



GREEN HYDROGEN - GS III MAINS

Q. Examine the measures taken by India to turn itself into a global manufacturing hub and place itself at the top of the green hydrogen export market along with its climate goal. (15 marks, 250 words)

News: *India awards tenders for 412,000 tonnes green hydrogen production, 1.5 GW electrolyser manufacturing*

What's in the news?

- India has awarded tenders for setting up 412,000 tonnes of green hydrogen manufacturing and 1.5 gigawatts (GW) of electrolyser manufacturing capacity, the Ministry of New & Renewable Energy (MNRE) said.

Key takeaways:

- MNRE Secretary Bhupinder S Bhalla during his opening remarks at the **World Hydrogen Summit 2024 in Netherlands** highlighted India's achievements under the SIGHT program and the progress of pilot projects under the mission.

Green Hydrogen Mission:

Backdrop:

- The National Hydrogen Mission was launched on August 15, 2021, with a view to **cutting down carbon emissions and increasing the use of renewable sources of energy**.
- The **Ministry of New and Renewable Energy (MNRE)** will formulate the scheme guidelines for implementation.

Aim:

- To make India the **global hub for the production of green hydrogen**.

Funding:

- The total outlay for the mission is **₹19,744 crore**.
 - ₹17,490 crore for the Strategic Interventions for Green Hydrogen Transition (SIGHT) programme.

GH₂: promises & challenges

Hydrogen produced is said to be 'green' if all its inputs are green. Decarbonisation plans of many countries include green hydrogen (GH₂) because combusting hydrogen releases only heat and steam

60% of India's energy comes from fossil fuel sources

The production mode of choice of green hydrogen is through the electrolysis of water

India currently lacks the required electrolysers and needs cheaper renewable energy



Technologies to adapt hydrogen fuel cells for use in vehicles are largely immature in India

Hydrogen leaks easily and liquid hydrogen reacts explosively with air, incurring significant storage and transport costs



- ₹1,466 crore for the upcoming pilot projects.
- ₹400 crore for R&D and
- ₹388 crore towards other mission components.

SIGHT (Strategic Intervention for Green Hydrogen) Programme:

Two separate financial incentive mechanisms - offered as part of SIGHT Programme.

1. For domestic manufacturing of electrolyzers.
2. For production of green hydrogen.

Expected Mission Outcomes:

1. Development of **green hydrogen production capacities of at least 5 MMT (Million Metric Tonne) per annum** with an associated renewable energy capacity addition of about 125 GW in the country by 2030.
2. Renewable energy capacity **addition of about 125 GW in the country.**
3. Anticipates **₹8 lakh crore in investments in the sector by 2030.**
4. **Create over 6 lakh jobs by 2030.**
5. Expected to **reduce fossil fuel imports by over ₹1-lakh crore.**
6. Abatement of nearly 50 MMT of annual **greenhouse gas emissions by 2030.**
7. Support pilot projects in emerging end-use sectors and production pathways.
8. **Development of Green Hydrogen Hubs** - Regions capable of supporting large-scale production.
9. **Establishment of Green Hydrogen Ecosystem** with robust standards and regulations framework.
10. **Strategic Hydrogen Innovation Partnership (SHIP)** - a public-private partnership framework for research and development will be facilitated. R&D projects will be goal-oriented, time-bound, and suitably scaled up to develop globally competitive technologies.
11. **Skill development programmes** will be developed with the coordination from the respective sectors for capacity building and training to the personnels.

Significance of the Mission:

- Creation of **export opportunities** for green hydrogen and its derivatives.
- **Decarbonization** of Industrial, mobility and energy sectors.
- **Reduction in dependence on imported fossil fuels and feedback.**
- Development of indigenous manufacturing capabilities.



- Creation of employment opportunities.
- Development of cutting-edges technologies.
- Facilitate demand creation, production, utilisation and export of green hydrogen.

Go back to basics:

India and Green Hydrogen:

- At the World Economic Forum in Davos, Switzerland, in May 2022, Minister of Petroleum and Natural Gas Hardeep Singh Puri said India will emerge as the leader of green hydrogen by taking advantage of the current energy crisis across the globe.
- **Oil India Limited (OIL) commissioned India's first 99.99% pure green hydrogen plant in eastern Assam's Jorhat.**

Green Hydrogen:

- A colorless, odorless, tasteless, non-toxic and highly combustible gaseous substance, hydrogen is the lightest, simplest and most abundant member of the family of chemical elements in the universe.
- But a color - green - prefixed to it makes **hydrogen the “fuel of the future”**. The ‘green’ depends on how the electricity is generated to obtain the hydrogen, which **does not emit greenhouse gas when burned**.
- Green hydrogen is **produced through electrolysis** using renewable sources of energy such as solar, wind or hydel power.

Benefits of Green Hydrogen:

1. Provides Renewable Grid Stability:

- The intermittent nature of renewable energy, especially wind, leads to grid instability. Green hydrogen can be **stored for long periods of time**. The stored hydrogen can be used to produce electricity using fuel cells.
 - In a fuel cell, a device that converts the energy of a chemical into electricity, hydrogen gas reacts with oxygen to produce electricity and water vapour.
 - Hydrogen, thus, can act as an energy storage device and contribute to grid stability.

2. Saves Import Bill:

- **India's average annual energy import bill is more than \$100 billion.**
- Thus, Green Hydrogen has a potential to save India's sinking forex reserves.

3. Energy Security:

- Green Hydrogen helps in fulfilling India's commitment to move from a fossil and import-dependent economy to a net-zero economy by 2070 in the Conference of Parties in Glasgow, 2021.



- In order to become energy independent by 2047, the government stressed the need to introduce green hydrogen as an alternative fuel that can **make India the global hub and a major exporter of hydrogen.**

4. Reduce CO2 Burden:

- The increased consumption of fossil fuel has made the country a high carbon dioxide (CO2) emitter, accounting for nearly **7% of the global CO2 burden.**
- Thus, Green Hydrogen with zero GHG emissions will reduce the CO2 burden.

5. Diversification of Energy Sources:

- Hydrogen is an important source of energy since it has zero carbon content and is a non-polluting source of energy in contrast to hydrocarbons that have net carbon content in the range of 75-85 per cent.
- Thus, it helps in diversification of the energy sources in India.

Challenges in Green Hydrogen:

1. Supply-Chain Issues:

- Green Hydrogen hinges upon the creation of a supply chain, starting from the manufacture of electrolyzers to the production of green hydrogen, using electricity from a renewable energy source.

2. Technology:

- Green hydrogen needs electrolyzers to be built on a scale-larger scales. However, India lacks technological features to manufacture large scale electrolyzers.

3. Storage:

- Either very high pressures or very high temperatures are required, both with their own technical difficulties.

4. Explosion Hazard:

- It is hazardous because of its low ignition energy and high combustion energy.

5. Risk to Use:

- Automotive fuels are **highly inflammable**, but a vehicle laden with hydrogen is likely to be more vulnerable in case of a major accident.

6. High Cost of Production:

- To become competitive, the price per kilogram of green hydrogen has to reduce to a benchmark of \$2/kg. At these prices, green hydrogen can compete with natural gas.



7. Energy Intensity:

- Creating green hydrogen needs a huge amount of electricity, which means an enormous increase in the amount of wind and solar power to meet global targets.

8. Lack of Proper Infrastructure:

- Only 500 Hydrogen stations exist globally. Only countable manufacturers are involved as market players in this technology.

Measures to improve Green Hydrogen Mission:

1. Demand Side:

Five Pronged Strategy:

- Create an initial demand by **providing incentives** to mature industries such as refining and fertilisers.
- Industries manufacturing low emission hydrogen-based products inter alia green steel and green cement need to be incentivised by government policies.
- **Blending hydrogen with natural gas** can act as a big booster shot which can be facilitated by framing blending mandates, regulations and promoting H-CNG stations.
- To **promote FCEVs, hydrogen fuel stations** may be planned on dedicated corridors where long-distance trucking is widespread.
- The concept of **carbon tariffs** needs to be introduced on the lines of European countries.

2. Supply Side:

Five Pronged Strategy:

- **Investment in R&D** should be accelerated to bring its cost at par with fossils.
- **Sustainable Alternative Towards Affordable Transportation (SATAT) scheme** with a target to produce 15 MMT of compressed biogas could be leveraged by exploring biogas conversion into hydrogen.
- To commercialise and scale-up nascent technologies, a **Viability Gap Funding (VGF)** scheme may be introduced for hydrogen-based projects.
- To secure affordable financing, electrolyser manufacturing and hydrogen projects need to be brought under **Priority Sector Lending (PSL)**.
- Since two dominant cost factors for green hydrogen are renewable energy tariffs & electrolyser costs, and India has the advantage of one of the lowest renewable tariffs; the thrust should be on reducing the cost of electrolysers by implementing the **Production Linked Incentive (PLI) scheme**.

Way Forward:

- Hydrogen energy is at a **nascent stage of development** but has significant potential for realizing the energy transition in India.
- The new policy is a futuristic vision that can help the country not only cut down its carbon emissions but also diversify its energy basket and reduce external reliance.



PL RAJ IAS & IPS ACADEMY

MAKING YOU SERVE THE NATION

- India's transition can be a testament to the world on the achievement of energy security, without compromising the goal of sustainable development.

The Government must strongly pursue the objective of creating a Green Hydrogen Energy to make India a **global manufacturing hub and place itself at the top of the green hydrogen export market.**



**P.L. RAJ IAS & IPS ACADEMY | 1447/C, 3rd floor, 15th Main Road,
Anna Nagar West, Chennai-40. Ph.No.044-42323192, 9445032221
Email: plrajmemorial@gmail.com Website: www.plrajiacademy.com
Telegram link: <https://t.me/plraji2006> YouTube: P L RAJ IAS & IPS ACADEMY**