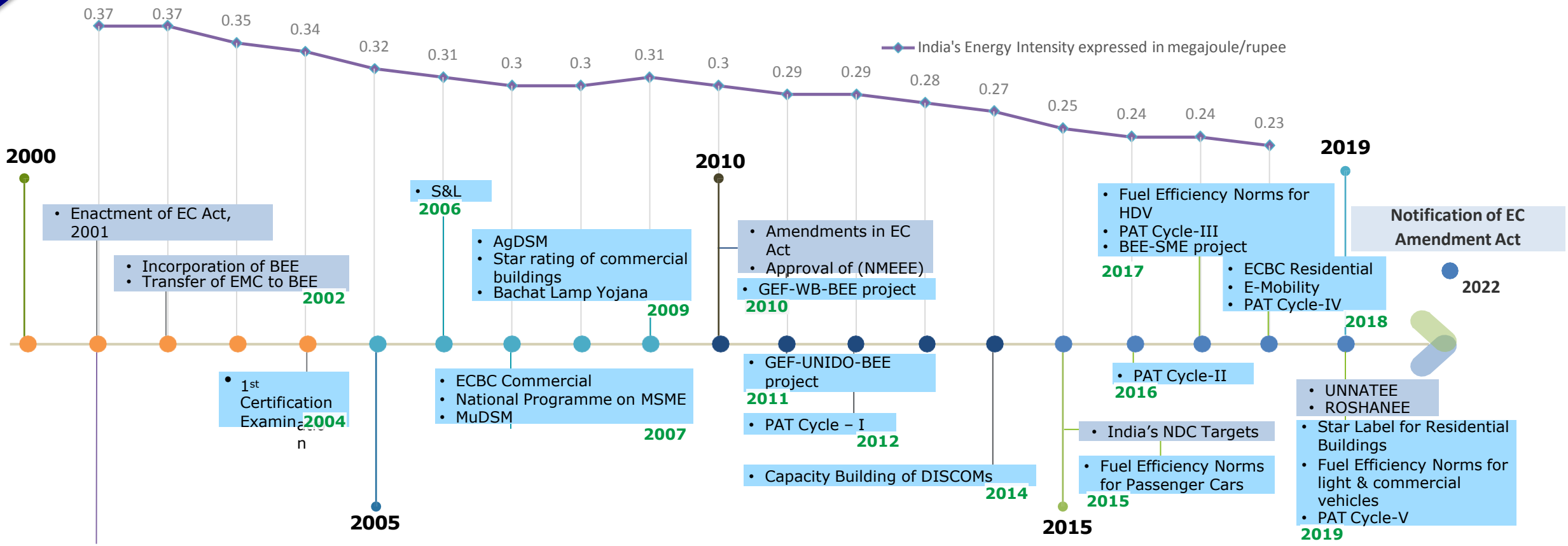
About Bureau of Energy Efficiency, India

- **Established in 2002 under Energy Conservation (EC) Act**
- To discharge regulatory functions on energy efficiency and energy conservation
- Provides the legal framework for promoting energy conservation activities:
  - Standards and Labelling for appliances & equipment
  - Energy Consumption norms for energy intensive industries
  - Demand Side Management (DSM) programmes
  - Energy Conservation Building Code (ECBC) for commercial buildings
  - Certification of Energy Auditors and Managers
- Mission Directorate for National Mission for Enhanced Energy Efficiency (NMEEE)
- **Supported by States Designated Agencies (SDAs) at State level**
- **For implementation of Energy Projects, Ministry created Energy Efficiency Services Limited (EESL).**
- EC Act amended in 2010 and 2022.

Journey of BEE towards making an Energy Efficient India



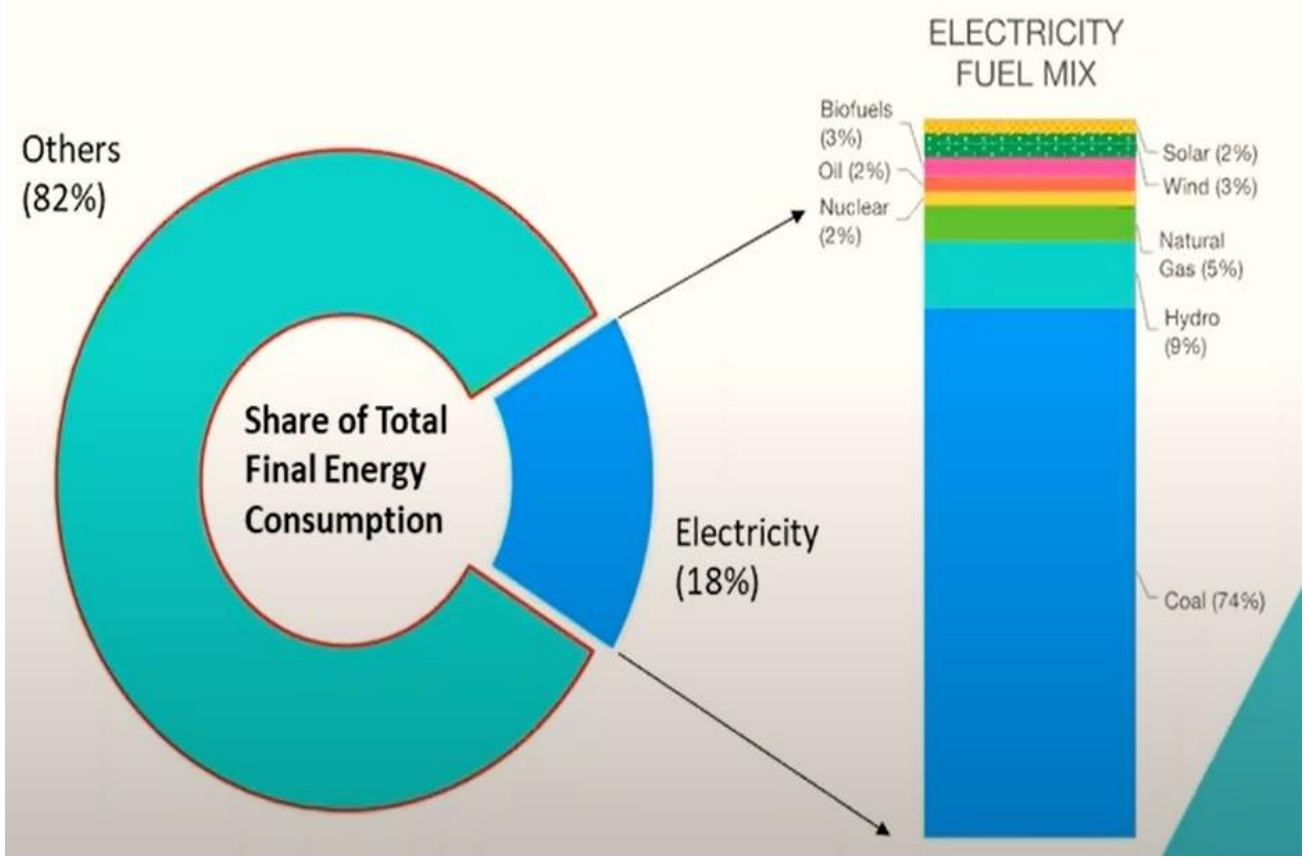
Guiding Missions | Schemes

Impact of Energy Efficiency Measures: FY 2021-22

- Annual Electrical Savings of **249.88 Billion Units**
- Annual Thermal Energy savings of **23.85 Million Tonnes of oil equivalent**
- Annual cost savings worth **INR 1,60,721 crores** approximately
- Annual Energy savings of **44.43 Millions Tonnes of Oil Equivalent** i.e., **6.00% of total primary energy supply** of the country
- Total reduction in CO2 emissions is around **280.77 Million Tonnes** annually

India - energy scenario

- Only 18% of total energy consumption is electricity.
- Rest 82% is from fossil fuels (Oil, coal, Natural Gas etc)
- 3rd largest greenhouse emitter.
- Per – capita emissions – only one-third of the global average



India’s Climate change Goals - Panchamrit

Announcements
❑ India will increase its non-fossil energy capacity to 500 GW by 2030.
❑ India will meet 50 percent of its installed power capacity from non-fossil energy by 2030.
❑ India will reduce the total projected carbon emissions by one billion tonnes from now to 2030.
❑ By 2030, India will reduce the carbon intensity of its economy by 45 percent as compared to 2005 level
❑ By 2070, India will achieve the target of net zero emissions.

Target to achieve 45% Emissions Intensity Reduction

	Year 2005 (Base year)	Year 2016 (As per BUR-3)	Year 2019 (Estimated)	Emissions on 33% reduction	Emissions on 45% reduction
Emissions Intensity [gCO2e/INR GDP at 2011-12 prices]	27.79 (Base)	21.12 (24%)	19.73 (29%)	18.62 (33%)	15.28 (45%)
GDP Projection (INR Lakh crore)		123	145	300	300
Emissions in 2030 as per base year (2005)		3418	4029	8337	8337
Net Emissions (Actual/Projected)		2597	2861	5586	4584
Emission reduction required (2030)				2751	3753
Emissions reduction achieved	-	821	1168	2418	2418
Additional emission reduction required 2020-30				333	1335

Roadmap to achieve 45% Emissions Intensity Reduction (CO_2 Savings of One Billion Tonne by 2030)

Emission in 2030		Emissions (MtCO2e)
Targeted Reduction (over baseline) **For GDP-300 INR Lakh Crore**		3753 (8337 – 4584)
Reduction achieved (upto 2019-20)		2418
Additional savings required (2020-30)		1335
Energy emissions **(Targeted reduction)**	Power Generation (Supply Side)	731
	Energy Efficiency (Demand Side)	740
	Total	**1471**

Part B: Demand Side Initiatives
(All figures in MTCO2)

S. N.	Sector	Activity Area	BAU Emission (2030)	Target Emission (2030)	CO_2 Emission reduction	Programme
1.	Industrial (including MSME)	Energy intensity improvement in large industry, Use of clean tech in MSMEs	1685	1310	312	• PAT Scheme • SME Progarmme • Tech. Upgradation
2.	Transport	Improving fuel efficiency of vehicles, Adoption of EVs, Modal shift from road to rail	844	619	187	• Fuel efficiency norms • Electric Mobility • Net zero Railway / Modal Shift
3.	Domestic	Deployment of LEDs, Use of efficient appliances, Energy efficient homes	683	543	116	• UJALA • Star Rated Appliances • ECO Niwas Samhita
4.	Commercial	Energy efficient /NZ buildings, Use of efficient appliances	320	230	75	• ECBC , Net Zero Campus • Star Rated appliance
5.	Agriculture	Solarization of Diesel Pumps, Promoting Star Rated pumps	269	229	33	• KUSUM • DSM
6.	Municipal	Deployment of energy efficient streetlights and pumps	98	78	17	• SLNP • DSM
	Sub-total		**3899**	**3009**	**740**	

PAT - Sectoral Coverage

Criteria for Identification of Sectors

- Listed in Schedule of EC Act
- Intensity or quantity of energy consumed
- Amount of investment needed
- Capacity to invest
- Availability of energy efficient technology

Sectors in PAT Scheme

1. **Aluminum;**
2. **Fertilizers;**
3. **Iron and Steels;**
4. **Cement;**
5. **Pulp and Paper;**
6. **Chlor-Alkali**;
7. Sugar;
8. **Textile**;
9. Chemicals;
10. **Railways**;
11. Port Trust
12. Transport Sector (Industries and Services)
13. Petrochemical, **Gas Crackers, Naphtha Crackers** and **Petroleum Refinery**
14. **Thermal Power Stations**, Hydel Power Stations, Electricity transmission companies and **distribution companies**;
15. **Commercial Buildings or Establishment**

Achievements of PAT programme (2012-2022)

Energy Saving	Emission Reduction	Capacity building	Savings	Investment
24.5 mtoe	~105 million tonnes of CO_2	**17000+** Engineers and operators	Monetary savings	Encouraged investments for energy efficient technologies
~3.8% of India's total final energy consumption (2018-19)	~3.5% of India's emissions	**30718** Energy Auditors & Managers	Rs 40,945 Crores	Rs 75,400 Crore (reported)

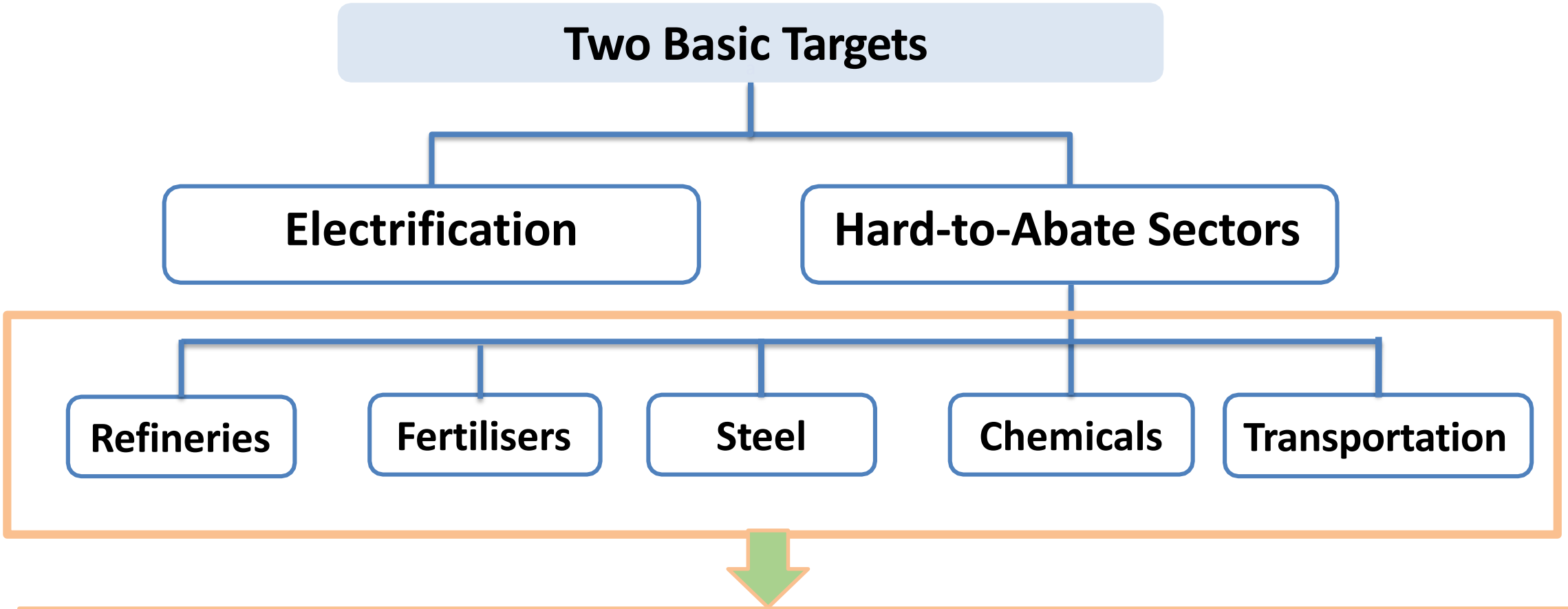
Energy Conservation (Amendment) Act 2022

Key Areas

1. Non-fossil Source usage norms (Hydrogen/ Renewable)
2. Framework for Carbon Markets
3. Buildings Sector
   - Inclusion of Large Residential Buildings
   - Enhanced scope of Building Code to include renewables
4. Strengthening Implementation
   - Rationalizing Penalty Provisions
   - Functions of State Electricity Regulatory Commissions
5. Other Amendments

- Notified on 20th Dec, 2022
- Effective from 1st Jan, 2023

Role of hydrogen



Hydrogen is the best pathway for decarbonising these hard to abate sectors

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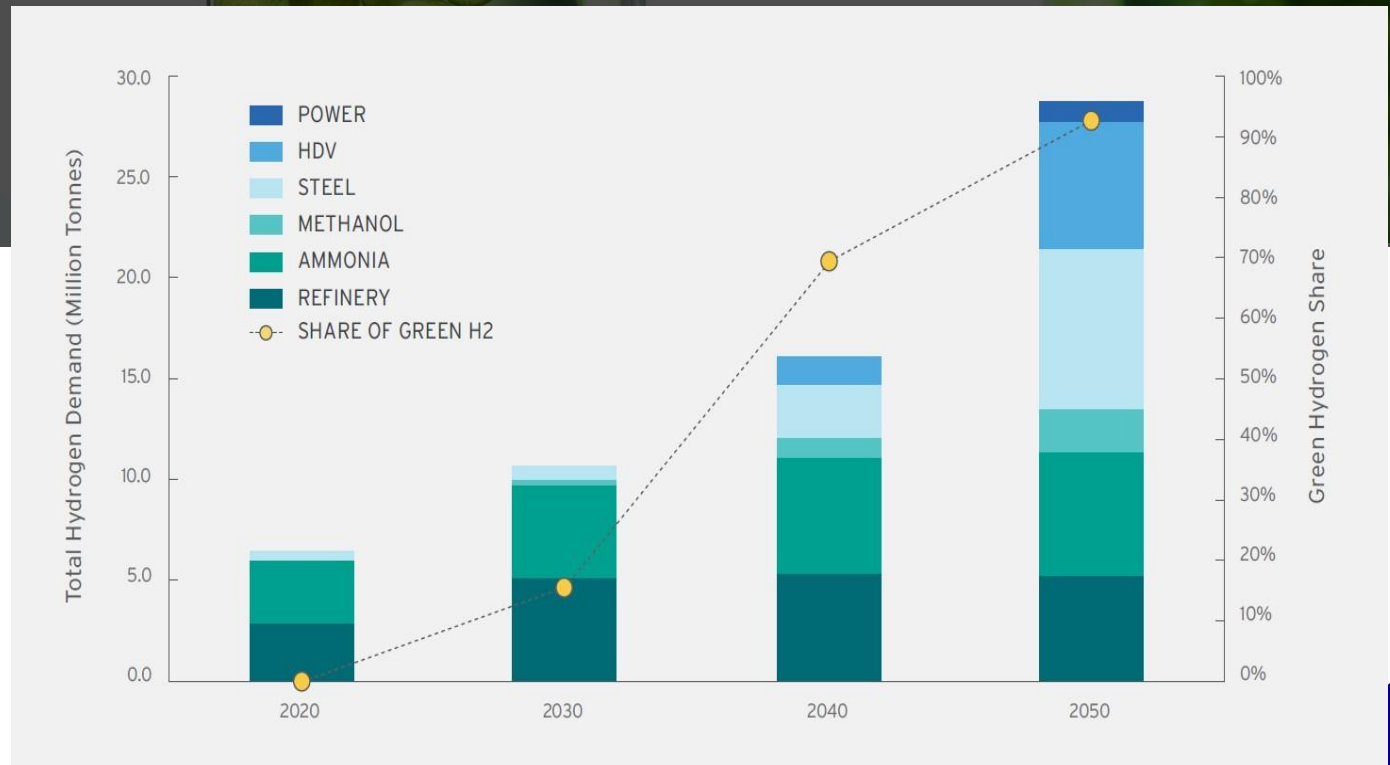
India – Hydrogen scenario

Green Hydrogen - Driver of India's Energy transition

- 6 million tonnes per year
- Production from natural gas reforming
- Global hydrogen consumption approx. 100 MMT
- Expected to increase by 5 fold by 2050



Green Hydrogen: Focus Areas

Refining

Fertilizer

Feedstock

Bulk Chemicals

Iron & Steel

Blending with Natural Gas

Energy Storage

Energy Carrier

Long Haul Mobility

Maritime & Shipping

Hydrogen Demand Scenario

- Global Hydrogen Demand - 90 MT/Yr. to grow to over 200 MT/Yr. by 2030 and over 500 MT/yr by 2050 and over 600 MT/yr in 1.5 deg C scenario.
- Majority of Hydrogen (95%) Globally presently is produced by Natural Gas Reforming except in China where Coal based Gasification technology is predominant source.
- Hydrogen demand >98 % is dominated by refining and ammonia production.
- India Hydrogen Demand – 6.7 MT/Yr. (7-8% of Global demand) which will grow to around 13 MT/yr by 2030 (excluding exports proposed for Green Ammonia) and may grow fourfold (including exports) by 2050 representing 10 % of global demand.
- In Net Zero Scenario of IEA, by 2050, 10% of Global Energy Demand and one third of Hydrogen demand will be for Hydrogen based fuels like ammonia, synthetic kerosene and synthetic methane.

National Green Hydrogen Mission

At least
5 MMT GH_2
annual
Production

60-100 GW
Electrolyser
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

National Green Hydrogen Mission

Demand Creation

Incentivising Supply

Export Markets

Capturing Global Demand

Substituting Imports & Domestic Demand

Fossil Fuels, Fertilizers, and Multiple Sectors

Strategic Interventions for GH2 Transition

Direct Financial Incentives for:

- Electrolyser Manufacturing
- Green Hydrogen Production

National Green Hydrogen Mission - Outlay

		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, Development of Standards	200	
		Total		**19,744**

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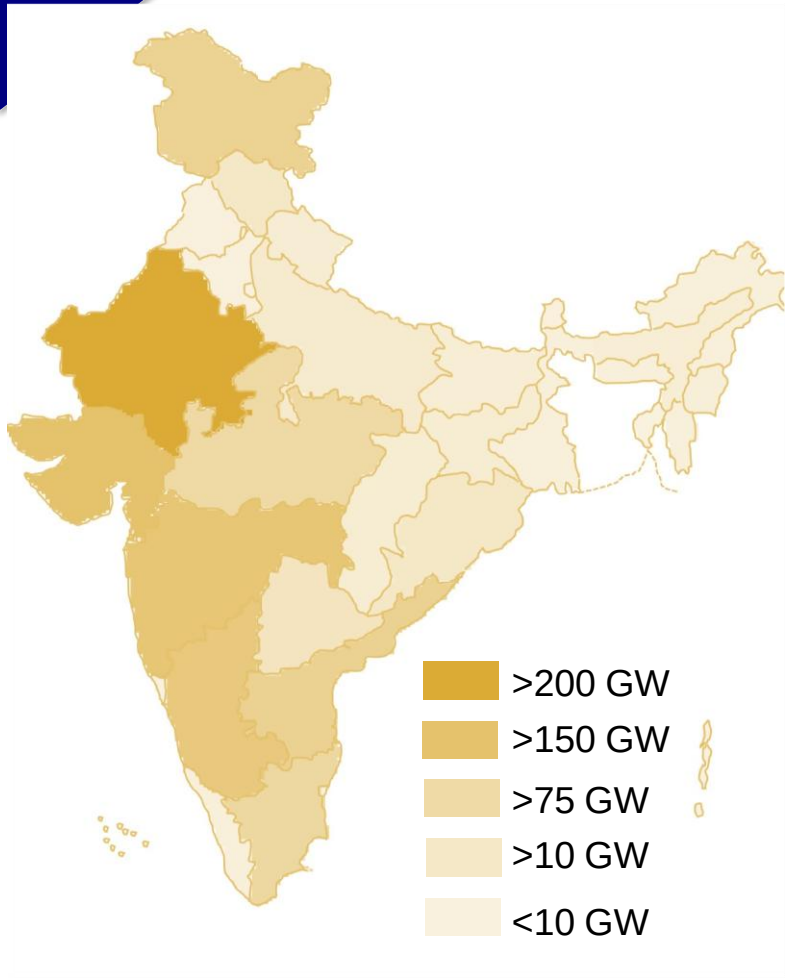
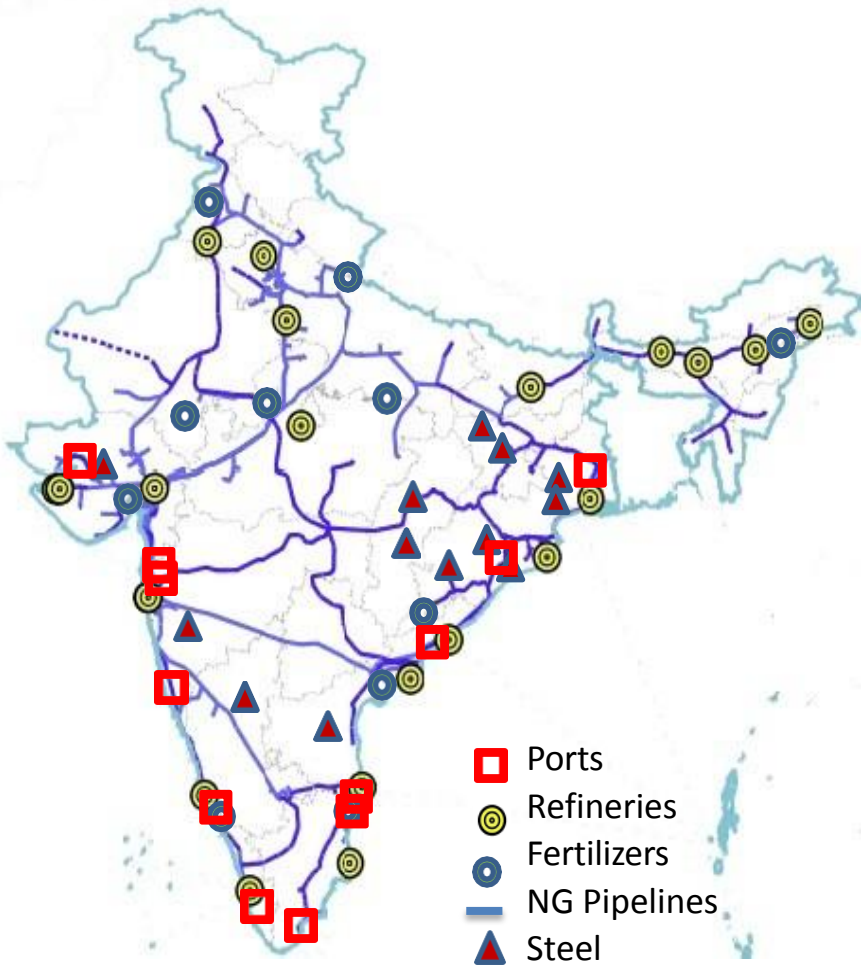
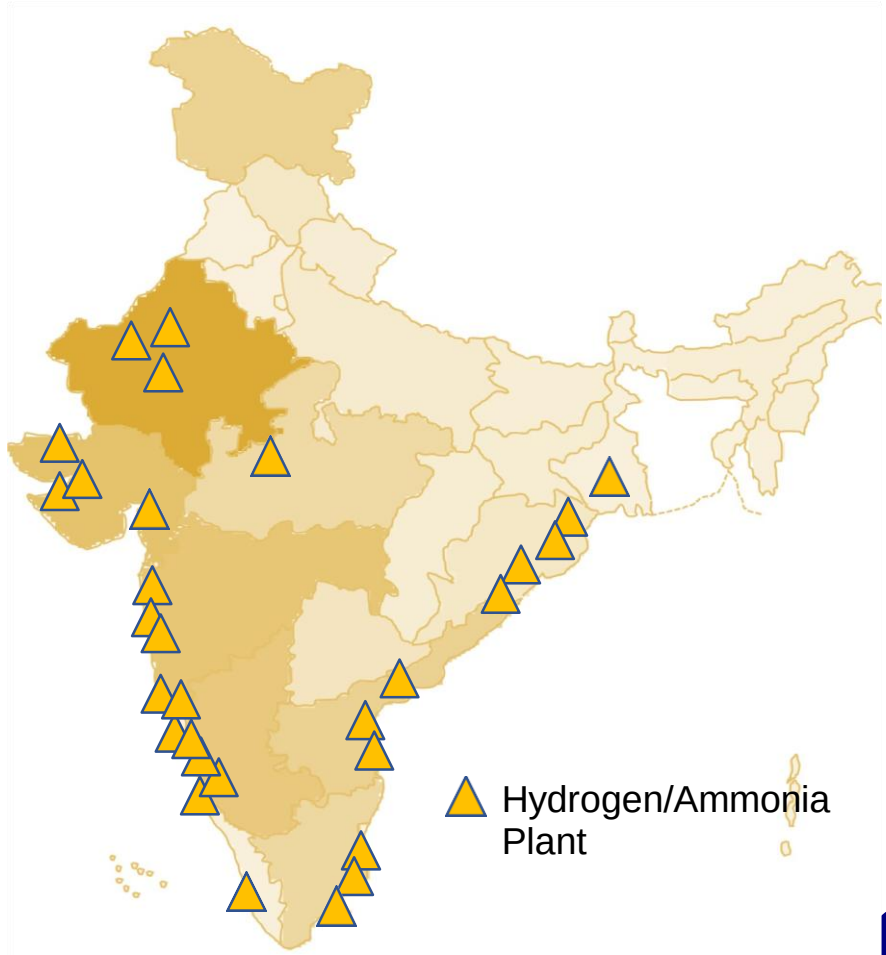
Resource Availability & Potential Project Locations



State-wise RE Potential

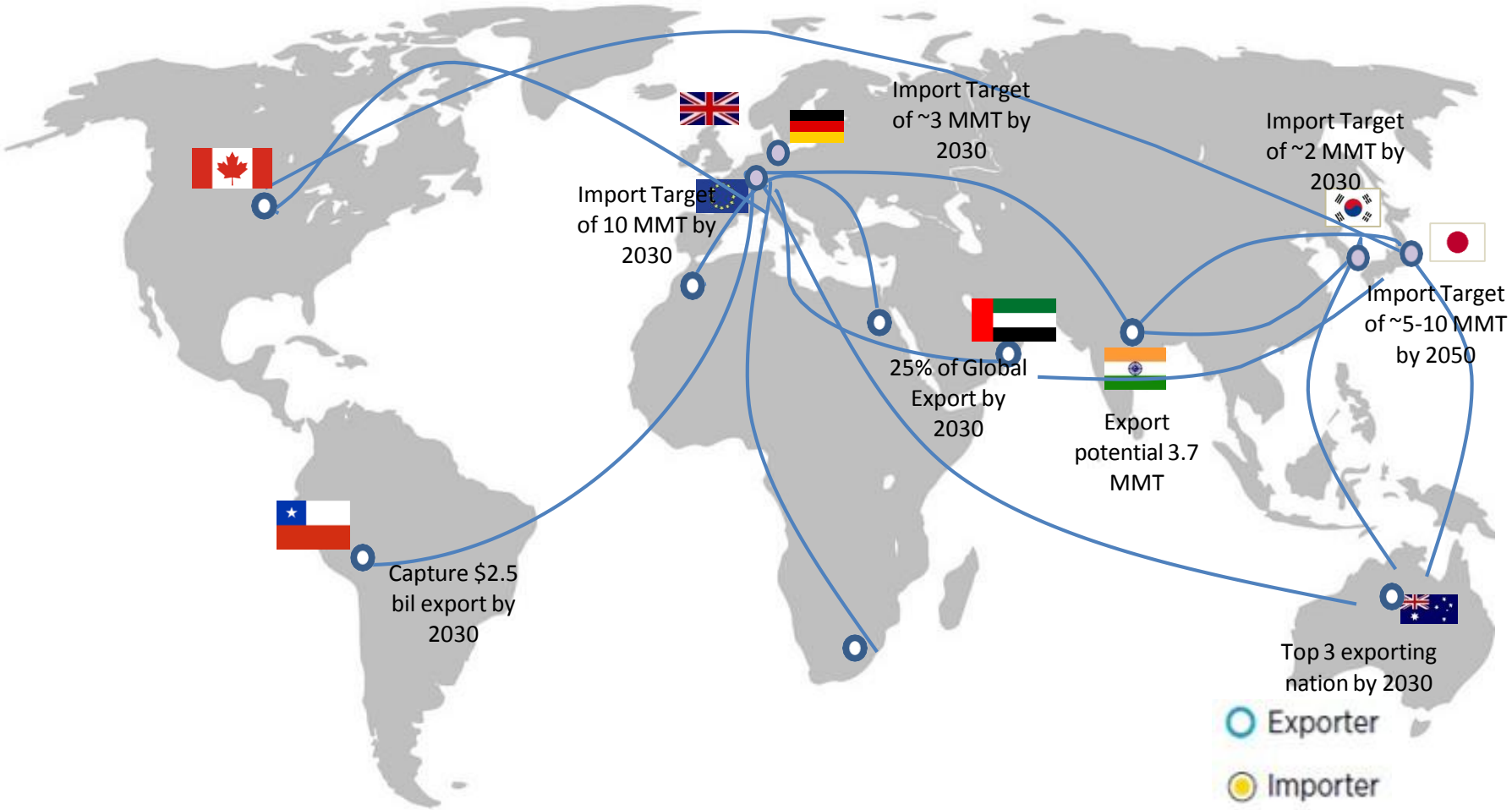


Potential Offtake of Green Hydrogen



Likely project locations

Hydrogen Trade Opportunities



- **Potential importers: Korea, Japan, EU, Germany**
- **Potential exporters: India, Canada, Australia, Chile, Gulf Countries, North Africa**

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

Over 210 Million Tonne of Hydrogen Demand by 2030, about half of it from Green sources (IEA)

Provision in EC Act for Demand Creation

The Energy Conservation Act, 2001

Clause 14 (g): Establish and prescribe such energy consumption norms and standards for Designated Consumer

Clause 14 (n): Direct every Designated Consumer to comply with Energy Consumption norms and standards

The Energy Conservation (Amendment) Act 2022

Amendment in section 14 : Clause 6 (x): Specify minimum share of consumption of non fossil source by Designated Consumer as energy and feedstock, provided different share of consumption may be specified for different types of non fossil sources for different DC

Challenges to transition to Green Hydrogen

- **High Production Costs:** Green hydrogen production is currently more expensive compared to hydrogen produced from natural gas through steam methane reforming (SMR). The high initial costs of renewable energy infrastructure and electrolysis technology make green hydrogen less economically viable for refineries.
- **Limited Renewable Energy Supply**: Availability and reliability of renewable energy sources like wind and solar can be intermittent. Refineries require a consistent and reliable hydrogen supply, making it challenging to depend entirely on renewable sources for green hydrogen production.
- **Infrastructure Challenges**: Existing hydrogen infrastructure in refineries is primarily designed for grey hydrogen and may not be compatible with green hydrogen. Retrofitting or building new infrastructure to accommodate green hydrogen can be costly and time-consuming.
- **Storage and Transportation**: Hydrogen has low energy density by volume, which means it requires large storage tanks or compression at high pressures, both of which come with their own set of challenges and costs. Additionally, there are safety concerns associated with handling and transporting hydrogen due to its low ignition energy and high reactivity. As many of the refineries are facing space constraint, storage and transportation standards are required.

Challenges to transition to Green Hydrogen

- **Implementation Timeline:** Establishing the necessary infrastructure and commissioning a green hydrogen plant in a refinery typically takes approximately 2-3 years.
- **Requirement in revision in energy banking policies**: India's energy banking policies need significant revisions to encourage the widespread adoption of solar and green hydrogen technologies.

Other

- Absence to access the General Network Access across states and industries.
- 5 MT of green hydrogen will need 125 GW of green power. We need to aim to have it in addition to 500 GW target meant for grid electricity.
- India’s current demand of hydrogen is 6.7 MT/Yr. which will grow to around 13 MT/Yr by 2030. Even with 5 MT/Yr of green hydrogen, we will have to continue to produce almost the current production of grey or blue hydrogen till 2030 or beyond.
- Availability of land for solar panels and availability of demineralized water at the place of hydrogen production could be a challenge when we want to increase the supply of green power and hydrogen.
- The efficiency of electrolysers need to be higher and cost need to lower with sources of indigenous components supply, including membrane, etc. to be developed.
- The cost of storage and supply of hydrogen is a significant cost which will need to be optimized.

Need for Carbon Market in India

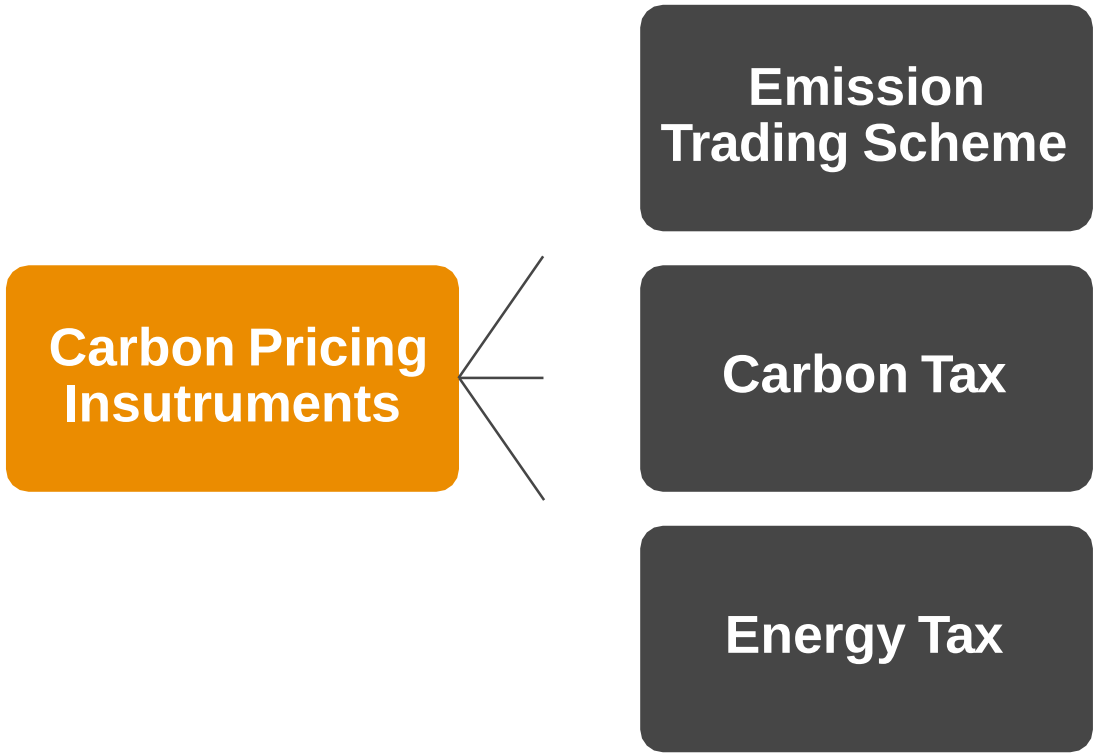
- **To facilitate cost effective** achievement of India's enhanced **NDC targets** and **future NDC goals**

- To mobilize new mitigation opportunities through **demand for emission reduction credits** by private and public entities.

- To **mobilise** a significant portion of **investments in clean technologies** required by growing economy to transit toward low-carbon pathways.

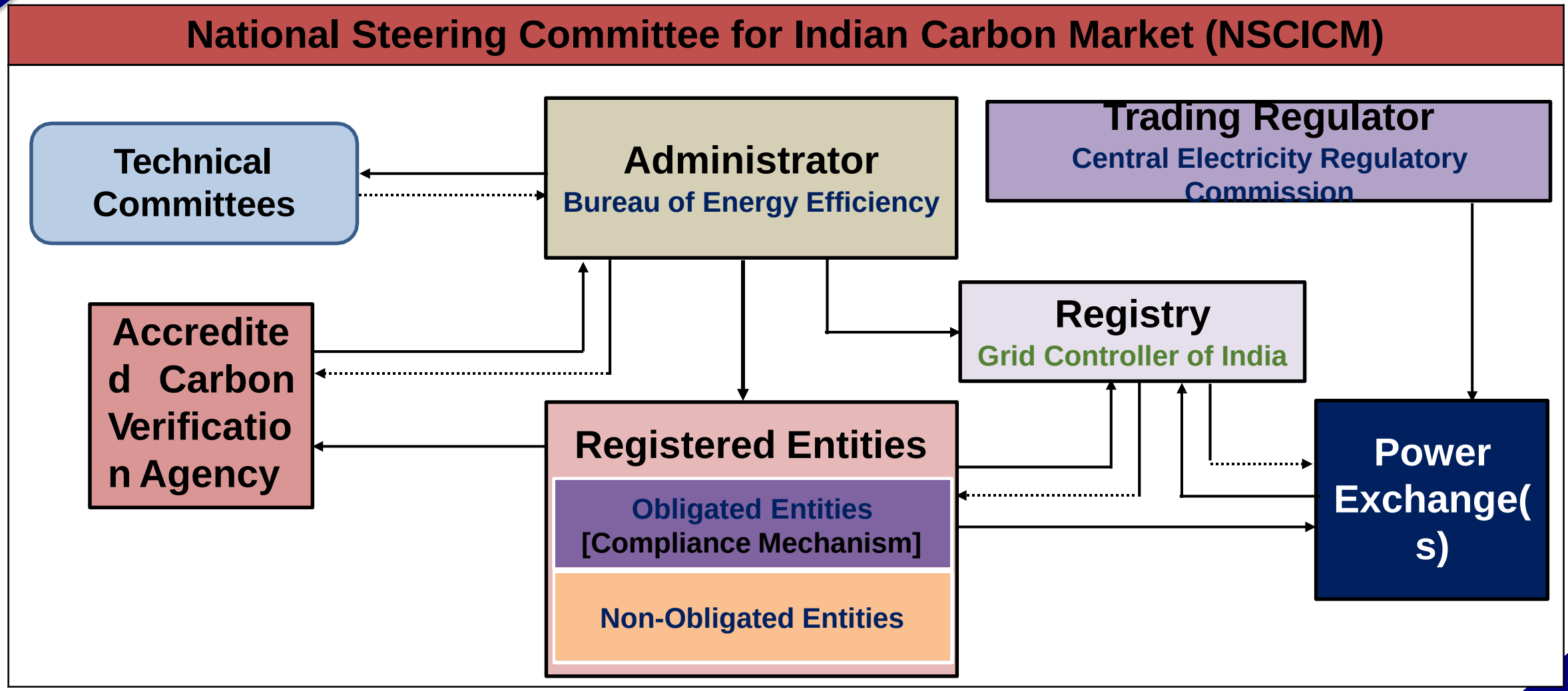
- To **leverage** the potential international collaboration and financing **opportunities under Article 6** of the Paris Agreement.

Global Perspective - Carbon Pricing Instruments (CPI)



- Key aspect of CPI is the "**polluter pays**" principle
- Its broad goal is to **discourage the use** of carbon dioxide–emitting fossil fuels
- An approach to reduce emissions that **passes the cost of emissions on to emitters**.
- Price on carbon **creates financial incentives** to reduce emissions.
- Globally 73 CPIs of which **36 are emission trading systems**

Institutional Framework



Expected Impacts -ICM

Emission Coverage and market size –More than 1000 entities having **35-40% of India GHG Emissions and INR 8000-10,000 Cr market size**

Technology Adoption: Cleaner and more efficient technologies, fostering innovation and sustainable growth

Facilitating more market opportunities - **Attract investments and finance** in emission reduction projects and **opportunities for Green jobs**

Incentivising the emerging solutions by the Government in areas of **Green Hydrogen, Biofuel, EV mobility and many such initiatives**

Enabling opportunities for **bilateral approaches** to attract finance for emerging technologies (Article 6.2 of the Paris Agreement)

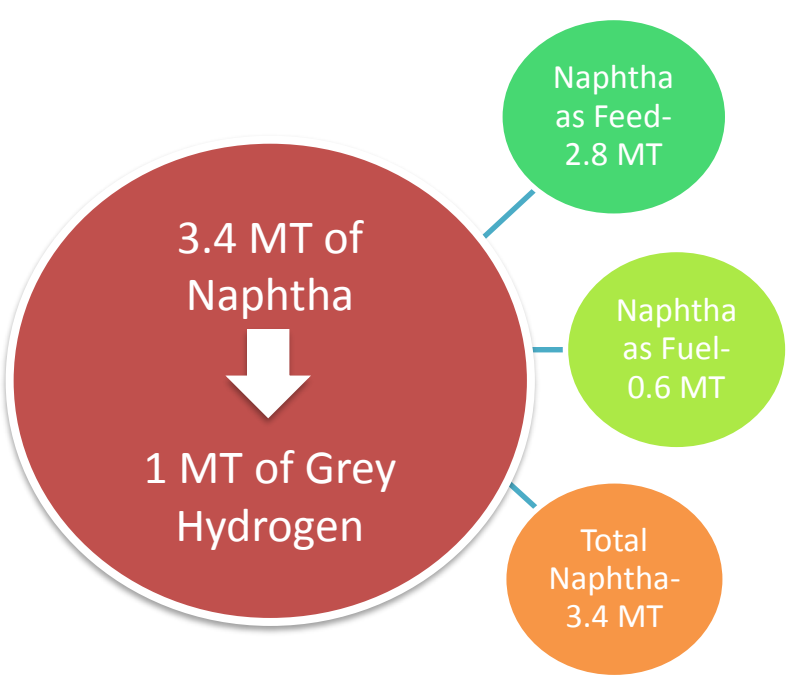
Meeting CBAM Requirements – Aligning MRV and the possibility of reduced impact resulting from **lower embedded emissions**

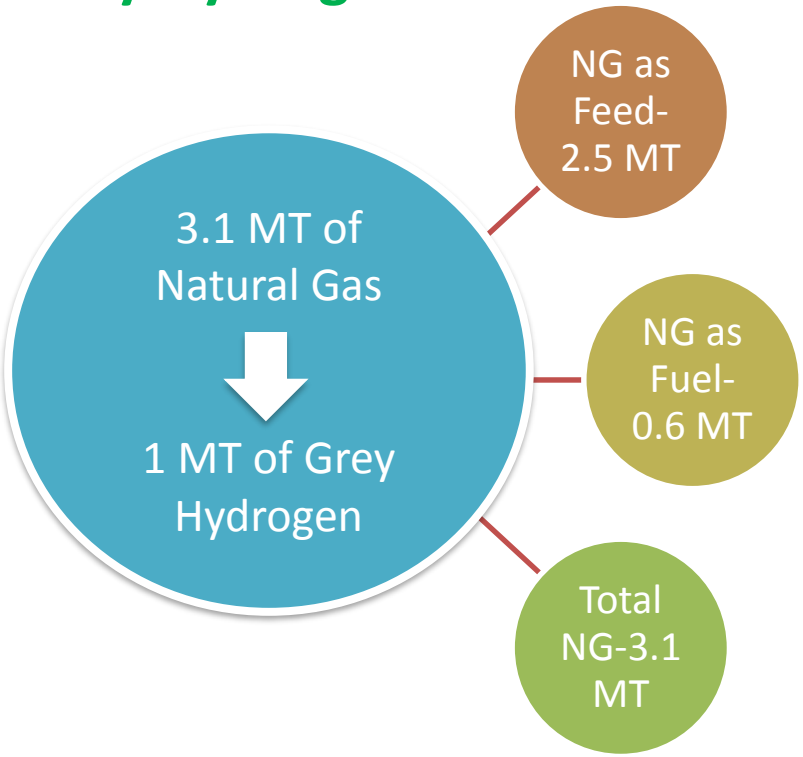
Enabler towards Net Zero Emissions


Thank
you

Hydrogen Production in Refinery

Production of 1 MT of Grey Hydrogen





Hydrogen Production in Refinery

Total Natural Gas consumed	-	59969 MMSCM
Total Natural Gas produced	-	33,664 MMSCM
Total Natural gas imported	-	26,647 MMSCM
Cost of Import	-	17.9 billion USD

Total Grey Hydrogen required for Refinery sector - 2.1 Million Tonne

3.3 MT (4372 SCM) Natural Gas is required to Produce 1 Tonne Grey Hydrogen

Assuming entire grey hydrogen is produced from NG,

9182 MMSCM Natural is required for producing 2.1 Million Tonne Grey Hydrogen.

Import Saving in Natural Gas

The Foreign exchange Outgo
- 6.167 billion USD
- Rs 49336 Crore

(Assuming replaced NG was imported)

If we replace 10% Grey H2,

Saving in Foreign Exchange
- 616 Million USD
- Rs 4933 Cr

Estimated Cost of Green H2 - 4.0 Lakh/ton

Additional Cost of 10% replacing Grey H2 - 2.5*0.21*10^6 = Rs 5250 Crore