



# CURRENT AFFAIRS



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Date -3 Feb 2024

## HYBRID VEHICLES

THIS ARTICLE COVERS 'DAILY CURRENT AFFAIRS' AND THE TOPIC DETAILS OF "HYBRID VEHICLES". THIS TOPIC IS RELEVANT IN THE "SCIENCE & TECHNOLOGY" SECTION OF THE UPSC CSE EXAM.

### WHY IN THE NEWS?

HSBC Global Research recently published a note recommending that, over the next 5-10 years, India prioritise the adoption of Hybrid Vehicles as a Sustainable Mobility Solution before switching to full Battery Electric Vehicles. Hybrid vehicles combine a normal internal combustion engine and an electric propulsion system.

### KEY HIGHLIGHTS OF THE RESEARCH

- **Lower Carbon Emissions:** According to the research, hybrid vehicles presently emit less carbon than both electric and traditional internal combustion engine (ICE) vehicles for equivalent sized vehicles. Specifically, hybrids produce 133 g/km of CO<sub>2</sub>, and EVs emit 158 g/km. This analysis takes into account overall emissions, which include car emissions (tank-to-wheel) as well as emissions from crude mining, refining, and electricity generation.
- **Hybrids enjoy a decade-long advantage:** It shows that emissions from EVs and hybrids may take up to a decade to converge. During this time, hybrids are expected to be at least 16% less polluting than EVs.
- **Hybrids are a practical medium-term solution:** HSBC believes that hybrid and compressed natural gas (CNG) vehicles are viable medium-term solutions for India in the next 5-10 years as the country transitions to full electrification. The practicality is due to both the cost of ownership and India's decarbonisation ambitions.
- **Convergence of emissions:** According to the study, emissions from EVs and hybrids could converge in 7 to 10 years. This convergence is predicted to occur if India's non-fossil power generation share rises to 44%. Even at 40% by 2030, hybrids are expected to release 8% less CO<sub>2</sub> than EVs.
- **Challenges in Electric Vehicle Adoption:** It identifies barriers to widespread EV adoption, such as the necessity for upfront subsidies, the relevance of charging infrastructure, the source of electricity (mostly coal-fired in India), and reliance on the global lithium value chain for battery production.

### ABOUT BATTERY ELECTRIC VEHICLES (BEVS)?

- BEVs are electric vehicles powered by high-capacity batteries. They do not have an Internal Combustion Engine (ICE) and emit no exhaust pollutants. BEVs use electric motors to power the wheels, resulting in rapid torque and smooth acceleration.

- BEVs use modern battery technology, specifically Lithium-ion batteries. Li-ion batteries provide higher energy density, longer range, and better performance.
- **Charging Infrastructure:** BEVs need a network of charging stations to recharge their batteries. Charging infrastructure consists of several types of chargers:
  1. Level 1 (Household outlets).
  2. Level 2 (Dedicated Charging Stations)
  3. Level 3 (dc fast chargers).
- Public charging stations, workplaces, and residential structures all contribute significantly to the expansion of the charging infrastructure.

## CHALLENGES IN ADOPTION OF BATTERY ELECTRIC VEHICLES

- **Upfront Cost and Subsidies:** The success of EV adoption in countries like Norway and the US is attributed to state subsidies. In India, tax breaks and subsidies tend to benefit the middle or upper middle classes, posing a challenge in ensuring equitable distribution and reaching a broader demographic.
- **Charging Infrastructure:** Unlike leading EV adopters such as China and Norway, India faces a significant shortage of operational charging stations for its growing EV market. The dominance of two- and three-wheelers with diverse charging requirements further complicates the situation. The article suggests that investing in charging infrastructure is more effective than providing upfront purchase subsidies.
- **Supply Chain Issues:** Concerns are raised about the global concentration of the supply chain for crucial components like lithium-ion batteries. With more than 90% of lithium production concentrated in a few countries and other key inputs sourced from specific regions, India's dependence on imports raises stability concerns for the supply chain.
- **Consumer Awareness and Education:** Lack of consumer awareness about the benefits of battery electric vehicles (BEVs) and misconceptions regarding capabilities, charging infrastructure, and overall cost-effectiveness hinder adoption. Consumer preferences for internal combustion engine (ICE) vehicles based on brand loyalty, resale value, and comfort, coupled with limited knowledge about EV benefits, further contribute to the challenge.

## ABOUT HYBRID VEHICLES

Hybrid vehicles revolutionize transportation by seamlessly **combining internal combustion engines with electric motors**. The integration of these power sources enhances fuel efficiency, reduces emissions, and elevates overall performance. **Some of its key features are:**

- **Dual Power Systems:** Integration of internal combustion engine and electric motor. Enables independent or combined power, ensuring versatility in diverse driving conditions.
- **Regenerative Braking:** Electric motor acts as a generator during deceleration or braking. Converts kinetic energy into electricity, stored for future use, enhancing energy efficiency.
- **Fuel Efficiency:** Electric motor assists the internal combustion engine during acceleration. Reduces engine workload, leading to better mileage and decreased reliance on traditional fuels.
- **Reduced Emissions:** Contributes to environmental sustainability by lowering emissions. Electric motor use during low-speed or idling reduces greenhouse gases and pollutants.
- **Different Hybrid Types:** Various configurations like parallel, series, and plug-in hybrids. Offers simultaneous, electric-generated, or externally charged driving options.

- **Battery Technology:** Incorporates advanced batteries (NiMH or lithium-ion) for energy storage. Lightweight, durable, and powerful, ensuring efficient electric motor performance.
- **Transition to Full Electric Mode:** Some hybrids operate in full electric mode for short distances at lower speeds. Particularly beneficial in urban settings, emphasizing emissions and noise reduction.

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### 1. Non-plug-in hybrid EVs (HEVs)

Instead of using an external plug to charge the vehicle, the electricity generated by the HEV's braking system is used to recharge the battery. This is called 'regenerative braking' and is also used in BEV's, PHEVs and FCEVs.

Petrol

### 2. Plug-in hybrid electric vehicles (PHEVs)

Powered by a combination of liquid fuel and electricity. They can be charged with electricity using a plug but also contain an internal combustion engine that uses liquid fuel.

Petrol Electricity

### 3. Fuel cell electric vehicles (FCEVs)

Use a fuel cell instead of a battery, or in combination with a battery or supercapacitor, to power their electric motors. FCEVs are typically fuelled by hydrogen and usually provide greater range than BEVs.

H<sub>2</sub> Electricity

### 4. Battery electric vehicles (BEVs)

Fully-electric, meaning they are solely powered by electricity and do not have a petrol, diesel or LPG engine, fuel tank or exhaust pipe. BEV's are also known as 'plug-in' as they use an external electrical charging outlet to charge the battery

Electricity

## STEPS TAKEN TO ENCOURAGE ELECTRIC VEHICLES

- The **National Electric Mobility Mission Plan (NEMMP) 2020** aspires to ensure national fuel security by encouraging hybrid and electric vehicles across the country. The ambitious goal is to sell 6-7 million hybrid and electric automobiles each year beginning in 2020.
- The **GST-Goods and Services Tax** on electric vehicles and chargers/charging stations has been decreased from 12% to 5% and 18% to 5%, respectively.
- The **Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)** plan, launched in 2015, intends to encourage electric mobility by providing financial incentives for improving electric transportation infrastructure.
- **FAME 2** – It was launched in 2019 with a budget of 10,000 crores to stimulate demand for Electric Vehicles (EVs) by offering upfront subsidies and developing EV charging infrastructure.

## PRELIMS PRACTICE QUESTIONS

**Q1) Consider the following statements:**

- 1) The inverter play in an electric vehicle Converts Direct Current to Alternating Current
- 2) Plug-in Hybrid Electric Vehicle is a type of electric vehicle that uses both an internal combustion engine and an electric motor
- 3) In a hybrid vehicle, the term “full electric mode” imply Operation without an internal combustion engine

**How many of the above statements are correct?**

- a) One
- b) Two
- c) Three
- d) None

**ANSWER: C**

### **MAINS PRACTICE QUESTION**

**Q1) Discuss the environmental impact of widespread electric vehicle adoption. Consider factors such as reduced emissions, resource extraction for battery production, and the overall sustainability of electric transportation.**

**Himanshu Mishra**

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