Unlocking India's Green Hydrogen Production Potential

1. Key Takeaways

- India aims to produce 5 million metric tonnes (MMT) of Green Hydrogen annually by 2030.
- Port-based Green Hydrogen pilots have been launched at
 - V.O. Chidambaranar Port (Tamil Nadu)
 - Deendayal Port Authority, Kandla (Gujarat)
- Hydrogen mobility pilots are running on 10 routes, using 37 hydrogen vehicles (fuel cell + hydrogen ICE).
- The Mission is expected to attract ₹8 lakh crore investment, generate 6 lakh
 jobs, and reduce fossil fuel imports by ₹1 lakh crore annually.

2. Introduction

- India is undergoing a major **energy transition** to reduce fossil fuel dependence and move toward **Net Zero by 2070**.
- In this shift, **Green Hydrogen (GH2)** has emerged as a strategic fuel to decarbonize:
 - Fertilizers
 - Refineries
 - Steel
 - Long-haul mobility
 - Shipping
- To build a national ecosystem around hydrogen, the Government launched the **National Green Hydrogen Mission (NGHM)** in **2023**.

Mission Vision:

Energy security

- Reduced import dependence
- Global leadership in hydrogen
- Industrial competitiveness
- Transition to a low-carbon economy

3. What is Green Hydrogen?

Green Hydrogen is hydrogen produced using renewable energy.

Process

- Water is split into hydrogen + oxygen using **electrolysis**, powered by:
 - Solar
 - Wind
 - Hydro
- Hydrogen qualifies as "Green" if life-cycle emissions ≤ 2 kg CO₂ per kg of H₂.

Other sources

Biomass → Hydrogen (also allowed if emission limits are met).

4. Targets and Scale of the Mission

By 2030, India aims to achieve:

- 5 MMT annual GH2 production
- 125 GW of renewable energy capacity dedicated to GH2
- ₹8 lakh crore+ investments
- 6 lakh new jobs
- Reduction of 50 MMT CO₂ emissions per year
- Reduced fossil-fuel imports by ₹1 lakh crore annually

5. Institutional Achievements (as of May 2025)

- 19 companies awarded 8.62 lakh tonnes/year GH2 production capacity
- 15 firms allocated 3,000 MW electrolyzer manufacturing capacity
- Pilot projects operational in:
 - Steel
 - Shipping
 - Road transport

6. Components of NGHM

The Mission is built on four pillars:

1. Policy and Regulatory Framework

- · Clear standards
- Certification
- Transmission charge waivers
- Open Access reforms

2. Demand Creation

- Incentives to replace grey hydrogen (from natural gas) in industries
- · Support for green ammonia in fertilizers

3. R&D and Innovation

Funding, technology development, safety systems

4. Infrastructure

- Hydrogen hubs
- Storage systems

7. Major Schemes Under the Mission

(i) SIGHT Scheme (₹17,490 crore)

Strategic Interventions for Green Hydrogen Transition

- Incentives for:
 - Domestic electrolyzer manufacturing
 - Production of green hydrogen and green ammonia

(ii) Development of Green Hydrogen Hubs

Three ports designated as GH2 hubs (Oct 2025):

- 1. Deendayal Port, Gujarat
- 2. V.O. Chidambaranar Port, Tamil Nadu
- 3. Paradip Port, Odisha

Purpose

• Integrated centres for production, storage, consumption, and export.

(iii) Green Hydrogen Certification Scheme (GHCI), 2025

- Certifies hydrogen as "green" based on life-cycle emissions.
- Mandatory for:
 - Any plant availing incentives
 - Any domestic sale
- Bureau of Energy Efficiency (BEE) is the nodal authority.

(iv) Strategic Hydrogen Innovation Partnership (SHIP)

Public-private R&D collaboration

- Involves:
 - BARC
 - ISRO
 - CSIR
 - IITs, IISc
- Focus: advanced hydrogen technologies.

R&D Funding

- ₹400 crore powering 23 projects on safety, storage, and production
- **₹100 crore** scheme for hydrogen start-ups
- International collaboration via EU-India TTC

8. Sectoral Applications

A. Industrial Applications

1. Fertilizers

• Green ammonia auctions: 7.24 lakh tonnes/year at ₹55.75/kg

2. Petroleum Refineries

- Gradual shift from grey to green hydrogen
- Reduces carbon intensity of refining operations

3. Steel

- 5 industrial pilots evaluating:
 - Direct reduction of iron using GH2
 - Safety
 - Cost feasibility

B. Mobility and Transport

1. Road Transport

- 37 hydrogen vehicles under trial:
 - 15 fuel cell vehicles
 - 22 hydrogen-ICE vehicles
- 9 refueling stations
- ₹208 crore financial support

2. Shipping

V.O. Chidambaranar Port

- 10 Nm³/hr Green Hydrogen plant
- Cost: **₹25 crore**

Deendayal Port (Kandla)

- Megawatt-scale GH2 facility
- Cost: **₹13 crore**
- Output: 140 tonnes/year

Green Methanol Bunkering (₹42 crore)

• Supports Kandla-Tuticorin Green Shipping Corridor

3. High Altitude Mobility (Leh, 3,650 m)

- NTPC pilot:
 - 5 hydrogen buses
 - GH2 fueling station
- Mitigation: 350 MT CO₂/year

Produces 230 MT oxygen/year (equivalent to 13,000 trees)

9. Enabling Framework

Policy Measures

- Waiver of interstate transmission charges for renewable energy used in GH2
- Time-bound open access approvals

Skill Development

- Over **5,600 trainees certified** in hydrogen-related skills
- Curriculum designed with:
 - NSDC
 - Sector Skill Councils
 - Industry partners

10. International Partnerships

1. World Hydrogen Summit (2024)

- India Pavilion inaugurated
- · Boosts global engagement

2. EU-India Trade and Technology Council

• Over 30 joint hydrogen proposals

3. India-UK Standards Partnership

- Cooperation on:
 - Safety codes
 - Regulations
 - Certification standards

4. Partnership with Germany's H2Global

- Joint tender designs for hydrogen exports
- SECI signed an MoU (2024)

5. Singapore Collaboration (2025)

- Sembcorp to develop hydrogen/ammonia hubs at:
 - Tuticorin
 - Paradip

11. Conclusion

Green Hydrogen forms the backbone of India's emergence as a **clean-energy leader**. The National Green Hydrogen Mission integrates:

- Energy security
- Industrial transformation
- Emissions reduction
- Job creation
- Global competitiveness

With strong renewable energy capacity, robust policy support, and expanding international partnerships, India is positioning itself to become a **major global producer and exporter** of green hydrogen and its derivatives.

The Mission represents a decisive step toward a sustainable, secure, and self-reliant future—aligning with the vision of a Viksit Bharat by 2047 and India's Net Zero 2070 commitment.

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