

National Green Hydrogen Mission

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Scientist F

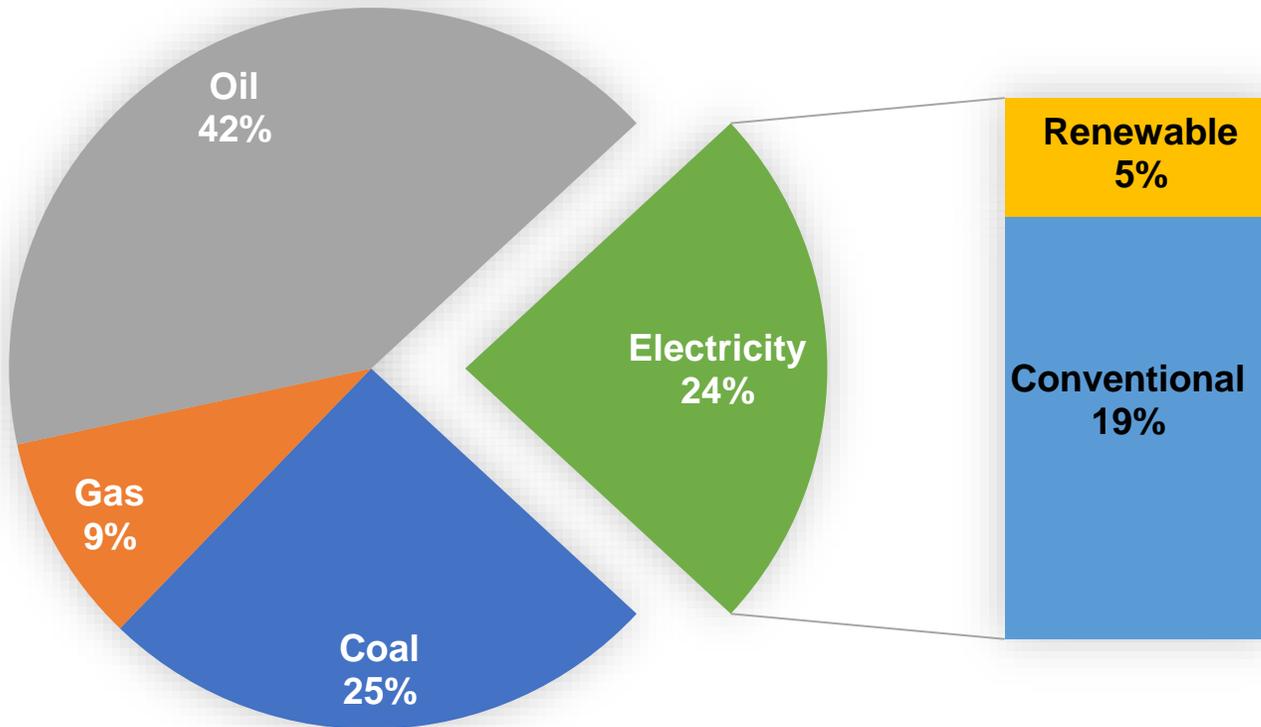
Ministry of New and Renewable Energy

Outline

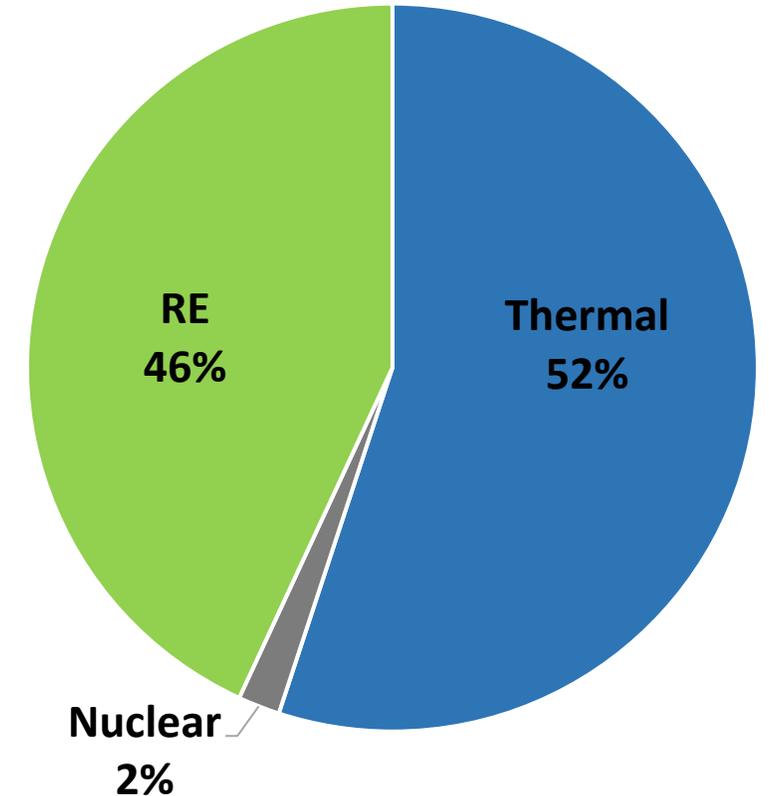
- Energy Mix and the need for decarbonization
- Hydrogen Basics
- Background of the Mission (NGHM)
- Mission Updates

Energy Mix & RE in India

India's Energy Consumption
(60 Lakh GWh)

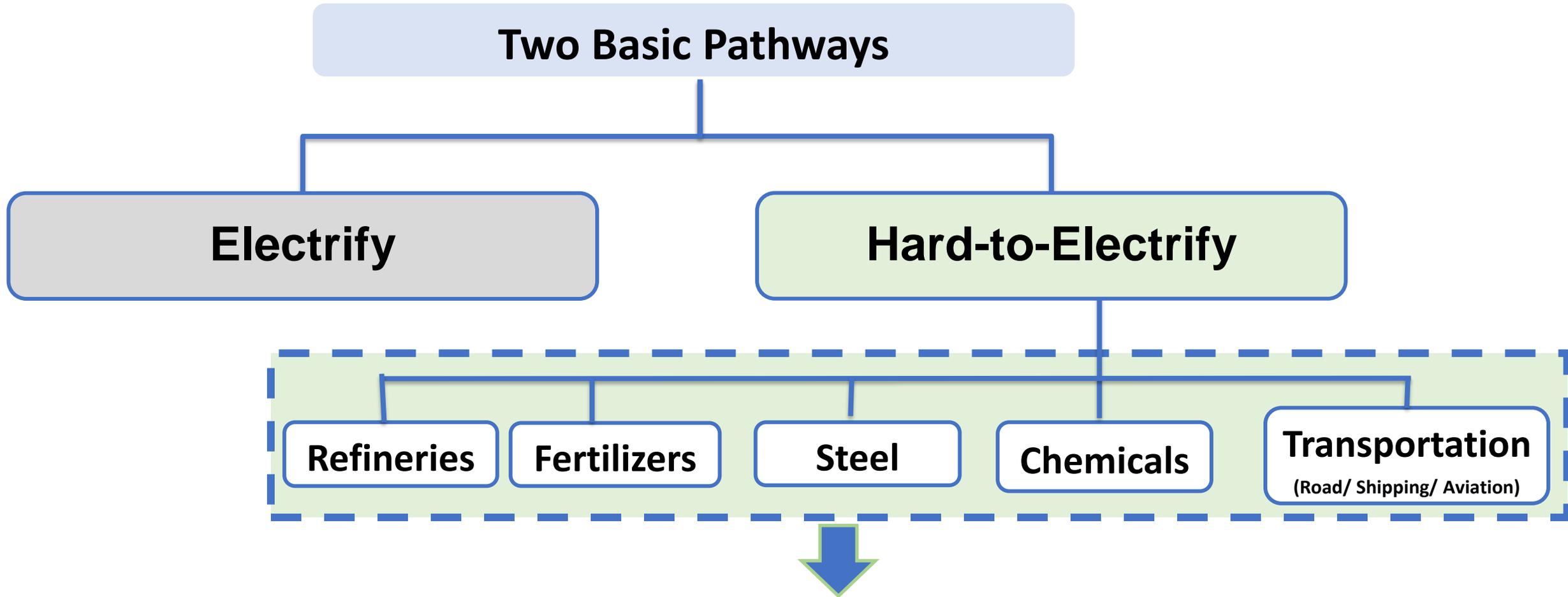


Electricity Generation Capacity (448 GW)



- **Share of RE in India's Energy Mix has been increasing**
- **However, decarbonization of 76% of Energy basket needs to be addressed for Net-Zero₃ target.**

Way Forward towards Decarbonisation



Hydrogen is the most promising pathway for decarbonising these hard-to-electrify (Hard-to-abate) sectors

Hydrogen: Basics

Abundantly Available

94%
throughout
the Universe

High Calorific value

120 MJ/kg,
as compared to
40 MJ/kg for
Natural Gas
(*3 times high*)

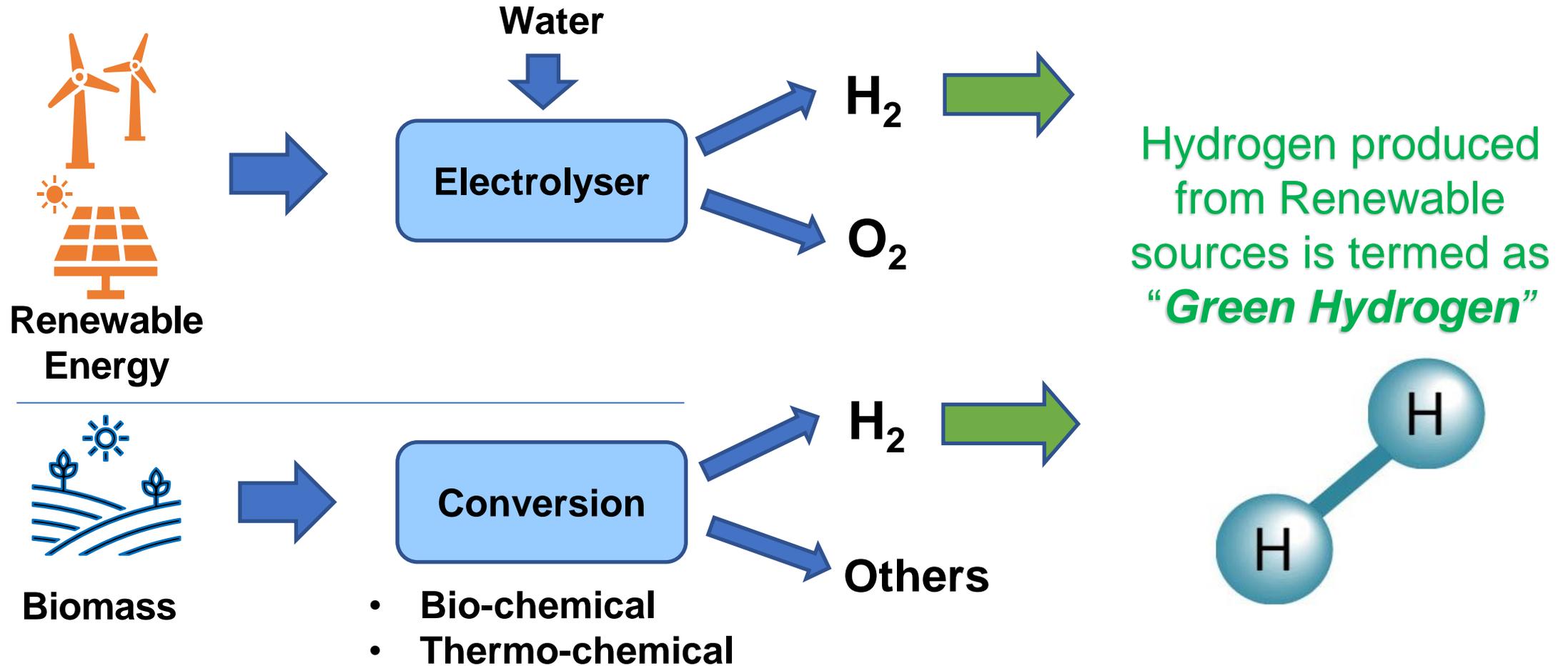
Low Volumetric Energy density

- First element in periodic table
- **0.011 MJ/litre**,
as compared to
0.036 MJ/litre
for Natural Gas
(*one-third*)

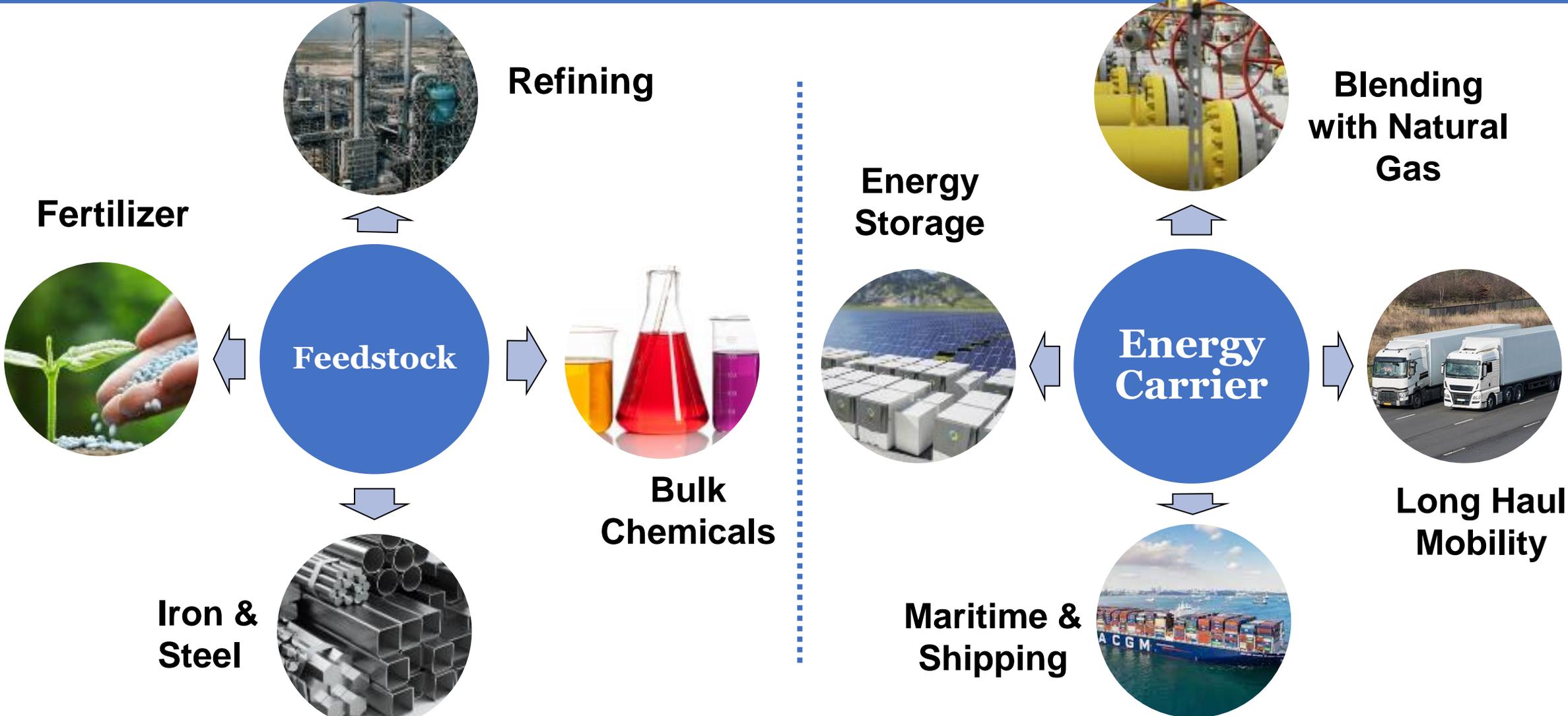
High Embrittlement

Small Size of H₂ atoms causes higher penetration into metal leading to deterioration

Green Hydrogen production - pathways



Green Hydrogen: Feedstock & Energy Carrier



Green Hydrogen can replace fossil fuels in all of the above

Colours of Hydrogen (by source)

BROWN
Coal Gasification

GREY
Steam Methane
Reforming

GREEN
Electrolysis/
Biomass using
RE

BLUE
Grey/Brown H₂ +
CCS

TURQUOISE
Pyrolysis of
Methane

WHITE
Natural Hydrogen

PINK
Electrolysis using
nuclear power

**CLEAN / LOW
CARBON**
Any source with
specified emission
threshold

Green Hydrogen Standard for India

**Emissions shall not be greater than
2.0 kg CO₂ eq per kg H₂**

GH2 Produced through electrolysis

- Non-biogenic GHG emissions include water treatment, electrolysis, gas purification, drying & compression of H₂
- As an average over a 12-month period

GH2 Produced from conversion of biomass

- Non-biogenic GHG emissions include Biomass processing, heat/steam generation, conversion of biomass to H₂, gas purification, drying and compression of H₂
- As an average over a 12-month period

Water Requirement

Water requirement for Green Hydrogen production		
	1 kg GH2	5 MMT GH2
Deionized water requirement Conductivity < 1 μ Siemens/cm	10 litre	50 bn litre
Fresh water requirement with conductivity 500 μ Siemens/cm	15 litre	75 bn litre

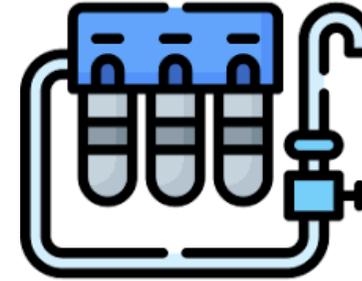
For every 10 litre of Deionized water, 15 litre of fresh raw water or 28 litres of sea water required

- Fresh water required for GH2 production = 0.013% of water potential of India
- Fresh water requirement for 5 MMT GH2 production can support thermal power generation capacity of 5.7 GW

System Efficiency for Power – Power Conversion

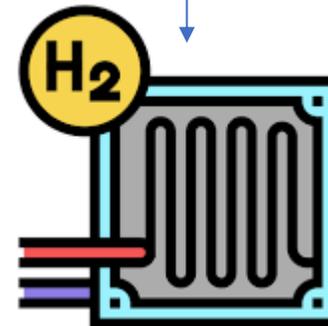


Electricity



Electrolyser

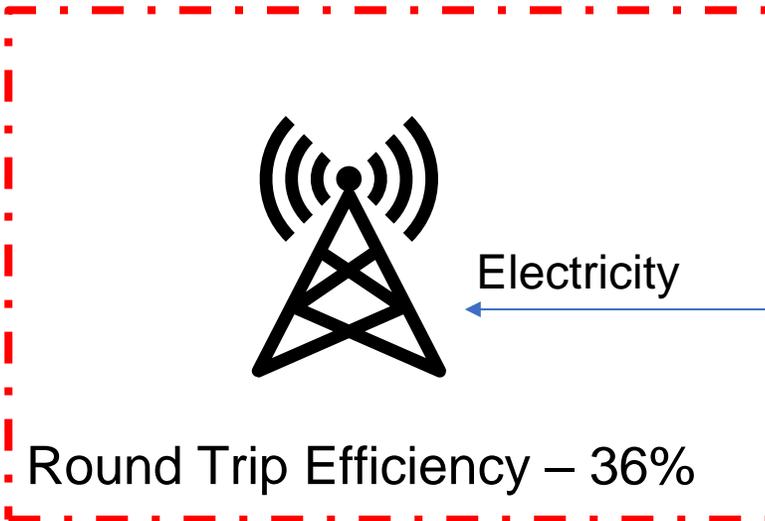
Efficiency 60%



Fuel Cell

Efficiency 60%

Electricity



Round Trip Efficiency – 36%

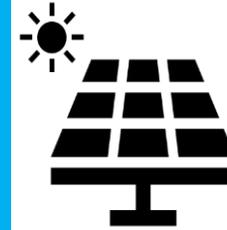
National Green Hydrogen Mission- launched on 4th January 2023



At least
5 MMT GH₂
Annual Production



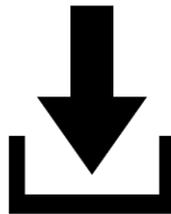
60-100 GW
Electrolyser
capacity



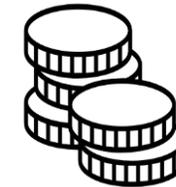
125 GW RE
Capacity for GH₂
Generation



50 MMT
Emissions Averted



1 lakh Crore
Import Savings



8 Lakh Crore
Investment

6 Lakh Green Jobs

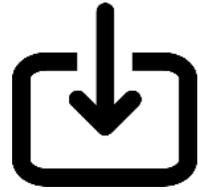
NGHM Key Elements

Demand Creation



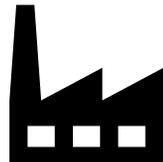
Export Markets

**Capturing
Global Demand**



Substituting imports

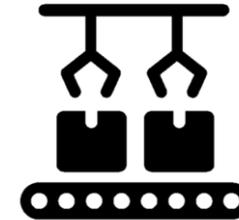
**Fossil Fuels and
Fertilizers**



Domestic Demand

Multiple Sectors

Incentivising Supply

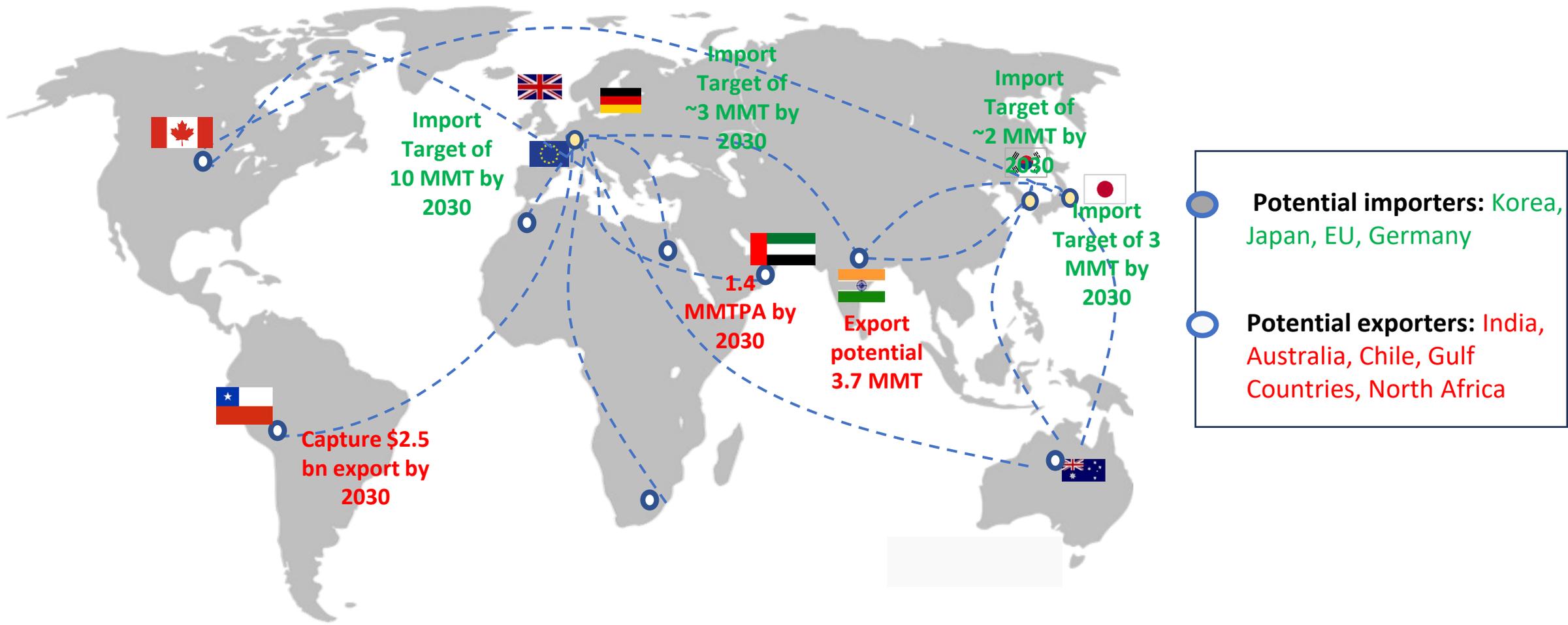


**Strategic Interventions
for GH2 Transition**

Direct Financial Incentives for:

- Electrolyser Manufacturing**
- Green Hydrogen Production**

Green Hydrogen Trade Potential



Hydrogen likely to be traded in form of derivatives (Green Ammonia, Green Methanol etc.)

NGHM Key Enablers



Resources

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



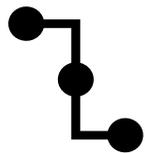
R&D

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



Ease of doing business

Simpler procedures, taxation, SEZ, commercial issues



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

NGHM Outlay

	S. No.	Mission Components	Amount (₹ Crore)	Amount (₹ Crore)
Outlay recommended till 2029-30	i.	Strategic Interventions for Green Hydrogen Transition (SIGHT)	17,490	18,133
	ii.	Support for low-carbon Steel projects	455	
	iii.	Human Resource Development	35	
	iv.	Public Awareness and Outreach	70	
	v.	Programme Management	83	
Outlay recommended till 2025-26	vi.	Support for Shipping and ports projects	115	1,611
	vii.	Support for Mobility projects	496	
	viii.	GH ₂ production technologies, storage, hubs, etc.	400	
	ix.	R&D Projects	400	
	x.	Testing Facilities, Standards & Regulations development	200	
Total				19,744

Timeline

