Green Hydrogen

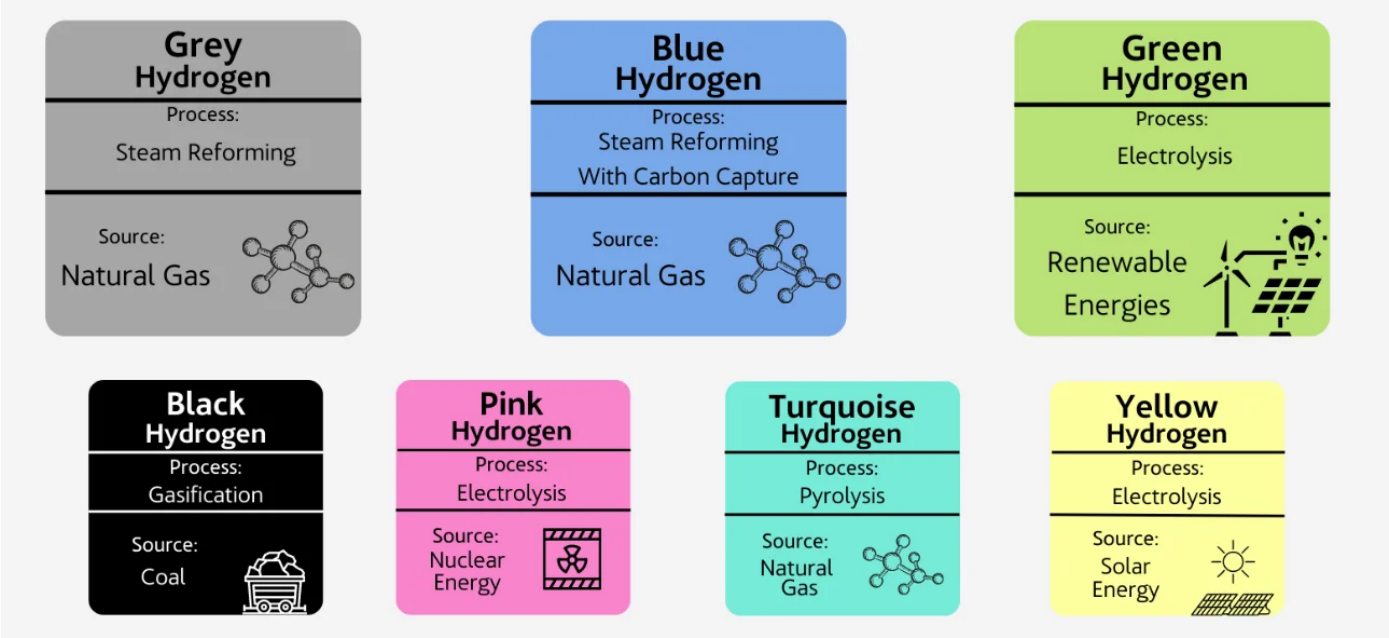
Source: DTE

Why in News?

A new report has positioned **India as a potential global leader in the green hydrogen economy**, with the capacity to capture **10% of the worldwide market** and export **10 million tonnes annually by 2030**.

What is Green Hydrogen (GH2)?

- **About: Green Hydrogen refers to** hydrogen produced through **electrolysis**, where **renewable energy sources** like **solar, wind, or hydro** are used to split **water molecules (H_2O)** into **hydrogen (H_2)** and **oxygen (O_2)**.
  - It can also be produced via **biomass gasification**, a process that converts biomass into hydrogen-rich gas.
- **Applications: Its uses include** a wide range of applications such as **Fuel Cell Electric Vehicles (FCEVs)**, **aviation and maritime transport**, and various **industrial sectors** like **fertilizers, refineries, and steel**.
  - It also holds potential in **road and rail transport, shipping**, and **power generation**.
- **India's Green Hydrogen Ambitions:** Through policies like the **National Green Hydrogen Mission, Green Hydrogen Certification Scheme**, and development of **Green Hydrogen Hubs at Kandla, Paradip, and Tuticorin,** India **MAPS** its Green Hydrogen Ambitions as follows:
  - **M – Market Leadership:** Capture **10% of the global GH2 market by 2030,** projected to cross 100 MMT.
  - **A – Abatement of Emissions:** Enable **~50 MMT CO_2 reduction** annually, aligning with India's NDC and net-zero goals.
  - **P – Powering Production:** Develop **5 MMT per annum of GH2 production** capacity by 2030.
  - **E – Employment Creation:** Generate **6 lakh+ green jobs across the GH2 value chain,** from R&D to production, storage, and export.
- **Other Types of Hydrogen:**



What are the Key Challenges in India's Green Hydrogen Ecosystem?

India's Green Hydrogen journey is hindered by a **CAGE** that restricts its scaling potential:

C – Cost Barrier: Early-stage Green Hydrogen costs nearly **$4–4.5/kg**, much higher than grey hydrogen, limiting competitiveness.

A – Access to Capital: High upfront investments in **electrolysers and renewable capacity** deter **private players.**

G – Gaps in Infrastructure: Lack of **transport pipelines, storage, and refuelling networks** slows adoption.

E – Economic Viability Issues: Delayed **carbon pricing mechanism** makes fossil fuel-based hydrogen artificially cheaper, undercutting Green Hydrogen.

What Measures can India Adopt to Boost Green Hydrogen Adoption?

To break free from the CAGE, India must step on the **POWER** pedal:

P – Pricing Carbon: Accelerating the introduction of a **carbon tax/market mechanism** to level the field with fossil fuels.

O – Obligation Mandates: Enforce **Green Hydrogen Purchase Obligations** in hard-to-abate sectors (steel, fertilisers, refining).

W – Widen Infrastructure Base: Build **electrolyser capacity, storage, transport pipelines, and export corridors** with partners like **EU, Japan, S. Korea.**

E – Economic Reallocation: Shift subsidies from fossil fuels to GH2, and provide **tax incentives & viability gap funding**.

R – Risk Pooling through Demand Aggregation: Create pooled procurement platforms with **payment security mechanisms** to ensure bankable contracts and competitive pricing.

Keywords for Mains

- **“Hydrogen is the New Oil”** – Fuel of the future.
- **“Act Green, Trade Clean”** – Export corridors for sustainable growth.
- **“Sustainability is the Truest Dharma”** – Green energy as ethical responsibility.
- **“Green Hydrogen is India’s Tryst with Clean Destiny.”**

NATIONAL GREEN HYDROGEN MISSION

NODAL MINISTRY

- Ministry of New and Renewable Energy

OBJECTIVE

- Decarbonise energy/industrial/mobility sector
- Develop indigenous manufacturing capacities
- Create export opportunities for GH_2 and its derivative

COMPONENTS OF NGHM

- Strategic Interventions for Green Hydrogen Transition Programme (SIGHT)
- Strategic Hydrogen Innovation Partnership (SHIP) (PPP for R&D)

GH_2 is not commercially viable at present; current cost in India is around ₹350-400/kg. The National Hydrogen Energy Mission aims to bring it down under ₹100/kg.

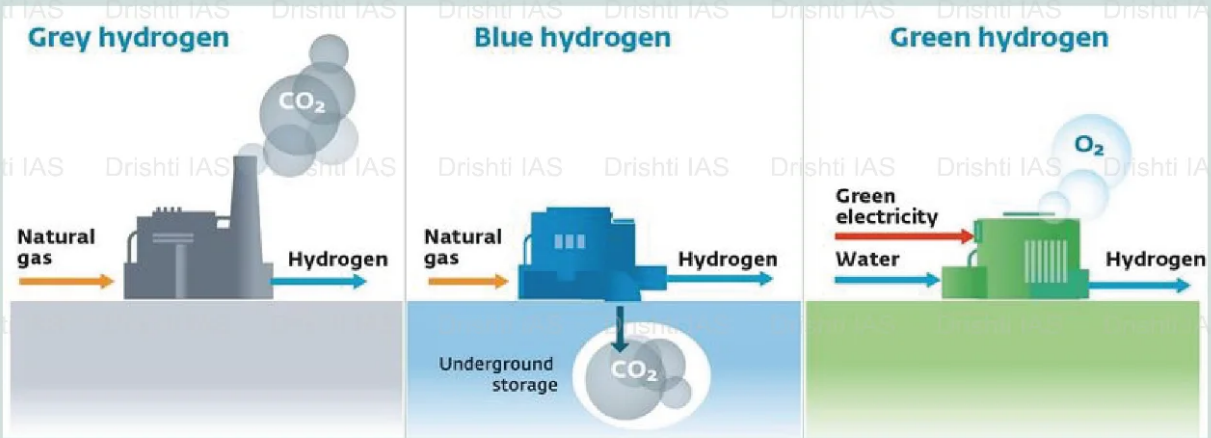
Expected Outcomes by 2030

- Atleast 5MMT GH_2 annual production
- Rs 1 lakh crore fossil fuel import savings
- 6 lakh jobs
- 50MMT CO_2 annual emissions averted
- ₹ 8 lakh crore investment

HYDROGEN AND GREEN HYDROGEN

Hydrogen is the most common element in nature but exists only in combination with other elements. It has to be extracted from naturally occurring compounds (like water).

Green Hydrogen (GH_2) is made by splitting water through an electrical process called electrolysis, using an electrolyser powered by renewable energy (RE).



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