of over 3000 cycles. They are environmentally friendly. The voltage provided by Ni-MH is 1.2 V. This technology has replaced Ni-Cud technology. These batteries are widely used in automotive batteries, computers, medical instruments as well as equipment, and electric razors.

Ultracapacitors:

Unlike batteries, Ultracapacitors hold the charge as static energy. They can provide a higher current so they have a far higher specific power. Ultracapacitors don't have any heating problems. The main advantage of ultracapacitors is that they can do millions of charging cycles. They are already used in multiple applications for instance in buses, trains, and microgrids. Nevertheless, these technologies will continue to improve and over time we might see changes in electric vehicles.

Battery Electric Vehicles (BEVs) have become a significantly feasible option in the automotive marketplace for consumers. Having a low self-discharge rate, and outstanding specific energy, it appears that variants of Li-ion batteries are now the leading type that is mostly utilized in BEVs. Meanwhile, lead-acid and Ni-MH batteries do not appear to be suitable for use, though these batteries are still frequently utilized in some electric vehicles.