National Green Hydrogen Mission

Why in news?

The Union Cabinet has approved the National Green Hydrogen Mission.

What is green hydrogen?

- Green Hydrogen is a type of hydrogen produced by splitting water through electrolysis, using electrolyser powered entirely by renewable power sources.
- **Advantages** - Green hydrogen could replace fossil fuels and fossil fuel-based feedstocks, and decarbonize a range of sectors such as petroleum refining, fertiliser production, steel production, chemicals, transport, etc.
- Renewable energy that cannot be stored or used by the grid can be channeled to produce hydrogen.
- **Disadvantages** - Green hydrogen is not commercially viable at present.
- The current cost in India is around Rs 350-400 per kg; it is likely to become viable only at a production cost of under Rs 100/ kg.
- This is what the National Hydrogen Energy Mission aims for.

What is the National Green Hydrogen Mission?

- The National Green Hydrogen Mission was first announced by the Prime Minister in his Independence Day speech in 2021.
- The initial outlay includes
    - ₹17,490 crore for the Strategic Interventions for Green Hydrogen Transition Programme (SIGHT);
    - ₹1,466 crore for pilot projects;
    - ₹400 crore for research and development; and
    - ₹388 crore for other mission components.
- **Objectives** - The mission has a stated aim of making India a global hub for the production of green hydrogen.
- The mission is also aimed at
    1. Creation of export opportunities for green hydrogen and its derivatives;
    2. Decarbonisation of the energy sector and use in mobility applications in a bid to lower the dependence on fossil fuels;
    3. Development of indigenous manufacturing capacities;
- The government plans to bring down the costs of renewable power generation and of electrolysers used to produce green hydrogen through,
    1. Implicit subsidy support and
    2. Government-backed R&D push.

How will it be implemented?

- The Ministry of New and Renewable Energy is to formulate the scheme guidelines for implementation of the respective components.
- This scheme will promote the development of green hydrogen production capacity of 5 million metric tonnes (MMT) p.a. with an associated renewable energy capacity addition of 125 GW by 2030.
- A major part of this is a proposed Strategic Interventions for Green Hydrogen Transition Programme (SIGHT).
- Under the SIGHT, there will be two financial incentive mechanisms that target domestic manufacturing of electrolysers and the production of green hydrogen.
- These mechanisms will be promoted to achieve a reduction in fossil fuel imports and abatement of annual greenhouse gas emissions by 2030.

The draft Mission will be a major push for hydrogen in the auto sector - R&D for fuel cell development and pilot projects for fuel cell vehicles.

How will the vehicles that run on hydrogen be called?

- Hydrogen is an energy carrier, not a source of energy.
- Hydrogen fuel must be transformed into electricity using a **fuel cell stack** before it can be used to power a car or truck.
- A fuel cell converts chemical energy into electrical energy using oxidising agents through an **oxidation-reduction reaction**.
- Fuel cell-based vehicles most commonly combine hydrogen and oxygen to produce electricity to power the electric motor on board.
- Since fuel cell vehicles use electricity to run, they are considered electric vehicles (EVs).

How do Hydrogen fuel cell cars work?

- Inside each fuel cell, hydrogen is drawn from an onboard pressurised tank and made to react with a catalyst, usually made from platinum.
- As hydrogen passes through the catalyst, it is stripped of its electrons, which must move along an external circuit, producing electrical current.
- This current is used by the electric motor to power the vehicle, with the only byproduct being water vapour.
- **Significance** - Hydrogen fuel cell cars have near-zero carbon footprint.
- Hydrogen is about 2-3 times as efficient as burning petrol, because an electric chemical reaction is much more efficient than combustion.
- The Toyota Mirai and the Honda Clarity cars are powered by fuel cells.

What is the case in India?

- India’s electricity grid is mainly coal-based and will continue to be so, thus negating collateral benefits from a major EV push - as coal will have to be burnt to generate the electricity that will power these vehicles.

- Hydrogen vehicles can be especially effective in long-haul trucking and other hard-to-electrify sectors such as shipping and long-haul air travel.
- Using heavy batteries in these applications would be counterproductive, especially for countries such as **coal-fired India**.
- Given that much of the generation capacity addition over last 10 years has been by way of renewable energy sources such as solar and wind, this can be diverted for green hydrogen production during non-peak hours.
- Besides auto, there is a concerted attempt to leverage green hydrogen in sectors such as petroleum refining and steel.
- **Steel sector, a stakeholder** - In the proposed Mission, the steel sector has been made a stakeholder.
- It will set up pilot plants partly government-funded to explore how green hydrogen can be used in Direct Reduced Iron (DRI) production by partly replacing natural gas with hydrogen in these gas-based DRI plants.
- Based on the success of the pilot projects, the gas-based DRI units are to be encouraged for large-scale adoption of the process.

Reference

1. Indian Express | Union Cabinet approves Green Hydrogen Mission
2. The Hindu | Centre clears ₹19,744 cr. Green Hydrogen Mission

Quick Facts

Hydrogen as a fuel

- Hydrogen is the most common element in nature.
- It exists only in combination with other elements, and has to be extracted from naturally occurring compounds like water.
- Hydrogen's potential as a clean fuel source has a history of 150 years.
- But, it was only after the oil price shocks of the 1970s that the possibility of hydrogen replacing fossil fuels came to be considered seriously.
- Three carmakers (Honda, Toyota, and Hyundai) having since moved to commercialise the technology, albeit on a limited scale.

Type of hydrogen	Sources and processes by which hydrogen is derived
Grey hydrogen	Hydrogen produced from fossil fuels. Constitutes the bulk of the hydrogen generated today.
Blue hydrogen	Hydrogen generated from fossil fuels with carbon capture and storage options
Green hydrogen	Hydrogen generated using electrolysers powered by renewable sources



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