Hydrogen Energy Ecosystem and Assessment

आरईसी REC
असीमित ऊर्जा, अनन्त संभावनाएं
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INDIA'S ENERGY TARGETS

2030

- 500 GW Non-Fossil Capacity
- 50% of Installed Capacity from non-fossil fuels
- One billion tonnes reduction in cumulative emissions
- Reducing emission intensity of GDP to 45% below its 2005 level

2047

- Energy Independence

2070

- Net Zero

IMPORTANCE OF HYDROGEN IN ENERGY STRATEGY

- Goal to achieve Net Zero emissions by 2070
- As India's growth story unfolds, its demand for energy and resources is set to rise
- Energy use has doubled in the last 20 years and is likely to grow by at least another 25% by 2030
- India currently imports over 40% of its primary energy requirements
- Major sectors like mobility and industrial production are significantly dependent on imported fossil fuels

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Necessitates a shift towards technologies that enable enhanced share of renewable sources in the energy mix, and progressively reduce the reliance on fossil fuels

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Green Hydrogen

INDIA'S HYDROGEN STRATEGY – TARGETS

To achieve:

- ✓ The world's largest electrolysis (green hydrogen generation) capacity of over 60 GW/5 million tonnes by 2030.
- ✓ The world's largest production of green steel at 15-20million tonnes by 2030
- ✓ The world's largest electrolyser annual manufacturing capacity of 25 GW by 2028
- ✓ The world's largest production of green ammonia for exports by 2030
- ✓ $1 billion investment into hydrogen research and development to enable breakthrough technologies for the world at scale and the speed

GREEN HYDROGEN – CHALLENGES & OPPORTUNITIES

National Green Hydrogen Mission

Ecosystem- Challenges

- Unfavorable Cost Economics
- Lack of harmonized Standards and Regulations
- Supply Challenges
- Costly Enabling Infra

Opportunities

- Abundant Renewable Energy
- Self Reliant Economics
- Achieving Net Zero Targets
- Employment Generation
- Optimized Land Use

Policy Initiatives – National Green Hydrogen Mission

BRIEF ABOUT – NATIONAL GREEN HYDROGEN MISSION

- National Green Hydrogen Mission was Approved on 4th Jan-2022 with following objectives
- To make India the Global Hub for production of Green Hydrogen and its derivatives.
- To make India Aatmanirbhar (self-reliant) through clean energy
- To make India a leader in technology and manufacturing of electrolysers and other enabling technologies for Green Hydrogen

Initial Outlay (Component wise):

Sr. No	Component	Outlay (Rs. Cr.)	Total Outlay (Rs. Cr.)
1	Strategic Interventions for Green Hydrogen Transition Programme (SIGHT)	17,490	**19,744**
2	Pilot projects	1,466	
3	R&D Projects: Public-Private Partnership framework for R&D (Strategic Hydrogen Innovation Partnership – SHIP	400	
4	Skill Development	388	

MISSION SUB-COMPONENTS

- **SIGHT Programme:** Strategic Interventions for Green Hydrogen Transition Programme (SIGHT), two distinct financial incentive mechanisms – targeting domestic manufacturing of electrolyzers and production of Green Hydrogen – will be provided under the Mission.

- **Pilot projects:** The Mission will also support pilot projects in emerging end-use sectors and production pathways. Regions capable of supporting large scale production and/or utilization of Hydrogen will be identified and developed as Green Hydrogen Hubs.

- **R&D Projects:** Public-Private Partnership framework for R&D (Strategic Hydrogen Innovation Partnership – SHIP) will be facilitated under the Mission. R&D projects will be goal-oriented, time bound, and suitably scaled up to develop globally competitive technologies.

- **Skill Development:** A coordinated skill development programme will also be undertaken under the Mission.

GREEN HYDROGEN: SECTORS IN FOCUS

Refining

Fertilizer

Feedstock

Bulk Chemicals

Iron & Steel

Blending with Natural Gas

Energy Storage

Energy Carrier

Long Haul Mobility

Maritime & Shipping

Green Hydrogen can replace fossil fuels in all of the above

NATIONAL GREEN HYDROGEN MISSION

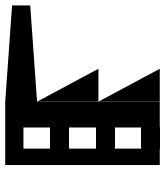
Demand Creation

Export Markets

Capturing Global Demand

Substituting imports

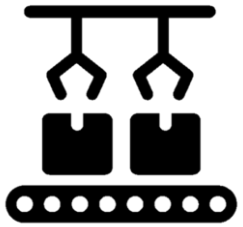
Fossil Fuels and Fertilizers



Domestic Demand

Multiple Sectors

Incentivising Supply



Strategic Interventions for GH2 Transition

Direct Financial Incentives for:

- ❑ Electrolyser Manufacturing
- ❑ Green Hydrogen Production

NATIONAL GREEN HYDROGEN MISSION

Key Enablers

Resources

Renewable energy - banking & storage, transmission, finance, land, water

R&D

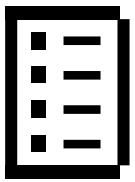
Result oriented, time- bound, including through PPP, grand challenges

Ease of doing business

Simpler procedures, taxation, SEZ, commercial issues, single window

Infrastructure & Supply Chain

Ports, Re-fueling, Hydrogen Hubs, pipelines



Regulations & Standards

Testing facilities, standards, regulations, safety & certification

Skill Development, Public awareness

Coordinated skilling programme, online portal

PILOT PROJECTS IN EMERGING SECTORS

Shipping

- ❑ Retrofit 2 ships to run on Green Hydrogen/derived fuels by 2027
- ❑ Development of Supply Chain, port infrastructure, Green Ammonia bunkers and re-fueling facilities

Transport

- ❑ Phased deployment of hydrogen fuelled buses & trucks
- ❑ Cost of hydrogen fuelled vehicles and associated infrastructure

Green Steel

- ❑ Support for blending/injection of Green Hydrogen in 2 steel plants

EXPECTED DELIVERABLES BY 2030

At least 125 GW Annual Production

60 – 100 GW Electrolyzer Capacity

125 GW RE Capacity for GH_2 Generation & associated Transmission network

₹ 1 lakh Crore Import Savings

50 MMT CO_2 Annual Emissions Averted

6 lakh Jobs

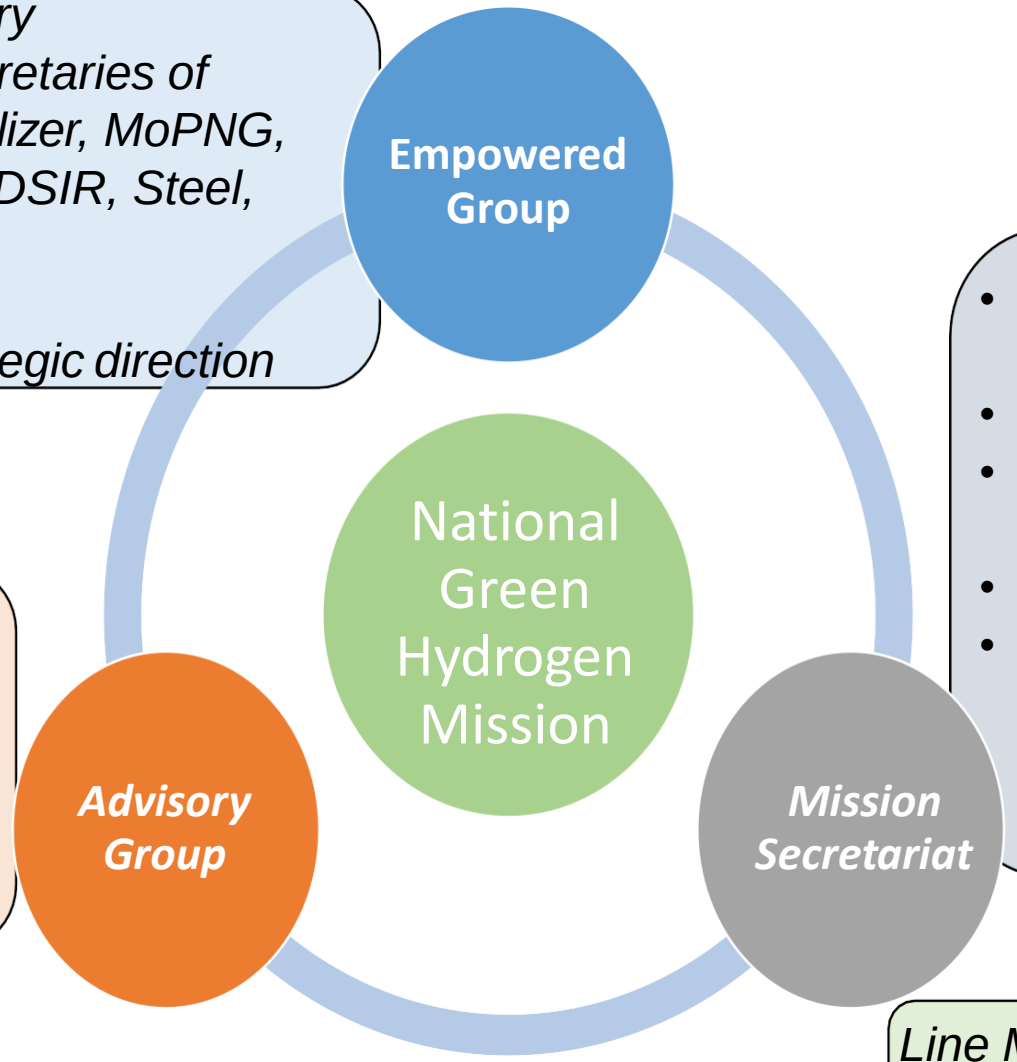
₹ 8 lakh Cr Investment

RISK ASSESSMENT AND MITIGATION FRAMEWORK

Type of Risk	Risk categorization Measures	Risk Management/Mitigation
Strategic Risks	Supply Chain Disruptions in Critical Inputs	Diversification in Supply Chains
Technological Risk	Technology Disruptions and Unforeseen Developments	Diversification of technology options, Technology agnostic approach in funding support. Funding of multiple R&D and pilot threads, Collaborative platforms for industry, academia and startups
Operational/Project Level Risks	Water Availability	Optimizing location of Renewable Energy and Green Hydrogen production plants
	Land Availability	States to be requested to create land banks for Renewable Energy and Green Hydrogen deployment
	Safety Concerns	Rigorous safety standards and regulatory mechanisms
Financial and Market Risks	Sustainable Demand	Demand creation efforts in identified sectors
	Availability of Affordable Renewable Energy (RE)	Integrated planning of RE capacity addition
	Availability of Electrolysers and other key components	Incentives to create domestic manufacturing ecosystem
	Additional infrastructure costs and capital expenditure	Ramp up of capacities to achieve economies of scale
	Availability of accessible Credit	Risk sharing framework in procurement, Facilitating projects to access FDI, bond markets, MFAs

MISSION GOVERNANCE FRAMEWORK

- *Chaired by Cabinet Secretary*
- *PSA, CEO NITI Aayog, Secretaries of Ministries incl. MNRE, Fertilizer, MoPNG, MoRTH, MHI, Power, DST, DSIR, Steel, Shipping, DPIIT*
- *Experts from Industry*
- *Provide Guidance and Strategic direction*



- *Chaired by PSA (Principal Scientific Advisor)*
- *Experts - academia, industry and civil society*
- *Technical advice to EGoS*

- *Headed by Mission Director*
- *Anchored in MNRE*
- *Comprise professionals and domain experts*
- *Programme management*
- *Assist EGoS and EG*

Line Ministries to create dedicated Green Hydrogen cells

GREEN HYDROGEN: ACTIONS INITIATED

Policy Initiatives

- ❑ Green Open Access Rules notified – provisions for Open Access, Banking
- ❑ Hydrogen policy initiatives by States – UP, Rajasthan, Gujarat

Standards

- ❑ Standards for Hydrogen mobility notified
- ❑ MNRE is anchoring a Working Group to consolidate regulations and standards

Research & Development

- ❑ Long term roadmap for Research and Innovation under development

Demand Aggregation

- ❑ Model Bidding Guidelines for procurement of Green Hydrogen/Ammonia being formulated

Pilot Projects

- ❑ PSUs and Private investors have initiated pilot projects for Green Hydrogen

International cooperation

- ❑ Cooperation initiatives: Germany, EU, Japan, US, UAE, Australia and multilateral institutions

OVERARCHING OUTCOMES OF THE MISSION

- Capture large share of global trade in Green Hydrogen and derivatives
- Enhance India's energy security
- Decarbonization of major industrial sectors
- Investments in manufacturing and projects
- Employment generation across value chain
- Boost to advanced technology development
- Contribute towards India's Net Zero Target by 2070

Brief about REC Ltd.

- REC Ltd. (a Govt. of India, Maharatna Company) is most valued NBFC in country extending financial assistance to Power Sector, Infrastructure & Logistic sector.
- REC is steered by visionary leadership and team of esteemed professionals of the Industry
- Occupies Strategic Position in the Growth and development of the Power Sector across India
- Highest Domestic Rating of "AAA"; International Ratings of "Baa3" & "BBB-" from Moody's and Fitch respectively
- Unique and close relationship with all major players Public & Private in Indian Power sector
- Nodal Agency for major Govt. of India's power sector programmes RDSS, Saubhagya, DDUGJY, etc.

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- Unique and close relationship with all major players Public & Private in Indian Power sector
- Government's Trusted Arm, Nodal Agency for major Govt. of India's power sector programmes RDSS, Saubhagya, DDUGJY, etc.
- Loan book of Rs. 4,35,012 Cr. (as on 31st Marc 2023)

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REC's Vision for Green Hydrogen

- Aspiring to pioneer in the Project Financing of Green Hydrogen and derivatives
- To provide one stop hassle free project financing solutions to the developers with most competitive rates and attractive terms
- To provide Customized Project financing solutions
- Significant Contribution to the sector through disseminating knowledge base, policy formulation assistance and other measures

REC's Experience in Green Hydrogen/ Ammonia Project Financing

- First Financial Institution in country who provided complete project financing to large scale commercial Project of Green Ammonia.

Project Details are as under

- Project Location - Duqm (Oman)
- Project Cost - INR 5740 Cr.
- Project Debt - 4305 Cr. (100% Debt)
- Debt : Equity - 75 : 25
- Project Capacity - Green Ammonia 300 MTPD (0.1 Million Ton/ Year)
- Project SCoD - 1st July 2025
- Product Offtaker - Yara Switzerland Limited

Green Ammonia Projects : Oman – Construction of Supporting Facilities

Labour Camp Overview at Site

Kitchen Block & Water Tanks

Site Office Installation

Underground and Plumbing Works

Green Ammonia Projects : Oman – Construction as of June 2023

Fencing of Camp and Overview

CCTVs & DVR Installation

Worker Mess & Camp Kitchen

Site Office with Gravel Filling, Window ACs

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Thank You!