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An Initiative to Electric Vehicle

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ABSTRACT: In an industrialized society, we are developing ourselves in great tempo from basic needs application to future needs supplication. But it also affecting mother nature namely Global warming. There are many causes for global warming by and large emissions from transportation. Different sectors within transportation have different emissions. Conventional petrol and diesel engines emit carbon dioxide (CO_2), carbon monoxide (CO), nitrous oxide (NO_x), particulate matter (PM), unburnt hydrocarbons (UHC), CH_4 , sulfur oxide (SO_2). Emission affected-

- rise in 26 to 82cm of sea level by 2100
- more frequent extreme weather (hurricanes, storms, drought, floods)
- less freshwater
- spread of diseases especially respiratory diseases and conditions
- change in ecosystem and extinction of some species.

We can deal with this issue escorting by operating the electric mode of transportation. We can make use of EV passenger cars, E-buses, E-trains, E-Aircrafts, E-Heavy Duty Vehicles, E-bikes. A vehicle with an energy source other than the traditional ICE (Internal Combustion Engine), for example, batteries, fuel cells, supercapacitors along with others, and powered by an electric motor is noted as an electric vehicle. Electric vehicles have zero or fewer emissions than an ICE at any point of driving but to make electric vehicles with high performance and specification is also challenging. In this paper, I will introduce you to battery specifications and battery management in electric vehicles.

I. INTRODUCTION

A vehicle with an energy source other than the traditional ICE (Internal Internal Combustion Engine), for case, batteries, energy cells, supercapacitors along with others, and powered by an electric motor is noted as an electric vehicle. An electric vehicle is a vehicle that's exhaustively or partly propelled by electric motors, using energy stored in rechargeable batteries. The first practical electric automobiles were produced in the 1880s. Electric automobiles were popular in the late 19th century and early 20th century. Innovation and advanced development in internal combustion machines (ICE ICE) and mass affair of cheaper gasoline vehicles have led to a decline in the use of electric vehicles. Electric vehicles (EVs EVs) are a promising technology for achieving a sustainable transport sector in the future, due to their low to zero carbon discharges, low noise, high edge, and elasticity in grid operation and integration. Electric vehicles are hourly presented as a technology option with the capability to redound in significant reductions in conservatory gas (GHG GHG) discharges and exhaust TRAP, and so potentially redounding in beaucoup health benefits. Notwithstanding, a really small number of studies assayed to quantify the reduction in TRAP and advancements in public health for different EV screenplays, and these were reviewed fro (Goldson Goldson etal., 2018). It's also clear that overall air quality benefits can not be achieved unless electricity used for charging these vehicles is generated by clean energy methodologies, correspondent as solar, wind, and hydro. In multifold regions, there's a lack of progress with electricity decarbonization which significantly limits the implicit flow and air quality benefits of EVs.

Electric vehicles have low running costs as they have minimum moving land for preservation and are also really environmentally friendly as they use little or no fuddy-duddy powers (petrol petrolpetrol or diesel). While some EVs used lead-acid or nickel-stuff hydride batteries, the standard for new battery electric vehicles is now considered to be lithium-ion batteries as they have lesser life and are excellent at retaining energy, with a natural- discharge rate of just 5 per month. Despite this perfected efficaciousness, there are still challenges with these batteries as they scheme

- i. Incentives-
 - Can be in form of road tax reduction, toll charges, free parking, and loan.
- ii. National Electric Mobility Mission Plan (NEMMP), 2013-
 - promoting hybrid and electric vehicles.
- iii. Faster Adaption and Manufacturing of Electric Vehicles (FAME 1), 2015-
 - Launch to encourage induction of EVs, 795 crores.



- iv. Faster Adaption and Manufacturing of Electric Vehicles (FAME 2), 2019 -
 - The outlay of INR 10,000 Cr over 3 years from 1st April 2019
 - 86% allocated for the demand of EVs
 - 7000 E-buses
 - 10 Lakh E-2 wheelers
 - 5 Lakh E-3 wheelers
 - 55,000 E-4 wheeler passenger cars
- v. Delhi Electric Vehicle Policy, 2020-
 - Waive off registration fee and road tax
 - Subsidy of up to 1.5 lakh

EVSE (electric electric electric electric-powered car inventory dive) consists of the electrical dive outside to the EV that gives a connection for an EV to a power supply for charging and is ready with superior functions like smart metering, cellular functionality, and community connectivity. EVs include Plug Hybrid electric motors (PHEVs PHEVsPHEVs PHEVs) and Hybrid electric motors (HEVs HEVsHEVs HEVs) in addition to pure battery-electric cars (BEVs BEVsBEVs BEVs). PHEVs use both petrol/ diesel and electricity. those automobiles have two strength systems, an inner combustion motor, and a battery. The battery may be recharged by plugging the vehicle into an outside source. HEVs combine conventional ICE structures with electric-powered propulsion structures. They use regenerative deceleration to convert energy that is mostly wasted throughout deceleration into strength. This strength is saved in a battery. traditional petrol/ diesel automobiles and Compressed natural gas (CNG CNGCNG CNG) motors contribute to particulate incomes that is a major cause for vehicular rested earnings. Battery-operated cars have zero tailpipe and noise inflows. exclusive types of electric cars changed and are advanced continuously giving junkies and feasible junkies selections. present the world is inchmeal familiar with the terms BEV, HEV, PHEV, and FCEV. There are 4 (4) forms of electric powered automobiles, with the following:

- 1.1 Battery Electric Vehicle (BEV)
- 1.2 Mild Hybrids (MHEV)
- 1.3 Hybrid-
 - Hybrid Electric Vehicle (HEV)
 - Plug-in Hybrid Electric Vehicle (PHEV)
- 1.4 Extended Range EV (EREV)
- 1.5 Fuel Cell Electric Vehicle (FCEV)

An EV has a forward freehearted cost of procurement as compared to its ICE counterpart. Notwithstanding, the cost of charging, maintaining, and operating an EV is lower than the ICE vehicle which in turn reduces the TCO of an EV. For illustration, Tata Tigor and Tata Tigor EV have been considered for figures. Tata Tigor has a claimed range of 20 km per liter. Assuming, the guidance of 100 km, it would consume around 5 liters of petrol. Assuming the cost of petrol of INR86.95 per liter, as of 08 Feb 2021. Hence, the cost of traveling 100 km is INR434.75. Tata Tigor EV, with a total battery capacity of 21.5 kWh, the total cost of charging the EV would be 21.5 kWh x INR4.5 per kWh (Assuming EV home charging tariff for Delhi), i.e., around INR96.75. Hence it's more provident to operate an EV than an ICE vehicle.

Components of EV:

- Electric Propulsion System
 - Electric Motor (EM)
 - Inverter
 - Electric Controller
 - Power Converter (DC-DC & DC-AC Converter)
- Energy Source
 - Energy Source (battery, UC)
 - Energy Management System
 - Charging/Refueling Unit
- Auxiliary System
 - Thermal Management System
 - Power steering, Headlamps, wipers.

II. RELATED WORK

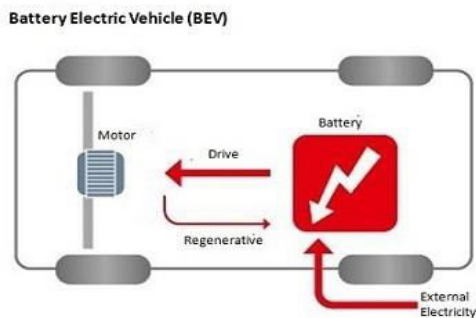
2.1 Battery Electrical Vehicle (BEV): -

A Battery electric-powered vehicle (BEV), additionally called All-electric powered automobile (AEV), runs totally on a battery and electric power educate. these styles of electric vehicles do now not have an ICE. energy is saved in a huge battery % that is charged employing plugging into the energy grid. The battery %, in turn, presents energy to at least one or greater electric-powered motors to run the electric vehicle.

➤ Components of BEV

- Electric motor
- Inverter
- Battery
- Control Module
- Drive train

➤ Architecture and Main Components of



➤ Working Principles of BEV

- strength is transformed from the DC battery to AC for the electrical motor
- The accelerator pedal sends a sign to the controller which adjusts the vehicle's velocity via changing the frequency of the AC electricity from the inverter to the motor
- The motor connects and turns the wheels thru a cog

➤ Examples of BEV

Volkswagen e-golf, Tesla version three, BMW i3, Chevy Bolt, Chevy Spark, Nissan LEAF, Ford recognition electric powered, Hyundai Ioniq, Karma Revera, Kia Soul, Mitsubishi i-MiEV, Tesla X, Toyota Rav4.

2.2 Hybrid

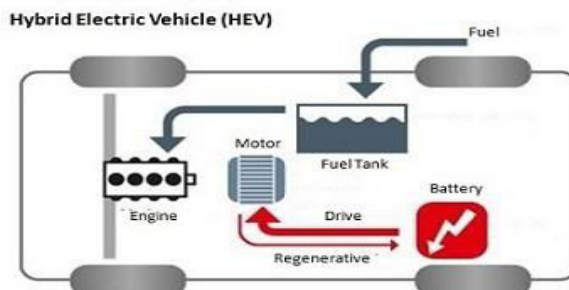
2.2.1 Hybrid electric powered automobile (HEV)

This kind of hybrid car is regularly called a widespread hybrid or parallel hybrid. HEV has an ICE and an electric-powered motor. In those kinds of electric vehicles, the internal combustion engine gets power from gasoline (gas and other kinds of fuels), even as the motor gets electricity from batteries. The gas engine and electric-powered motor concurrently rotate the transmission, which drives the wheels. The distinction among HEV compared to BEV and PHEV is wherein the batteries in HEV can most effectively fee by way of the ICE, the movement of the wheels, or an aggregate of each. there's no charging port so that the battery can't be recharged from the outdoor of the system, for example from the electricity grid.

➤ components of HEV

- Engine electric
- powered motor
- Battery
- p.c. with controller & inverter gas tank control module

➤ **Architecture and Main Components of HEV**



➤ **Working Principles of HEV**

- Has a gasoline tank that elements fuel to the engine like an ordinary car
- It also has a hard and fast of batteries that run an electric powered motor
- both the engine and electric powered motor can turn the transmission on at the same time

➤ **Examples of HEV**

Honda Civic Hybrid, Toyota Prius Hybrid, Honda Civic Hybrid, Toyota Camry Hybrid

2.2.2 Plug-in Hybrid Electric Vehicle (PHEV)

PHEV is a type of hybrid automobile that is both an ICE and a motor, regularly referred to as a series hybrid. This form of the electric vehicle gives a preference for fuels. This kind of electric-powered vehicle is powered by using conventional gasoline (together with gas) or alternative gasoline (such as bio-diesel) and with the aid of a rechargeable battery p.c. The battery can be charged up with electricity with the aid of plugging into an electrical outlet or electric car charging station (EVCS).

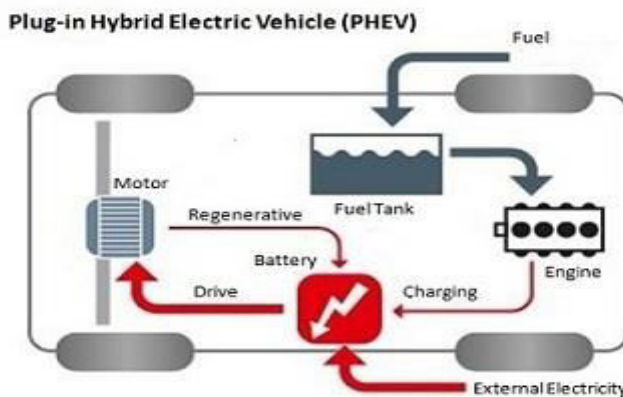
PHEV generally can run in at least two modes:

- All-electric Mode, wherein the motor and battery offer all the automobile's electricity
 - Hybrid Mode, wherein each strength and gas are employed.
- a few PHEVs can travel more than 70 miles on power alone.

➤ **Components of PHEV**

- Electric motor
- Engine
- Inverter
- Battery
- Fuel tank
- Control module
- Battery Charger (if onboard model)

➤ **Architecture and Main Components of PHEV**



➤ **Working Principles of PHEV**

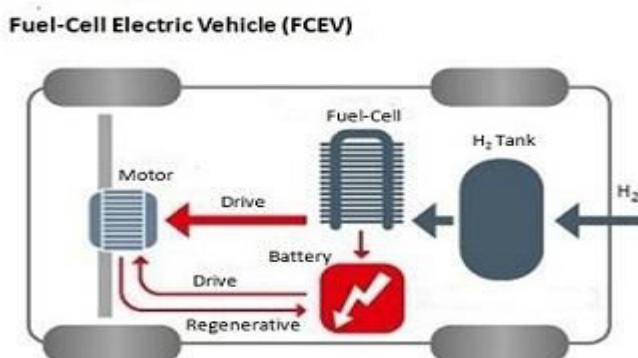
PHEVs usually begin-up in all-electric mode and operate on electricity until their battery percent is depleted. a few models shift to hybrid mode after they attain dual carriageway cruising pace, generally above 60 or 70 miles in step with hour. once the battery is empty, the engine takes over and the vehicle operates as a conventional, non-plug-in hybrid. in addition to plugging into an outside electric-powered electricity supply, PHEV batteries may be charged by an internal combustion engine or regenerative braking. at some stage in braking, the electric motor acts as a generator, the usage of the strength to charge the battery. the electric motor dietary supplements the engine's power; as a result, smaller engines can be used, growing the auto's gas efficiency without compromising overall performance.

➤ **Examples of PHEV**

Porsche Cayenne S E-Hybrid, Chevy Volt, Chrysler Pacifica, Ford C-Max Energi, Ford Fusion Energi, Mercedes C350e

2.3 Fuel Cell Electric Vehicle (FCEV)

Fuel cellular electric powered cars (FCEVs), additionally known as fuel cellular automobiles (FCVs) or 0 Emission cars, are sorts of electric-powered cars that appoint 'fuel cellular generation to generate the energy required to run the automobile. on this type of automobile, the chemical electricity of the gasoline is converted at once into electric power.

➤ **Architecture and Main Components of FCEV**➤ **Components of FCEV**

- Electric motor
- Fuel-cell stack
- Hydrogen storage tank
- Battery with converter and controller

➤ **Working Principles of FCEV**

The working principle of a 'fuel cell' electric car is different compared to that of a 'plug-in' electric car. This type of electric car is because the FCEV generates the electricity required to run this vehicle on the vehicle itself.

➤ **Examples of FCEV**

Toyota Mirai, Hyundai Tucson FCEV, Riversimple Rasa, Honda Clarity Fuel Cell, Hyundai Nexo.

2.4 Battery of EVs**1.1 2 wheelers-**

- TCO depends on usage
- Low/Medium speed 2W have lower TCO
- Usage should be more than 40km/day for high-speed E-scooters
- Examples-Ather 450X, TVS unique
- Range-85 km



- Charging time- 2h 40m
- Price- up to 1.45 Lakh
- 1.2 3 wheelers-
 - At the moment probably the best-incorporated market
 - Lead-acid battery to li-ion shift
 - E-autos have 15% lower TCO as compared to ICE autos
 - Example- Mahindra Treo
 - Range-130-170 km
 - Charging time-3h 50m
 - Price-1.77 Lakh
- 1.3 4 wheelers (Passenger cars)-
 - The electric cars sold at the moment in India have a higher upfront cost as compared to similar ICE variants
 - The RCO is still higher, about 10% for passenger cars due to the lower utilization per day
 - Example-Tata Nexon, Hyundai Kona
 - Range-312 km
 - Charging time-8h 30m
 - Price-14 to 16 Lakh
- 1.4 Commercial EVs-
 - They have large batteries
 - TCO is still higher than ICE driven vehicles (Buses, Pickup)
 - City E-bus have 40% higher TCO than diesel buses
 - Government subsidies help to breakeven the TCO
 - Example-eBuzz K6 (BYD-Goldstone)
 - Range-200 km
 - Charging at bus depots

III. TOPOLOGY OF ELECTRIC VEHICLE

Topology is the architecture or how the components are arranged(layout). They are Powertrain of EV.

- Types of EV architecture and sub-topologies:

1. Battery EV
2. Hybrid EV:
 - Series Hybrid
 - Parallel Hybrid
 - Series-Parallel Hybrid

1. Typical BEV Topology:

- Simple Layout
- Battery as a power source
- EM for propulsion
- Electrical to mechanical energy transfer
- Energy management system
- Power converters
- Transmission or fixed gearing

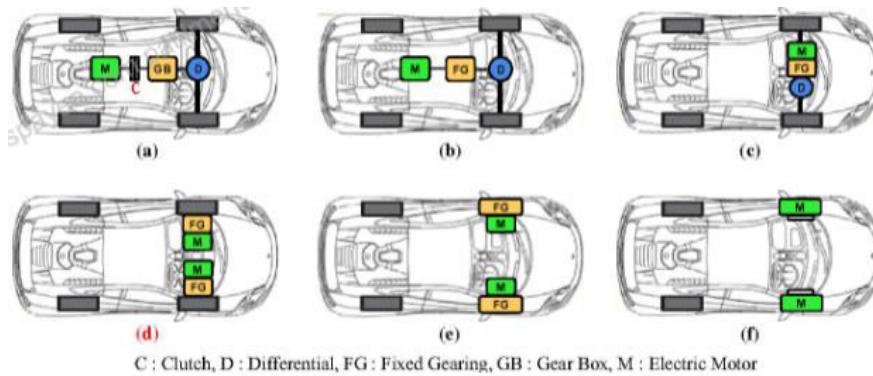


Fig.3.1: Possible topologies for a BEV

2. Typical HEV topology:

- The tractive system of a hybrid electric vehicle includes both an ICE and, at least, one electric machine.
- The number of possible hybrid topologies is very large, considering the combinations of electric machines, gearboxes, clutches.

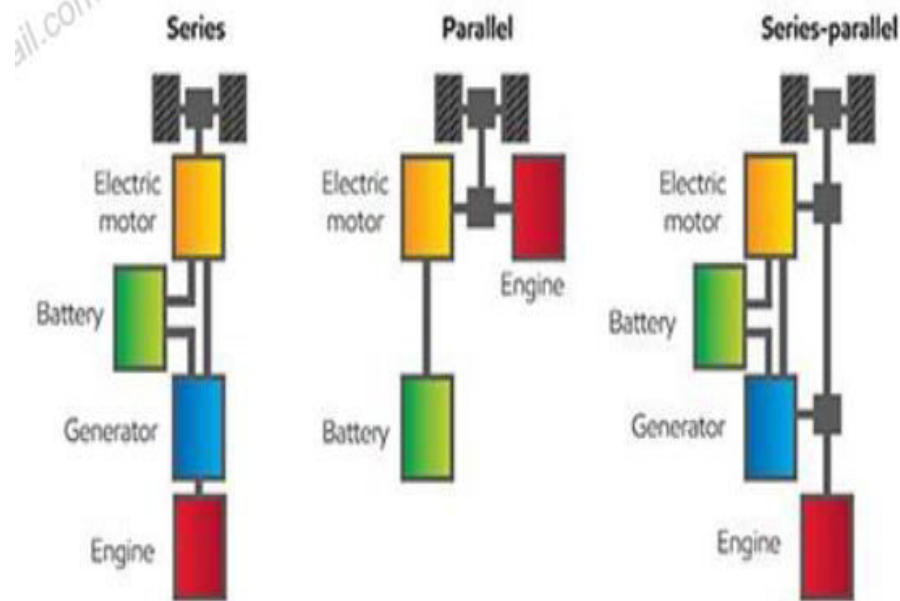


Fig.3.1: Hybrid car topologies

IV. THEORETICAL RESULTS

After studying topologies of Battery electric vehicles and Hybrid electric vehicles we can also distribute them with their Pros and Cons.

1. Battery Electric Vehicles (BEV)

Pros	Cons
<ul style="list-style-type: none"> • Very little maintenance is required • Extremely quiet 	<ul style="list-style-type: none"> • Not yet ideal for long driving due to limited battery range • More time-consuming in case of charging

2. Hybrid Electric Vehicles (HEV)

	Pros	Cons
Series	<ul style="list-style-type: none"> Mechanical separation of the engine thus ICE can run optional The complex transmission can be eliminated 	<ul style="list-style-type: none"> Heavy Efficient loss due to energy conversion from mechanical to electrical Expensive due to bigger battery
Parallel	<ul style="list-style-type: none"> Efficient power transfer Smaller traction motor and no generator required Cheaper than series hybrids 	<ul style="list-style-type: none"> ICE can't run optional Complicated transmission
Series-Parallel	<ul style="list-style-type: none"> The engine can run optional Efficient power transfer 	<ul style="list-style-type: none"> Complex construction Complex Controls

V. CONCLUSION

It's far very essential to mention that no car will ever be a hundred percent easy. The appearance of the electric car does not alternate that. What we're pronouncing is that if you need to use a vehicle, an electric-powered vehicle is the higher choice for the surroundings. However, the use of public delivery or honestly taking walks or biking to work will constantly be an awful lot higher for the surroundings. A vehicle is still a vehicle; changing one with any other type is not going to resolve delivery troubles like congestion. We already know that Internal Combustion Engines (ICE) vehicles are harmful to our environment also ourselves. As compared to ICE vehicles Electric Vehicles are far efficient and pollution-less cars. The same goes for hybrid cars which are more environmentally friendly than Internal Combustion Engines.

Electric motors are sincerely extra green than combustion engines, so the greater of the strength put inside the battery finally ends up getting used to pressure the automobile. Specifically, when riding in cities, electric automobiles waste much less electricity. Also, there are virtually no tailpipe emissions of air pollutants which include nitrogen oxides and debris. We still get particles from braking and tire wear, but overall there is less than from a petrol or diesel car. Electric vehicles also can bring down the noise, mainly at lower speeds they're much less noisy than conventional cars. Batteries are being engineered to have an extended existence. When hybrid cars become more widespread, battery recycling will become economically possible. Research into other energy sources such as fuel cells and renewable fuels makes the future look brighter for hybrid cars.

In a nutshell for now we can say those electric vehicles going to start an automotive revolution that will help us to save mother nature. Health-sensible, the principal advantage is related to air high-quality. You may nonetheless have some air pollution from the energy that goes into electric-powered cars however this usually comes from power stations that may have better pollution controls than you could put in force in a traditional automobile and are generally located further far from densely populated areas.

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