KAMARAJ IAS ACADEMY
Only IAS Academy by Grandson of "Perunthalaivar Kamarajar"

Hybrid Electric Vehicle

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Why is in news?

A crucial element of the world's transition to becoming net-zero is electric vehicles (EVs). In this milieu, hybrid EVs present a big opportunity for economically developing countries: while their power generation and grid capacity and reliability, the fraction of renewable sources in the power generation mix, and availability of fast-charging infrastructure are still less than ideal, hybrid EVs offer a way to begin the transition instead of waiting.

About Hybrid EV:

A HEV uses an internal combustion engine (ICE) (a petrol/diesel engine) and one or more electric motors to run.

It is powered by the electric motor alone, which uses energy stored in batteries, by the ICE, or both.

Net-zero for a vehicle:

Net-zero for a vehicle includes **emissions at both the tailpipe of the vehicle and at the power plant**. Making vehicles net-zero requires cutting emissions from both new and existing vehicles.

Types of EVs:

Any **vehicle propelled by an electric drivetrain**, taking electric power from a portable, electrical energy source, is called an **Electric vehicle** (EV).

Hybrid EV - an **internal combustion engine** (ICE) is used to produce electricity with an electrical generator. A **small batter**y, typically 1-5kWh, is used in a hybrid EV as an energy buffer to store the electricity. The **battery can't be charged from the grid**.

Full EV – a.k.a. **a battery EV or a plug-in EV** – has **no ICE** and hence no tailpipe emissions. The battery typically is much larger at 20-120 kWh. And it can only be charged from the grid.

Plug-in hybrid EV - is still a **hybrid EV with a much larger battery**, typically 5-15 kWh. This larger battery can also be charged from the grid. This means a plug-in hybrid operates like a fully electric vehicle as long as there is energy in the battery.

Fuel-cell EV - **uses a fuel cell to produce electricity** for the drivetrain together with a small battery buffer to manage variations.

Main Advantages:

Fuel Efficiency: Most vehicles with hybrid technology offer better fuel efficiency, more power, and minimum emissions.

Increased Mileage: The design of hybrid vehicles for reduced engine size and car weight as compared to ICE vehicles, translates into increased mileage to favour the demand for these vehicles.

Instant Torque: With the increase in total power and torque, HEVs can deliver instant torque and provide high torque even at low speeds.

Auto Industry Transition: The automotive industry is transitioning, with an increasing focus on hybrid and battery electric vehicles (BEVs or EVs).

The rise in fossil fuel prices, increase in the adoption of clean mobility solutions, and stringent government norms for emission control are driving the growth of the EV market.

Challenges:

Charging infrastructure - A successful transition to full EVs requires fast charging infrastructure along highways. This is vital because people generally want to own one affordable car serving both short and long distance travel needs, and want to drive without range anxiety.

Cost & Capital - The indicative prices for EV fast chargers are: capital cost of $5001,000/kW, service and maintenance at 5% per year; and an installation cost of around 50% of the charger cost.

Grid connection - many parts of the world, especially economically developing nations, don't yet have access to a grid or the grid isn't 100% reliable.

The Indian EV industry has been hit hard due to **rupee's dramatic depreciation** in recent months (Battery imports)

India does not have any known **reserves of lithium and cobalt**, which makes it dependent on imports of lithium-ion batteries from Japan and China.

High rate of GST on EVs when government is trying to promote EVs.

Way Forward:

Overcoming these challenges requires **concerted efforts from various stakeholders**, including governments, private companies, and international organizations.

Addressing the **fast-charging infrastructure**, **expanding access to reliable grids**, and **promoting research and development** to **reduce battery costs** are crucial steps towards enabling a successful transition to electric mobility worldwide.

Additionally, **supportive policies, incentives, and public awareness campaigns** can further facilitate the adoption of EVs and accelerate the shift towards a more sustainable and eco-friendly transportation system.