HYDROGEN FUEL: ECONOMY

NEWS: Hydrogen versus battery: The cost of clean public transport

WHAT'S IN THE NEWS?

Hydrogen Fuel Cell Electric Vehicles (FCEVs) are emerging as a faster, cleaner alternative to Battery Electric Vehicles (BEVs), especially for long-range and cold-climate use. India, leading in global electric 3-wheeler sales, is expanding its EV ecosystem while evaluating FCEV viability.

1. Context and Emerging Trends in Sustainable Transportation

- As global transportation systems shift towards **decarbonization and sustainability**, multiple green vehicle technologies are emerging.
- **Battery Electric Vehicles (BEVs)** have led the global electric mobility revolution so far.
- However, Hydrogen Fuel Cell Electric Vehicles (FCEVs) are now being considered as a viable alternative, especially in sectors where BEVs face performance limitations.

2. Battery Electric Vehicles (BEVs) – Features

- BEVs are powered by electricity stored in lithium-ion batteries.
- These vehicles require **external charging infrastructure**, which connects to the **electric grid**.
- **Recharging time** depends on charger capacity:
 - Regular home charging may take 6–12 hours.
 - Fast chargers can recharge to 80% in **30–60 minutes**.
- Emissions: BEVs are **zero-emission at the tailpipe**, but lifecycle emissions depend on electricity source (renewables vs coal).
- Limitations include long charging times, heavy battery weight, and reduced efficiency in cold climates.

3. Fuel Cell Electric Vehicles (FCEVs) – Features

- FCEVs generate electricity **onboard using hydrogen gas** through a chemical reaction in a fuel cell.
- The only **byproduct is water vapor**, making it a clean-energy vehicle.

- Unlike BEVs, they do not require charging but need hydrogen refueling infrastructure.
- Key advantages:
 - Quick refueling: Takes only 5–15 minutes to refuel.
 - Longer range per tank than most BEVs.
 - Better suited for rugged terrains and off-road or heavy-duty use.
 - Superior performance in cold climates, as fuel cell efficiency is less impacted by low temperatures.



4. Comparative Overview – Hydrogen vs Battery Vehicles

Feature	Battery Electric Vehicles (BEVs)	Hydrogen Fuel Cell Vehicles (FCEVs)
Refueling Time	Long (Several hours depending on charger)	Short (5–15 minutes)
Range	Moderate	Long
Vehicle Weight	Heavier (battery mass)	Lighter
Terrain Suitability	Less suited for off-road	Well suited for rugged and off- road terrain
Cold Climate Performance	Battery efficiency drops	Better performance

5. India's Electric Vehicle (EV) Landscape – Current Scenario

a. EV Market Share in India (2023)

- EVs accounted for **5% of all vehicle sales** in India in 2023, showing a slow but steady transition toward clean mobility.
- Government support in the form of **FAME-II scheme**, state EV policies, and tax incentives is encouraging faster adoption.

b. Electric 3-Wheelers

- In 2023, India overtook China to become the world's largest market for electric three-wheelers.
- India contributed to **60% of the global sales** in this segment, making it the global leader in electric rickshaws and auto-rickshaws.
- Reasons for dominance include:
 - Lower operational cost
 - Last-mile delivery demand

- Urban transport needs
- Informal economy penetration

c. Electric 2-Wheelers

- India became the **second-largest global market** with **0.88 million electric twowheelers** sold in 2023.
- China remains the leader in this segment with 6 million units sold in the same year.
- High adoption in India driven by:
 - Urban mobility needs
 - Growing number of EV startups (like Ola Electric, Ather)
 - Rising fuel prices and better EV awareness

d. Global Positioning

- The EV two- and three-wheeler market is concentrated in India, China, and ASEAN countries.
- The **rest of the world accounts for less than 5%** of total sales in these segments, showing a regional concentration of clean mobility adoption.

Source: <u>https://epaper.thehindu.com/ccidist-</u> ws/th/th_international/issues/130788/OPS/G86EABQIO.1+GIVEBBJ87.1.html