

AVENER

Green Hydrogen

Zero Emissions, Infinite Possibilities

Industry Report

April 2025



Table of contents

1.

Overview of Green Hydrogen in India

Fueling the future growth with Green Energy

2.

Policy Initiatives

Aligning Indian and Global Policies with 2030 Vision

3.

Demand Dynamics

Green Hydrogen, Electrolysers and Ammonia

4.

Cost Breakdown & Outlook

Analyzing intricacies in structures for cost reductions

5.

Value Chain and Potential Offtakers

Well-integrated value chain with sizeable potential offtakers

6.

Bid Awards

SECI Awards and Incentives

7.

Marquee Investors & Deals

Transactions & Partnerships

8.

Way Ahead

Future of green hydrogen

Overview of Green Hydrogen in India

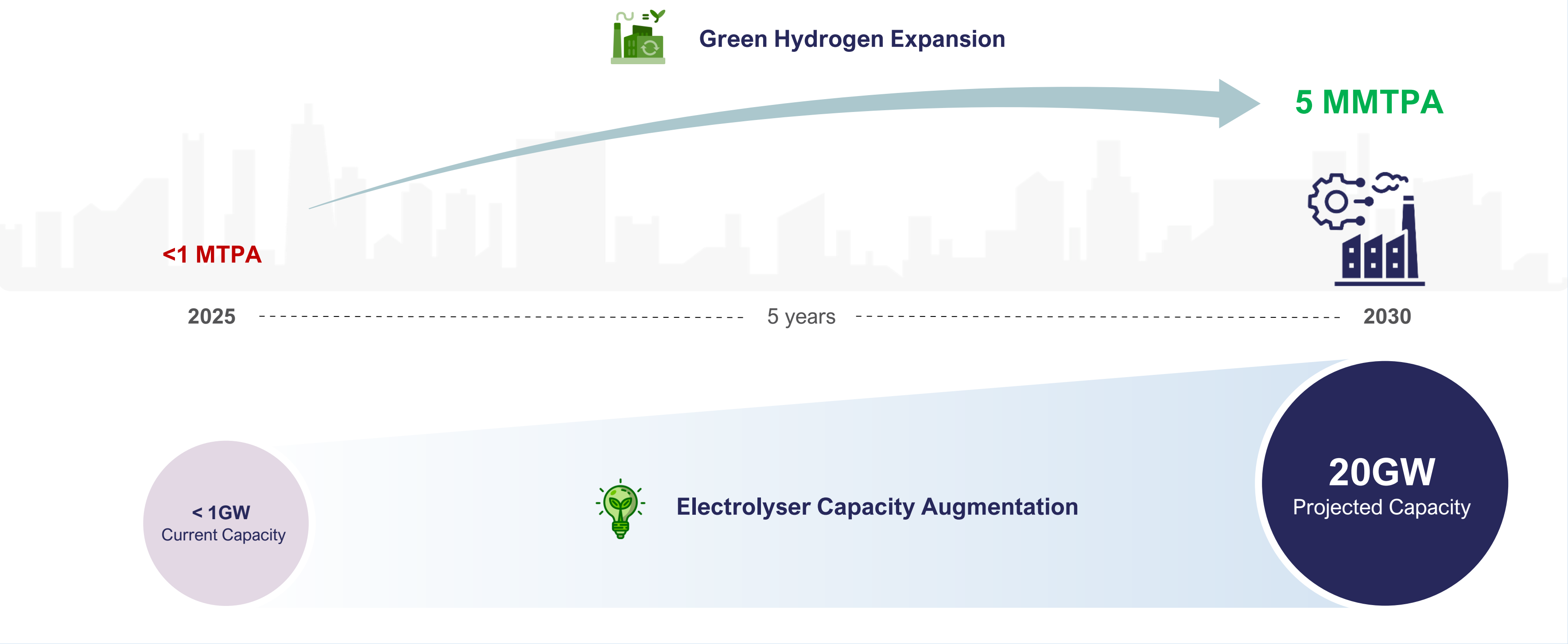
Fueling the future growth with Green Energy



Unlocking Green Hydrogen - Opportunities

Driving Deep Decarbonization and Investment Momentum

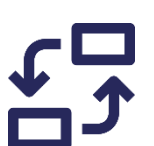
Green hydrogen and Electrolysers set for rapid growth in India



Green hydrogen fuels India's decarbonisation goals



Launch of National Green Hydrogen Mission in Jan'23



Replacement potential of 80% of Energy Consumption



Net Zero by 2070

₹10 Lakh Cr

Opportunity

₹1 Lakh Cr

Reduction in fossil fuel imports

50 MMTPA

Abatement of GHG emissions

Policy Initiatives

Aligning Indian and Global Policies with 2030 Vision



Policy Initiatives for Implementation of Green Hydrogen in India

Multiple schemes announced to incentivize investments and promote domestic production

 National Green Hydrogen Mission	 National Hydrogen Policy	 SIGHT – Electrolyser (Component I)	 SIGHT – Green Hydrogen (Component II)	 RE Open Access for GH2	 States implementing policies
<ul style="list-style-type: none">• Aimed to make India a global hub for green hydrogen• Outlay of INR 19,744 crore towards producing GH₂• To identify and develop regions capable of supporting large scale production	<ul style="list-style-type: none">• Waiver of ISTS charges for 25 years for projects commissioned before 31st December, 2030• Connectivity shall be granted on priority• MNRE to establish single portal clearances	<ul style="list-style-type: none">• Focus on establishment of domestic manufacturing• Total outlay of INR 4,440 crore allocated till FY 2029-30• SECI issued tenders under two tranches for electrolyser manufacturing	<ul style="list-style-type: none">• Focus on establishment of domestic production• Total outlay of INR 13,050 crore allocated till FY 2029-30• SECI issued tenders under two tranches for green hydrogen manufacturing	<ul style="list-style-type: none">• Granting of open access for RE energy within 15 days• Incentive such as exemptions from cross-subsidy surcharge and additional surcharges• Banking allowed for 30 days of energy used	<ul style="list-style-type: none">• Various states introduced GH2 policies – Mah, Guj, Raj, Kar, UP, AP, WB, etc• Benefits as ED exemption, wheeling charges exemption• Additional benefits such as classifying the projects under ‘White category’ status

PLI Scheme for Green Hydrogen & Electrolysers

Bolstering local production through government incentives

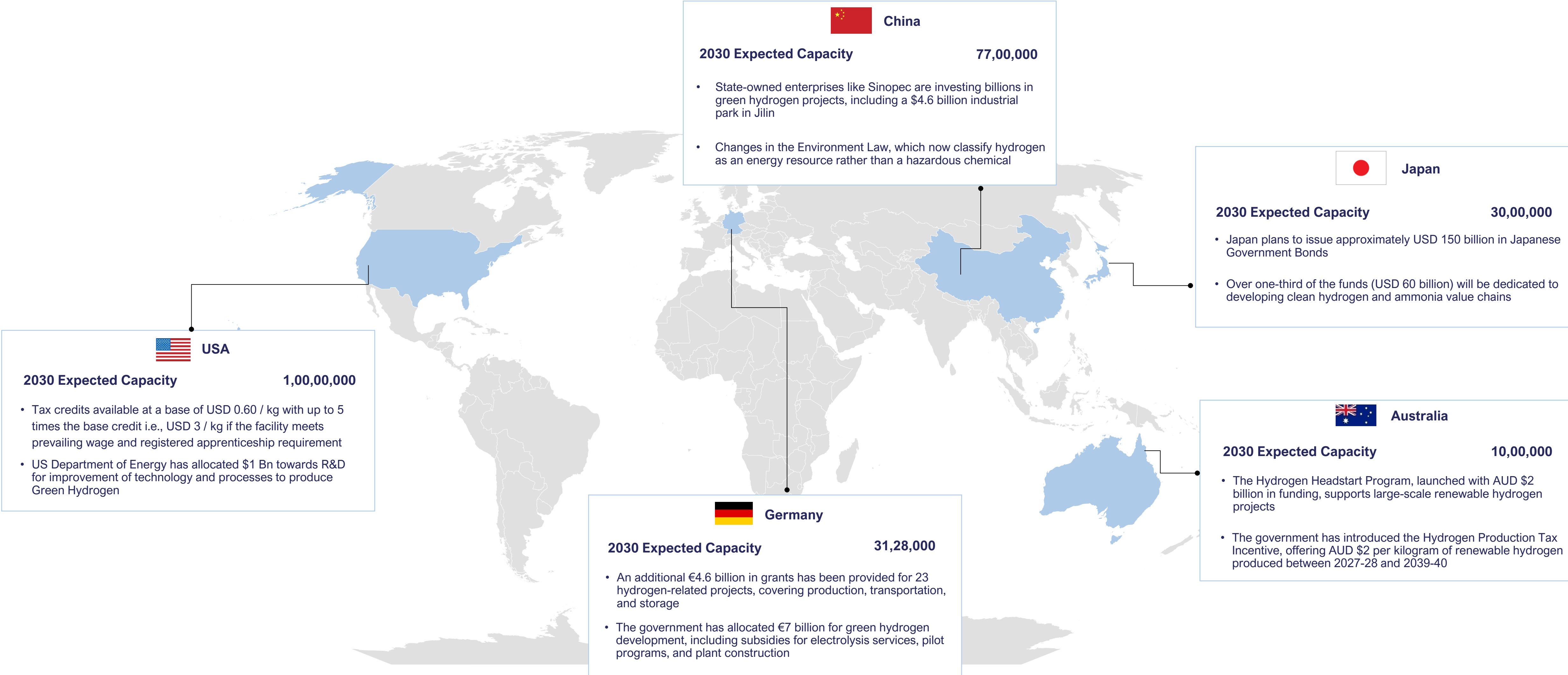
Electrolyser Manufacturing (Component – I)					
SECI					
5 years from the date of start of manufacturing					
Year	1	2	3	4	5
Base INR/KW	4,440	3,700	2,960	2,220	1,480
Any stack technology		Indigenous Stack			
2,300 MWPA		700 MWPA			
Any stack : ~INR 3,404 Cr Indigenous stack : ~INR 1,036 Cr					
Incentive based on (Actual production + Energy efficiency for electrolysers + Domestic content)					

Awarding Authority
Tenure
Base Incentive
Incentive Capacity Awarded (till Apr'25)
Incentives Committed (till Apr'25)
Annual Incentive

Green Hydrogen Production (Component – II)			
SECI			
3 years from the date of start of production			
Year	1	2	3
Upper Cap (INR/kg)	50	40	30
Technology Agnostic		Biomass based	
8,58,500 MTPA		3,500 MTPA	
Technology Agnostic : ~INR 5,258 Cr Biomass based : ~INR 36 Cr			
Incentive based on Actual production or Allocated capacity			

Global Push for Green Hydrogen

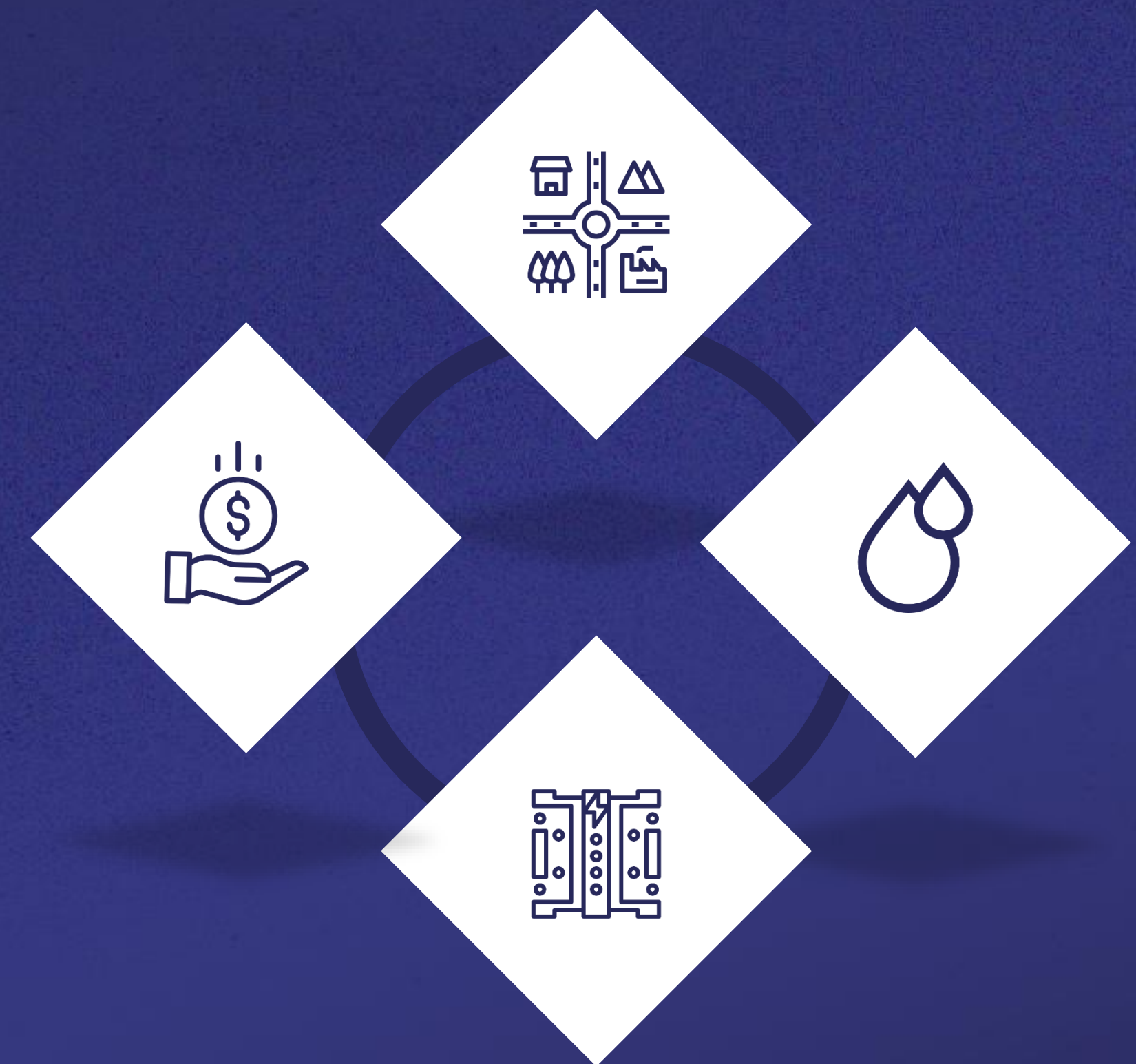
Roadmap of development of Green Hydrogen by 2030 via Government policies and subsidies



Capacities in Metric tonnes per annum

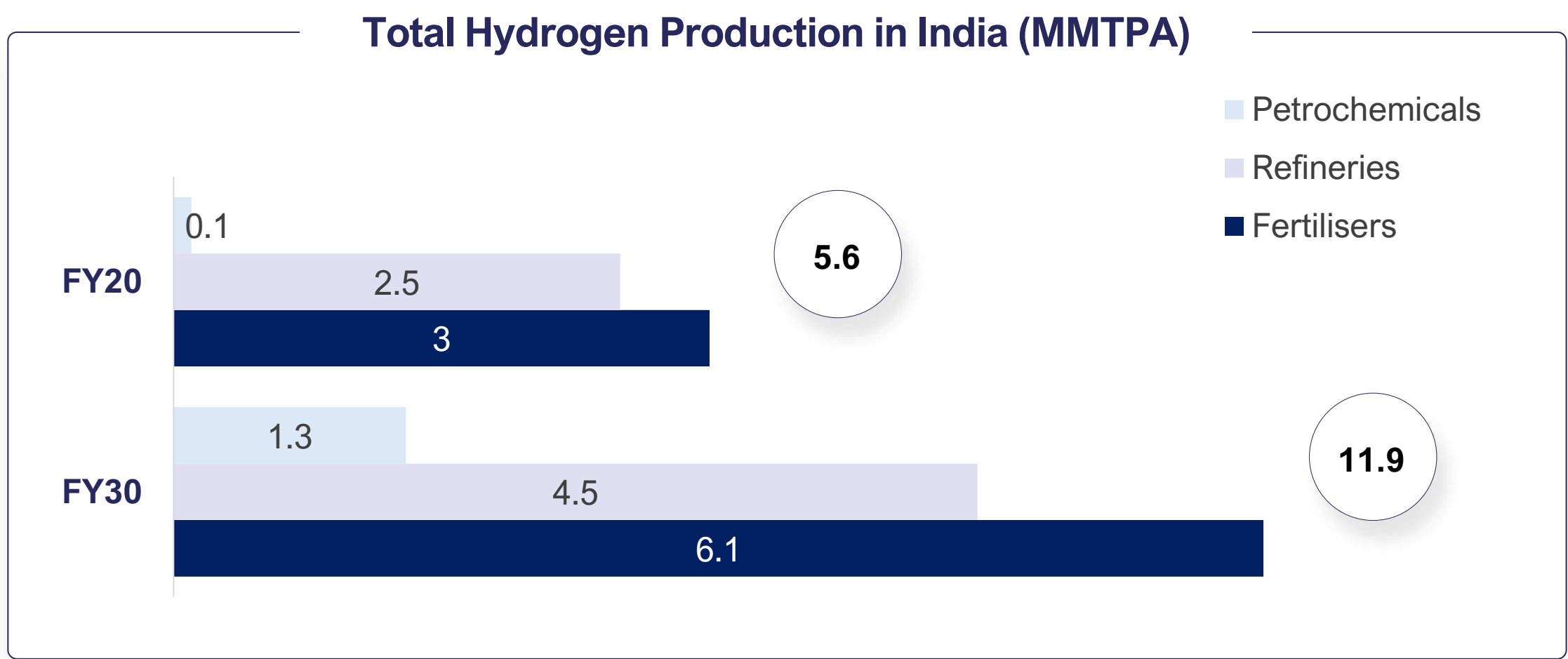
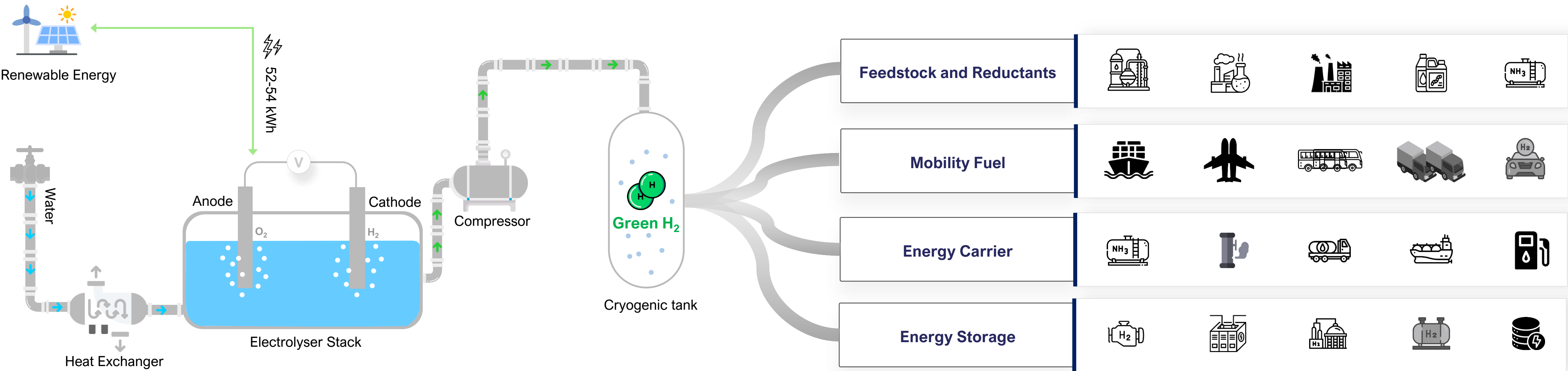
Process and Demand Dynamics

Green Hydrogen, Electrolysers and Ammonia



Green Hydrogen


Produced through electrolysis of water using electricity through RE & its utility across sectors



**Ammonia**


Fertilizer Feedstock

Ammonia, largely used compound, and fertilisers, making its production greener will help reduce carbon footprint significantly

**Reductant**

Industrial Feedstock

Hydrogen consumption in the steel and refining industries could expand to nearly 4.5 MTPA by FY 2030

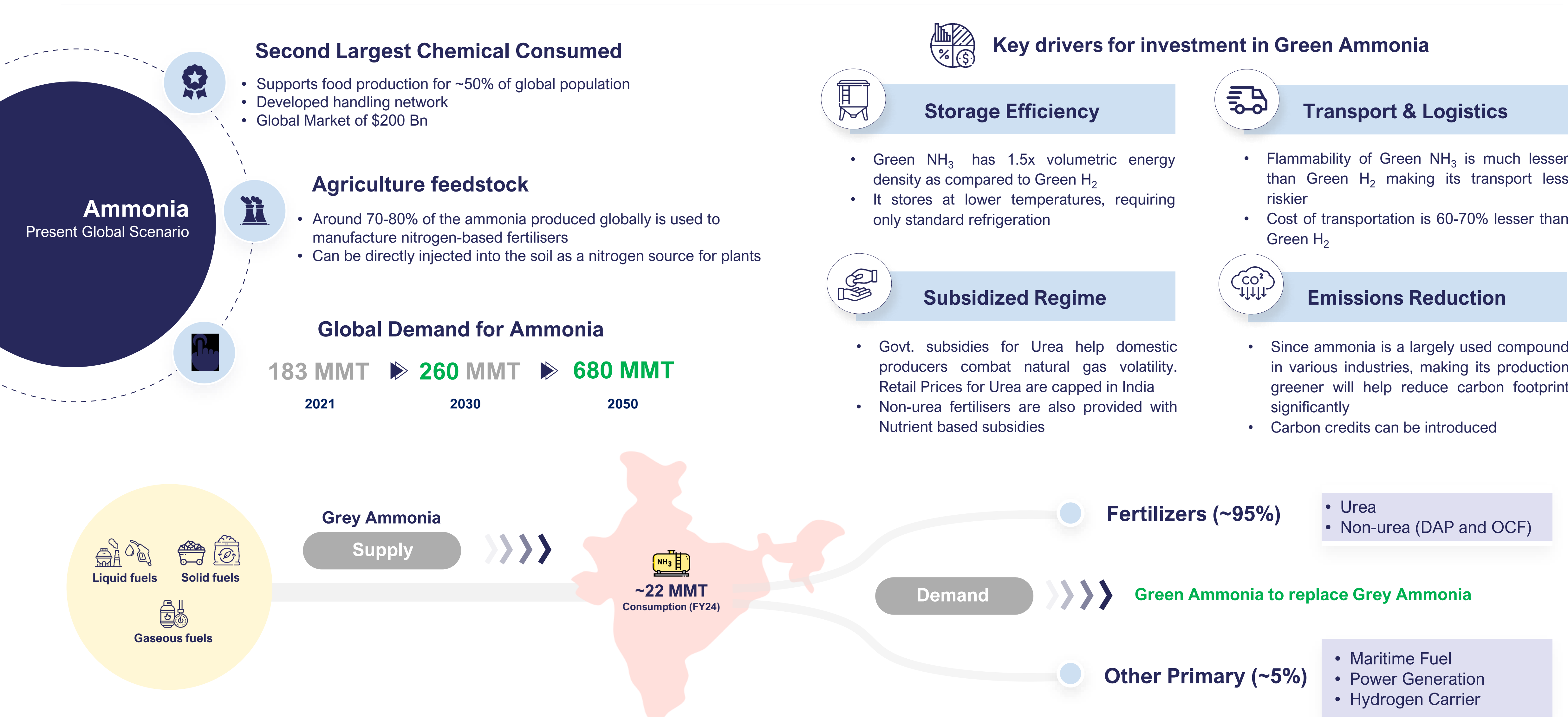
**Mobility**

Fuel Substitute

Hydrogen is significantly more energy dense than batteries. Hence, for vehicles that have higher payloads, hydrogen refilling can be done in ~5 mins

Green Ammonia

Analyzing the most prominent offshoot of Green Hydrogen in India



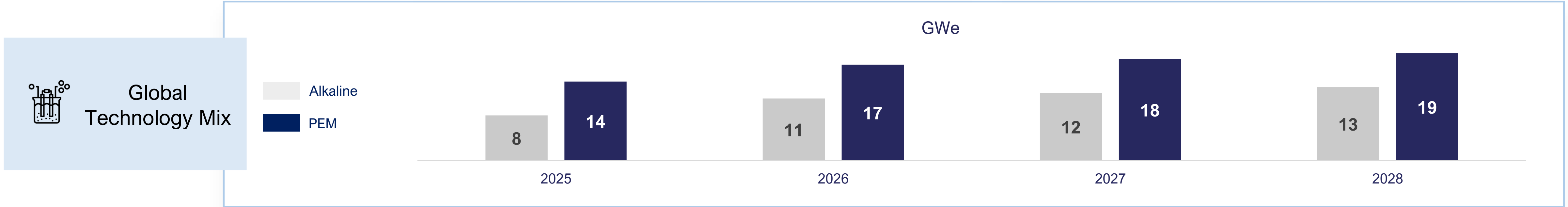
Source: Iberdola, CEEW, IGEF Study, Indian Journal of Fertilizers, Avener Estimates | Green H2: Green Hydrogen | NH_3 : Ammonia | DAP: Diammonium Phosphate | OCF: Other Chemical Fertilisers

Electrolysers

Technological advancements in electrolysers to improve efficiency

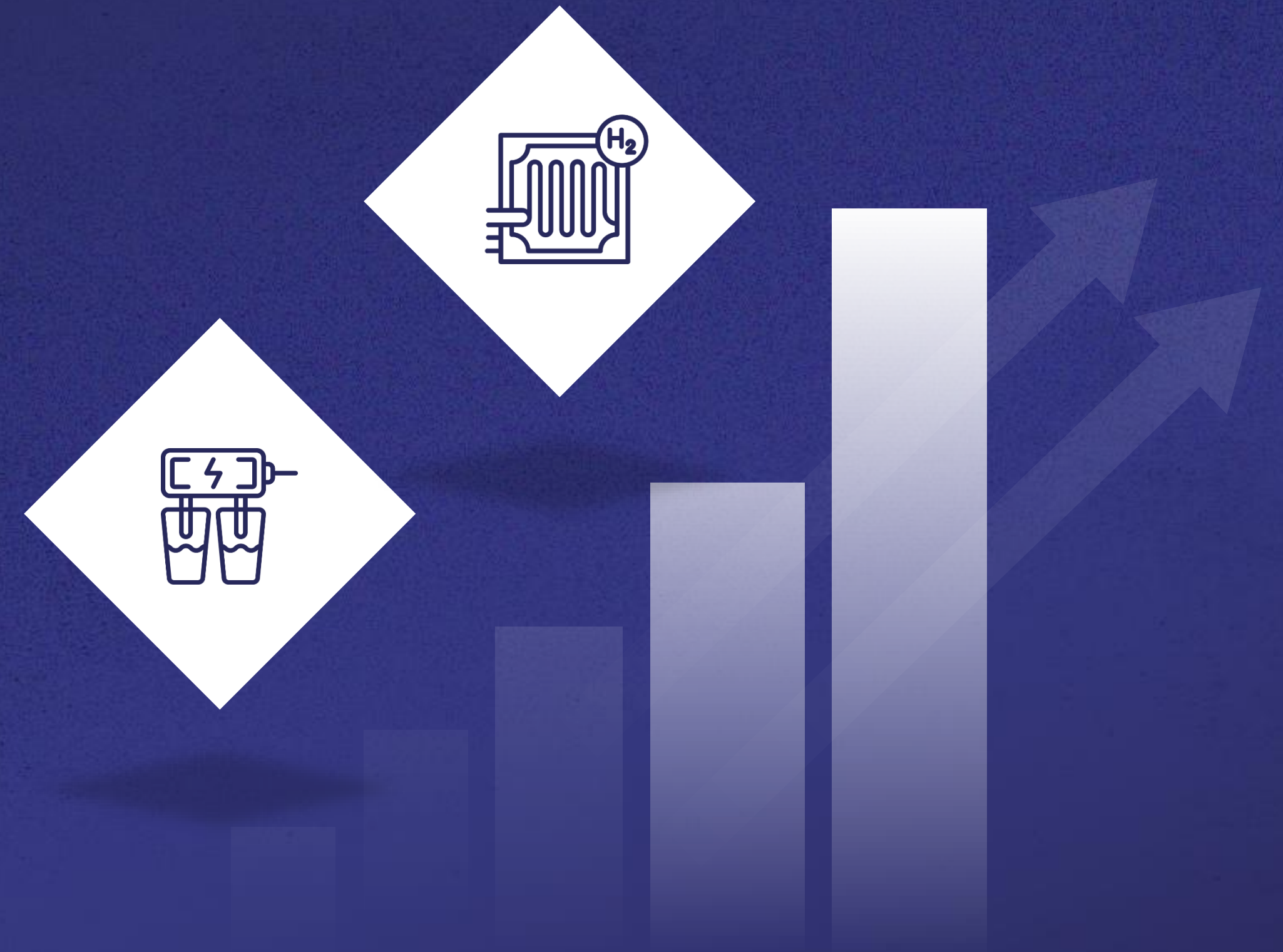


Technology Type	Alkaline	Proton Exchange Membrane (PEM)
Energy for 1kg of Green H ₂	54 kWh	52 kWh
Current Costs (1 MW Scale)	USD 600 / kWh	USD 800 / kWh
Efficiency Degradation	0.25-1.5% p.a.	0.5-2.5% p.a
Global Capacity	1,152 MW	921 MW
Advantages	<ul style="list-style-type: none">• Good Durability• Low upfront cost• No need for critical raw materials• Typically grid connected and operated at high utilisation levels	<ul style="list-style-type: none">• Higher Efficiency• High hydrogen output pressure• High flexibility in load changes• Suited for off-grid installations powered by highly variable energy resources



Cost Breakdown and Outlook

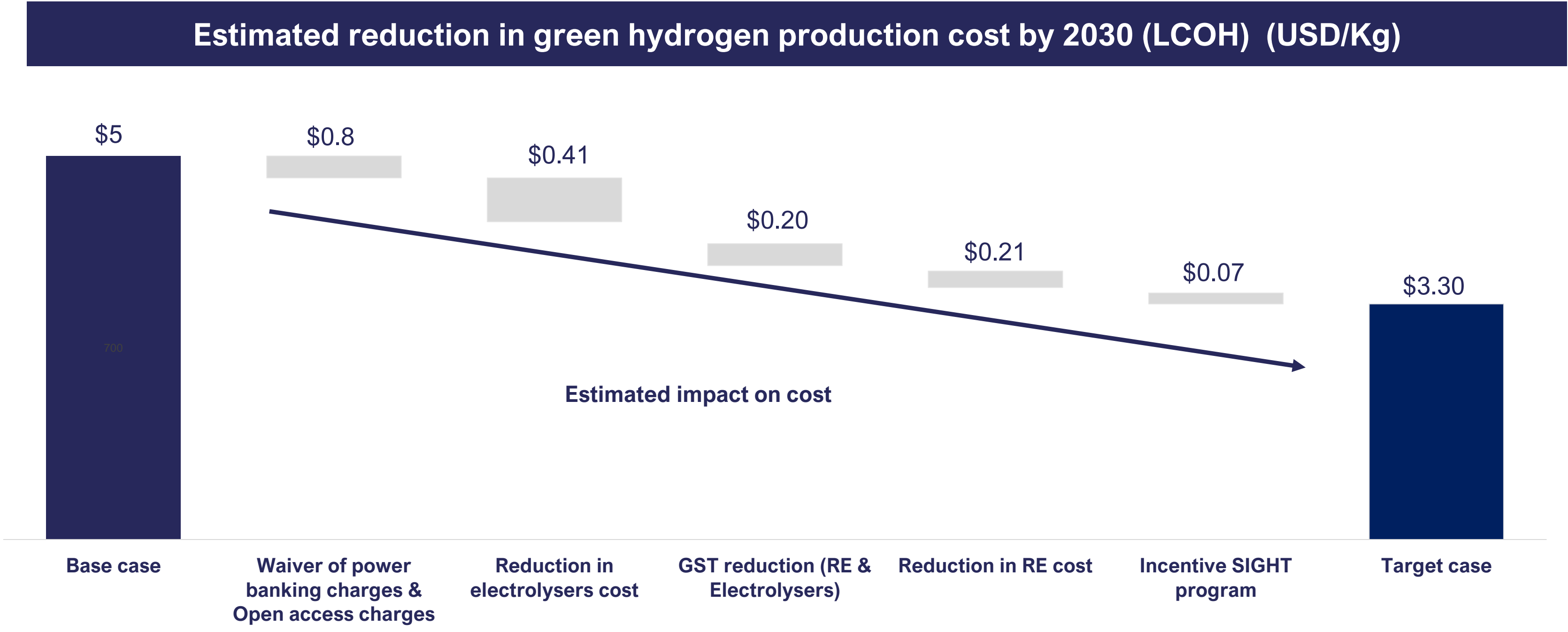
Analyzing intricacies in structures for cost reductions



Green Hydrogen

Project cost breakdown and impact on LCOH

Project Cost*	
Particulars	Value (c.)
RE cost	45-50%
Electrolysers	30-35%
BoP & Other Costs	15-25%
Total	100%



Electrolysers

Reduction in cost of electrolyzers with improvement in design enhance efficiencies and are market driven

RE

LCOE for RE technologies, is expected to continue decreasing making them increasingly competitive with traditional fuels

Open access

Waivers on open access charges considering distance from renewable assets to production sites

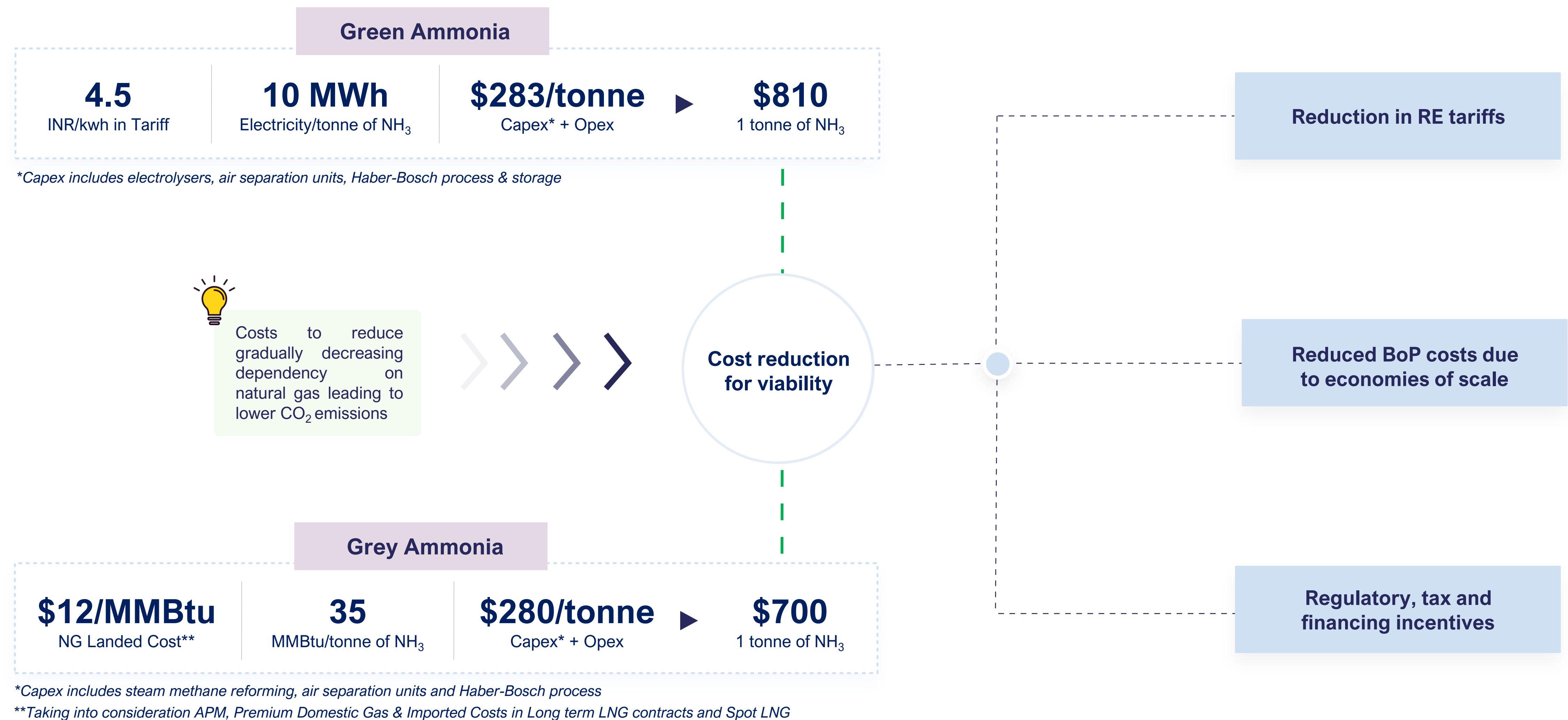
GST

Government of India can reduce the GST for the components used in green hydrogen production

* Assuming project cost of \$1,600 for 1 MW with Alkaline Electrolysers | RE: Renewable Energy | LCOH: Levelized cost of Hydrogen | Source: CEEW Report 2024

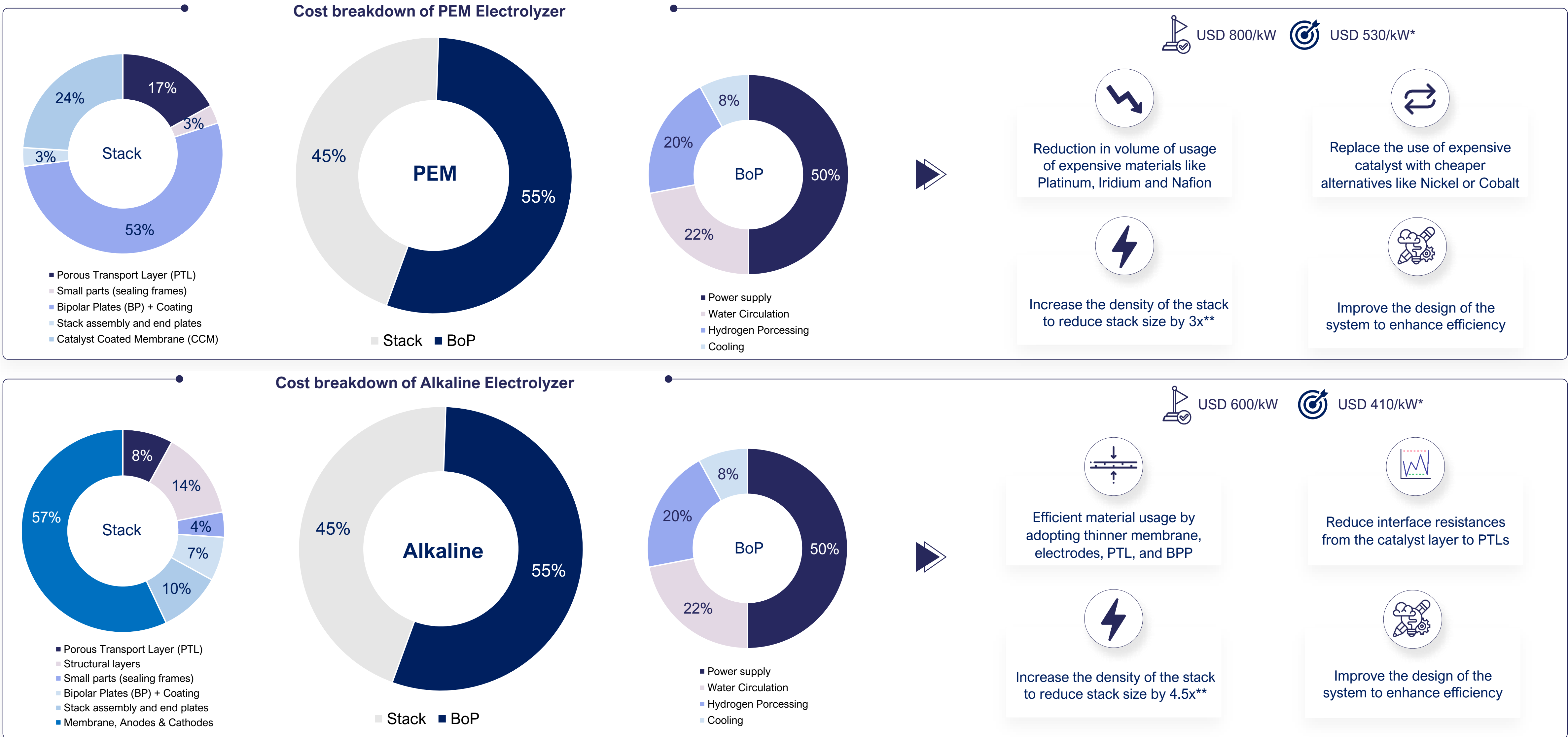
Green Ammonia

Green Ammonia providing sustainable alternative to grey ammonia



Electrolysers

Improvement in efficiency and design can help reduce electrolyser cost



Source: IRENA, CEEW, Avenier Analysis

*Cost Reduction through the improvements in stack only. Higher utilisation of BoP will drive the cost down further.

**As per CEEW Estimates

Value Chain and Potential Offtakers

Well-integrated value chain with sizeable potential offtakers



Value Chain

Key Players across the value chain spectrum

Electrolyzer Technology & Manufacturing													
EPC Project Implementation													
Standalone Green Hydrogen Producers													
Integrated Players with RE Capacity													

Potential Offtakers

Key consumers of Green Hydrogen and Green Ammonia

Transportation & Storage										
Steel Manufacturers										
Green Ammonia										
Refineries/Gas Blend										
Mobility										
Fuel Cells										

Bid Awards

SECI Awards and Incentives



Recent Contract Awards - Green Hydrogen (1/2)

Tender awards by SECI under the SIGHT Programme

Developer									
Technology	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic
Capacity	1,39,000	90,000	90,000	90,000	90,000	90,000	90,000	75,000	20,000
Tranche	1 & 2	1	1	2	2	2	2	1	1
Allocated Incentive	877	810	810	513	510	300	437	563	120

Capacity in Metric Tonne Per Annum
Allocated incentive in INR Cr

Recent Contract Awards - Green Hydrogen (2/2)

Tender awards by SECI under the SIGHT Programme

Developer									
Technology	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Technology Agnostic	Biomass based	Biomass based
Capacity	19,000	18,000	10,500	10,500	10,000	10,000	6,500	2,000	1,500
Tranche	2	1	1	2	1	2	1	1	2
Allocated Incentive	46	156	0	47	0	0	68	18	18

Capacity in Metric Tonne Per Annum
Allocated incentive in INR Cr

Recent Contract Awards - Electrolysers (1/2)

Tender awards by SECI under the SIGHT Programme

Developer	Newage Green Electro							
Technology	Any stack + Indigenous	Any stack	Any stack	Any stack	Indigenous stack	Indigenous stack	Any stack	Any stack
Capacity MW	300	300	300	300	10	300	300	274
Tranche	2	1	1	1 & 2	2	1 & 2	2	1 & 2
Allocated Incentive	444	444	444	444	15	444	444	406

Capacity in Metric Tonne Per Annum
Allocated incentive in INR Cr

Recent Contract Awards - Electrolysers (2/2)

Tender awards by SECI under the SIGHT Programme

Developer							
Technology	Any stack	Any stack	Indigenous stack	Any stack	Any stack	Indigenous stack	Indigenous stack
Capacity MW	300	105	102	300	50	30	30
Tranche	1 & 2	2	1	1	2	2	2
Allocated Incentive	444	155	150	444	73	44	44

Capacity in Metric Tonne Per Annum
Allocated incentive in INR Cr

















Global Deals & Partnerships

Marquee deals and partnerships in the Green Hydrogen and Electrolyser space












Marquee Global Green Hydrogen Deals

Significant capital infusion has happened in recent years owing to the robust pipeline

	2025	2024	2024	2023	2022	2022
Target						
Deal Size	10	8	11,000	635	127	4,000
Investors			<div>Consortium I</div> <div></div> <div></div> <div>Consortium II</div> <div></div>			
Type	Acquisition	Strategic investment	Bid Awards	Joint Venture	Strategic Collaboration	Joint Venture

Marquee Global Electrolysers Deals

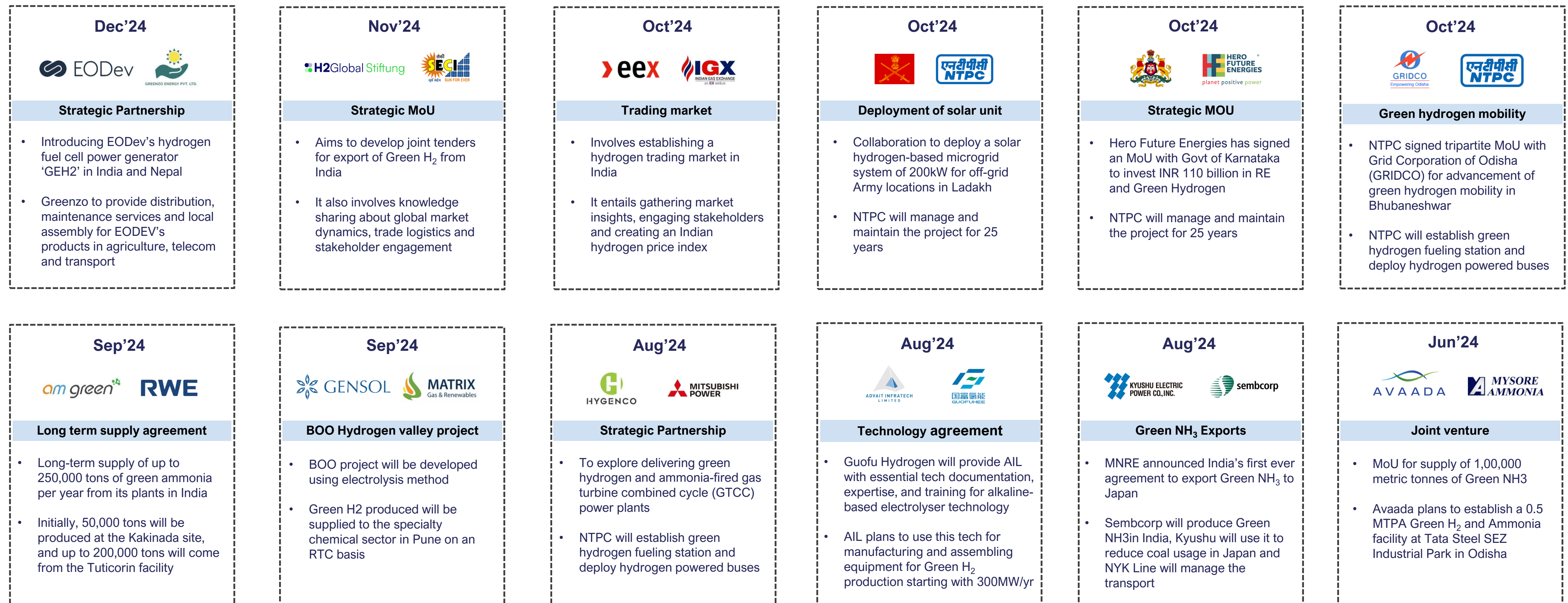
Significant capital infusion has happened in recent years owing to the robust pipeline

	2025	2023	2023	2023	2023	2022	2022
Target							
Deal Size	33	250	73	6	13	75	198
Investors			 	 		 	
Technology	Alkaline	PEM	Alkaline/PEM	PEM	Water vapor	E-TAC*	PEM
Type	Minority Stake	Series C	Series B	Seed Funding	Series A	Series B	Series B and VC Debt

*E-TAC: Proprietary H₂ Production Technology by H₂Pro
Deal Size in USD Mn

Green Hydrogen Developers Partnership across Value Chain

Major Partnerships Reshaping the Industry Landscape



Way Ahead



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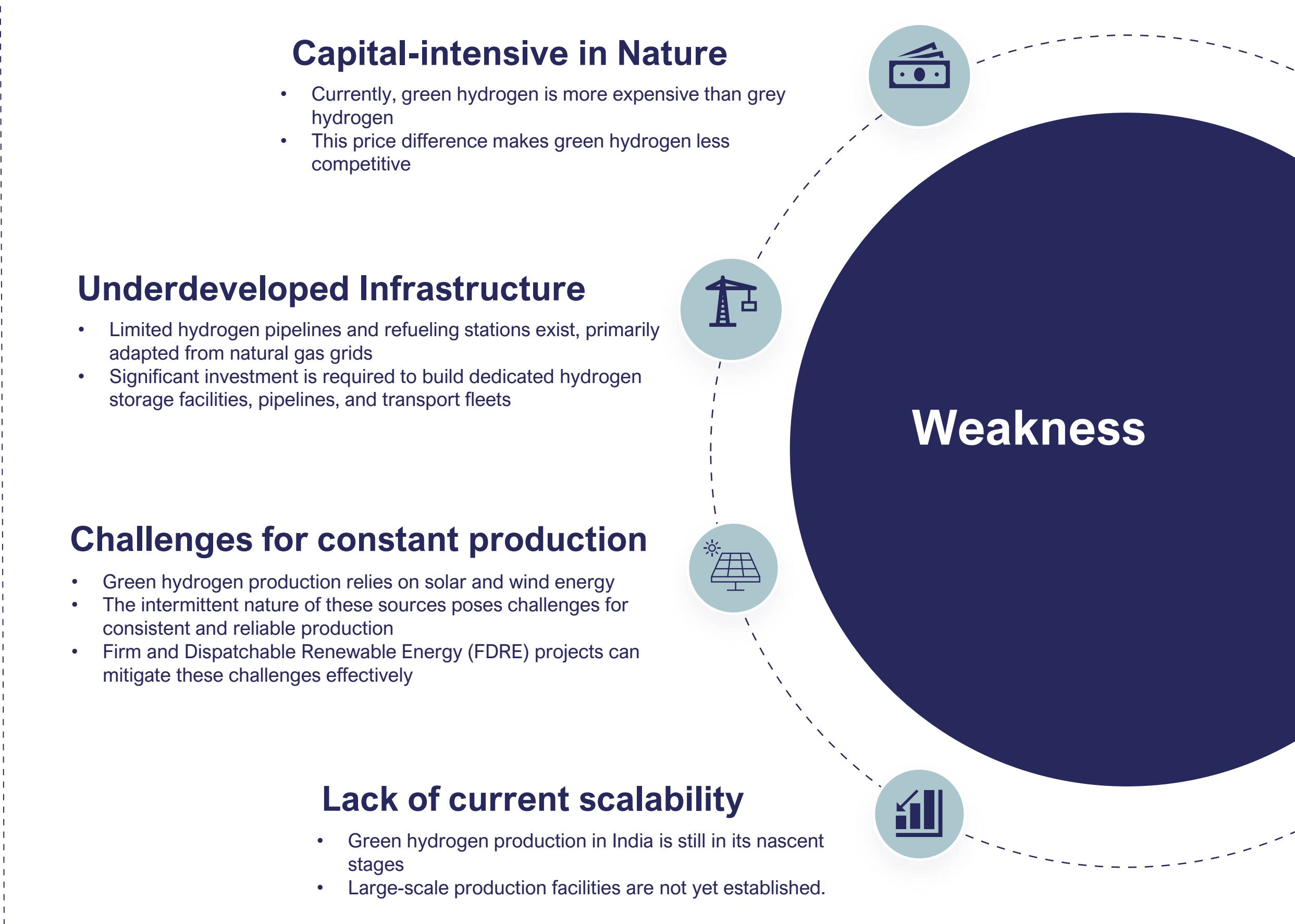
Export Infrastructure in Indian Green Hydrogen Space

Key players are exploring to establish plants near ports to cater exponential global demand

 State	 Type	 Entities	Benefits
 Gujarat	Kandla Port	 	<ul style="list-style-type: none">Manufacturers of Green Hydrogen/ Green Ammonia shall be allowed to set up bunkers near Ports for storage of Green Ammonia for export/use of shippingThe land for storage purpose shall be provided by respective port authorities at applicable chargesNational strategies emphasize the development of bunkering facilities at major ports by 2035 to support long-term storage and distributionPorts equipped with bunkering stations can supply green hydrogen as fuel for ships, helping decarbonize the maritime sector and reduce greenhouse gas emission
 Kerala	Vizhimjam Port		
 Tamil Nadu	Tuticorin Port	  	
 Andhra Pradesh	Kakinada Port	 	
	Simadri		
 Odisha	Gopalpur Port	  	
 Madhya Pradesh	Indore		

Green Hydrogen : Powering tomorrow naturally

Scalable and Sustainable despite cost and efficiency Barriers



Integrated (IPPs + Green Hydrogen producers) and Non-Integrated players are well placed to ride India's Green Hydrogen expansion, driven by falling RE costs and tech gains


About Avener



Investment Banking | Infrastructure & Real Assets

Leading financial advisors in the Infrastructure & Real Assets space in India with cumulative team experience of 100+ years

Renowned experts in Indian Infrastructure and Real Assets space




70+

Platform, equity, M&A and debt transaction closures by the team till date



\$ 15 Bn+

Total fund raising by the team till date



25+

Among the largest teams in the country dedicated towards the Infra space



Policy Formulation

Part of committees of various regulatory bodies

Transaction Footprint in FY24

18

Total deals

\$ 4.6 Bn

Total deal value



06

M&A/
Private Equity

Value: \$ 1.3 Bn

04

Project Finance

Value: \$ 1.4 Bn

08

Refinancing/
Structured Debt

Value: \$ 1.9 Bn

Accolades

- 

“Emerging Investment Bank of the year” FY24
- 

Ranked 5th in M&A & 7th in PE in YTD24
- 

Ranked 8th in PE in 2021 & 2019
- 

Ranked among the Top 10 advisors for Asia & Australia by Finance Asia in 2023
- 

Ranked among the Top 25 bookrunners in Asia by Thomson Reuters in 2019

Key Clientele - Leaders of Respective Sectors



Avener's Connects

Abhishek Kumar

Executive Director

✉ abhishek.kumar@avener.in

☎ +91 99308 13380

Dixit Porwal

Senior Associate

✉ dixit.porwal@avener.in

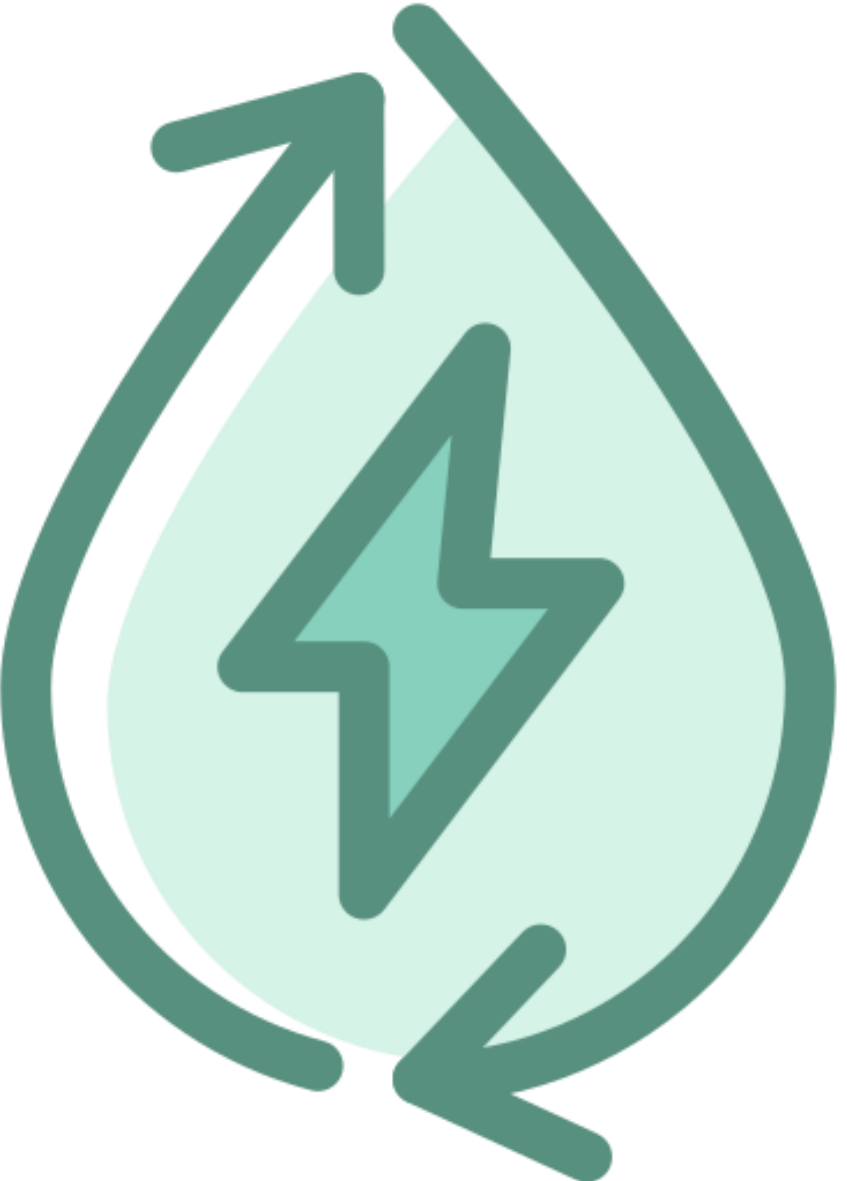
☎ +91 90296 40806

Varsh Palrecha

Analyst

✉ varsh.palrecha@avener.in

☎ +91 70219 65320



Thank You

AVENER

**Address:**

C – 1312, One BKC, G Block, Bandra Kurla Complex, Mumbai – 400 051

**Tel:**

B : +91 22 6244 1100

**Email:**

info@avener.in

**Website:**

www.avener.in