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Hybrid Vehicles

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Why is in news? Why hybrid vehicles could be a cleaner solution for India than EVs, at least for the next 7-10 years

India needs to “embrace” hybrid vehicles over the next 5-10 years on the way to full electrification, HSBC Research has said. Such vehicles are the more practical medium-term solution for the country’s decarbonisation efforts and, more importantly, less polluting, according to the note.

Currently, **overall carbon emissions are lower in hybrids** compared to both electrics and those that run on petrol and diesel for similarly proportioned vehicles. In fact, it could take as long as a decade for EV and hybrid vehicle emissions to come to the same level.

Hybrid EVs:

Hybrids have **both an internal combustion engine and an on-board electric motor**, with the two systems working in tandem to provide motive power.

Countries everywhere, including India, are pushing toward electrification.

In India, Tata Motors, Mahindra & Mahindra and Hyundai Motor have been betting big on EVs.

But passenger car market leader Maruti Suzuki has taken a **more conservative approach**, with no battery electric vehicle in the market so far. Maruti has, however, **prioritised hybrids** in its portfolio in partnership with Toyota Kirloskar.

The Centre currently **offers clear tax incentives** for primarily one category of cars, with practically all other vehicular technological platforms clubbed together towards the upper end of the tax bracket.

India’s **electric mobility plan** is largely focussed on battery electric vehicles or BEVs replacing internal combustion engine (ICE) vehicles. Li-ion is seen as the most viable battery option for now.

Advantages of Hybrid EVs:

Fuel efficiency: A hybrid EV’s **fuel economy is 1.5-2x times higher than in conventional ICE vehicles** for city driving and **1-1.5x times higher for highway driving**.

A PHEV combines the best of both hybrid and full EVs. Using a small battery (5-15kWh) that can be charged from the grid offers **3-4x higher fuel economy** than conventional vehicles.

The purchase price of hybrid cars is **only 5-15% higher than conventional vehicles** and is independent of the vehicle range.

Hence, hybrid EVs are an **alternative to full EVs (in the short-term)**, given the power generation and grid capacity-reliability, the fraction of renewable sources in the power generation mix, and availability of fast-charging infrastructure in developing countries.

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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.

Why does HSBC believe hybrid vehicles are a good medium-term solution?

There is a **long-standing belief** that hybrid and compressed natural gas cars are a **practical medium-term (5-10 years) solution for India**, while the country moves towards eventual electrification.

Hybrids are **critical not just from a cost of ownership perspective**, but also for India's decarbonisation drive.

The total (wheel-to-wheel, or WTW) carbon emissions from an EV is currently 158 g/km, compared to 133 g/km for hybrids — which means that a hybrid is **at least 16% less polluting than the corresponding EV**. These numbers are 176 g/km and 201 g/km for corresponding petrol and diesel vehicles respectively.

This analysis does not focus only on tailpipe emissions, but includes vehicle emissions (tank-to-wheel, or TTW) and emissions from crude mining, refining, and power generation as well.

For how long is this situation expected to hold?

EV and hybrid emissions could converge after 7-10 years, according to estimates made by the HSBC analysis.

The **non-fossil share of power generation** in India in FY23 was **26%**, and the blended Indian power generation emission was 716g/kWh. According to the note, total emissions from hybrid cars and EVs will converge if non-fossil power generation in India moves up to 44%.

By 2030, even if India's share of non-fossil fuels is 40%, hybrids will **still release 8% less emission than EVs**, which, however, will be half of the 16% of today, the note said.

Challenges for hybrid vehicles:

In a price-sensitive market like India, one of the major challenges for HEVs is the **high vehicle cost**. Battery increases the cost of the vehicle, making it pricier than vehicles powered only by an ICE.

Requires power levels of 50-350 kW for cars and up to 1,000 kW for heavy-duty vehicles. **Lack of fast-charging discourages full EV adoption.**

India's road to a fully-electric ecosystem still has a few hurdles – **inadequate infrastructure**, lack of high performing EVs .

The **absence of a robust manufacturing ecosystem** for the materials associated with the EV revolution, coupled with the concentration of the supply chain in certain regions.

As India struggles to make inroads into the **global lithium value chain**, there is discussion on the **need to diversify the country's dependency on Li-ion batteries** in the EV mix. The demand for Li-ion batteries from India is projected to grow at a CAGR of more than 30% by volume up to 2030, which translates to more than 50,000 tonnes of lithium requirement for the country to manufacture EV batteries alone.

Role of Hybrid EVs in decarbonization:

Hybrid EVs, both **full and plug-in**, offer a **practical and cost-effective solution** to lower emissions in the interim.

They drastically **reduce fuel costs, emissions, and oil imports** with higher fuel economy in electric mode.

Regenerative braking and engine start-stop mechanisms further improve fuel economy in hybrid EVs.

Hybrid EVs can **match several benefits of full EVs regarding emissions** and performance without requiring large batteries.

Way Ahead:

Regenerative braking in hybrid EVs (recovering the kinetic energy of the vehicle) can improve fuel economy in urban areas and in hilly conditions.

An **engine start-stop mechanism** can also save fuel at traffic junctions and in heavy traffic.

The above steps will not only help to improve fuel economy of hybrid EVs, it will also help in net emissions reduction.

Conclusion:

Hybrid EVs provide an important transition strategy for economically developing countries. They offer fuel economy and emissions benefits while addressing the challenges of limited grid access and high vehicle costs. Full EVs remain the ultimate goal, but in the short term, hybrid EVs present a practical and sustainable solution towards net-zero emissions in the transport sector.