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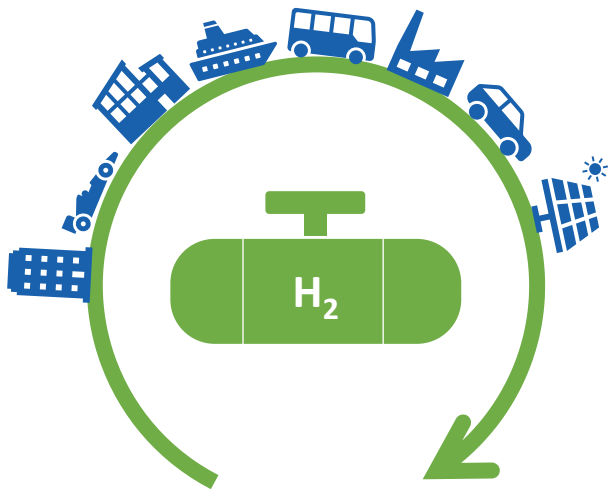

Tata Cleantech Capital

Building Green Hydrogen Economy for India

July 2023

Tata Cleantech Capital: Introduction

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First of its kind Private Sector Green Investment Bank

Business activities

Project Finance | **Debt Syndication** | **Advisory**

Key highlights

Leading climate transition in India since 2014

13.1 GW
Renewable capacity financed

346
Projects financed

20.2 million tons
Annual carbon emission averted

₹ 241.9 bn
Total disbursements

₹ 106.9 bn
Portfolio

All figures as of Mar-23

Green Logistics | Storage | Hydrogen | Utility Scale Solar | Wind | Distributed Solar

Power Transmission | Water Treatment | Small Hydro | Biomass | Energy Efficiency | Electric Mobility

TATA CAPITAL + IFC → TATA CLEANTECH CAPITAL

300 MTPD Green Ammonia	**1.63 MW** Green Hydrogen	**240** Electric Buses
20 EE ESCO sites	**2.5 MSF** Green Warehouse	**40,000** Smart Meters
> 3 GW Corporate Renewable Projects	**187 MLD** Sewage Water Treatment	**12.5 MLD** Water Desalination

Decarbonization is need of the hour

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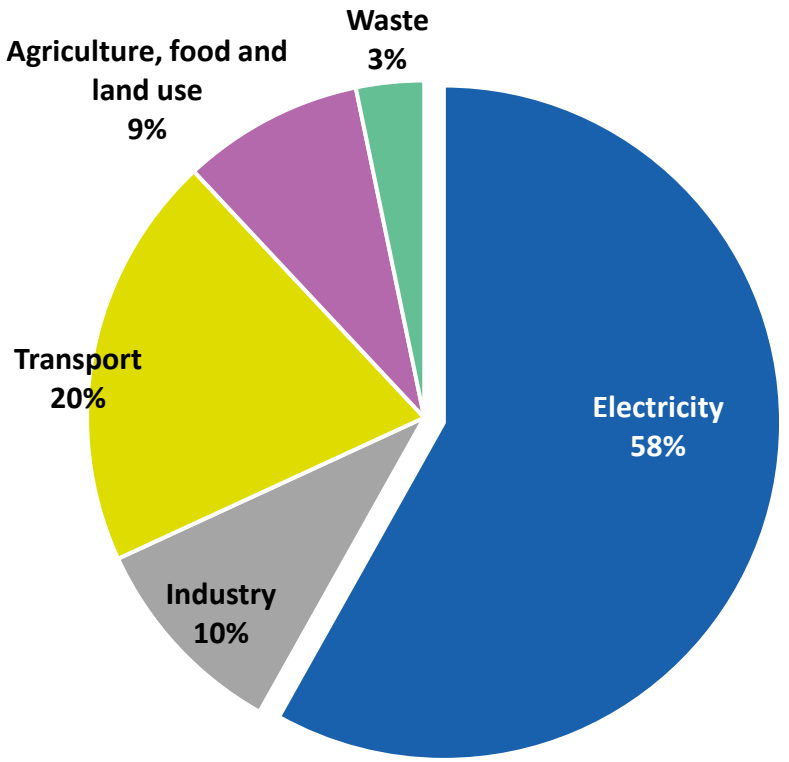
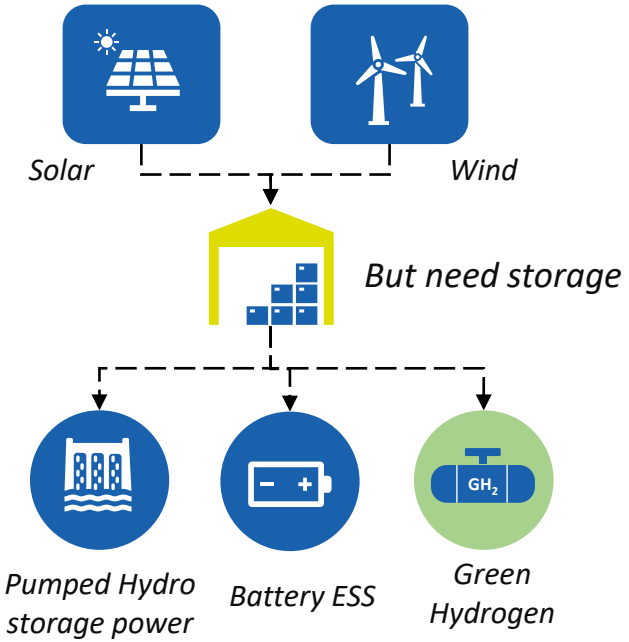
Sectors contribution to India's emission



Source: Council on Energy, Environment and Water

RE power to decarbonise fossil based generation



Decarbonization of power requires solution to integrate the carbon free infirm power

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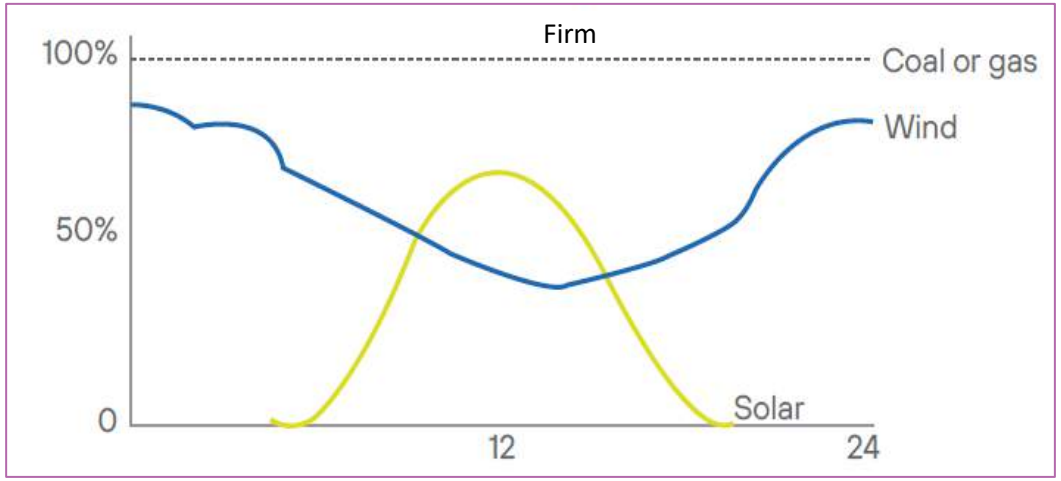
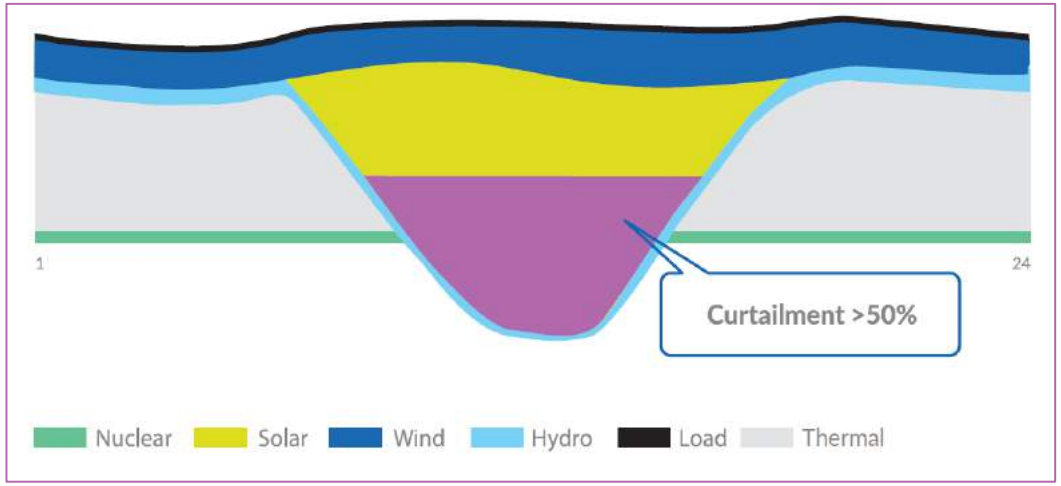
Solar and wind power are infirm



Source: TCCL research

Projected load curve and possible curtailment by 2030



Source: SECI estimates for 450 GW renewable without Energy Storage System

CEA estimates by 2030

435 GW
Solar & Wind capacity

60 GW
Storage capacity

Pumped Hydro storage power → **Limited potential of Pumped storage hydropower**

Battery ESS → **Dependence on imports for battery raw materials**

Green Hydrogen → ***Rely for long term storage needs***

Decarbonization is need of the hour

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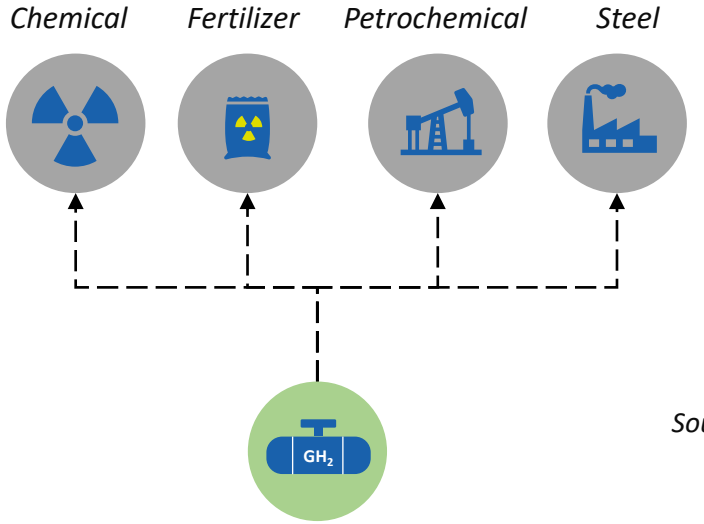

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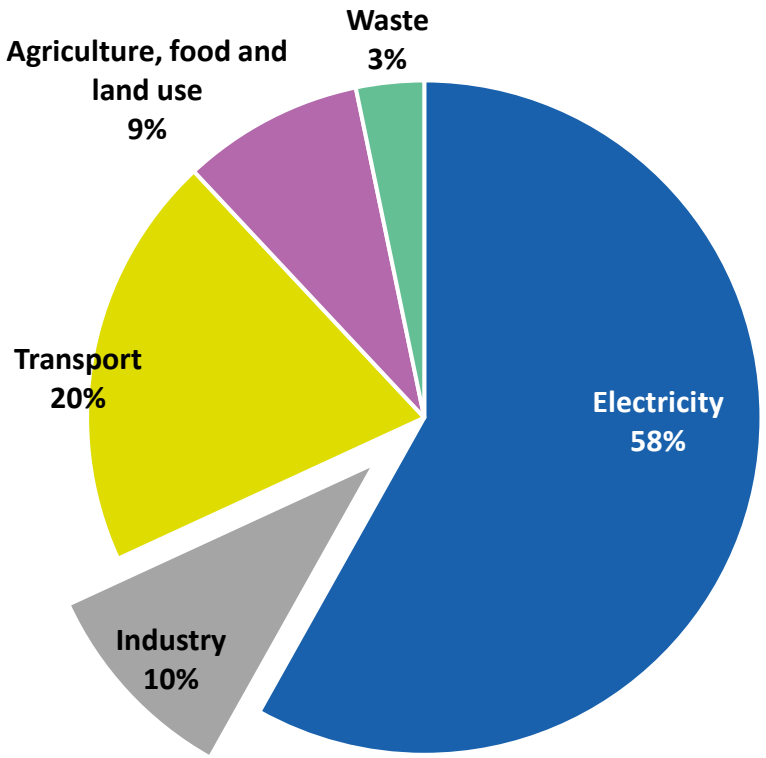

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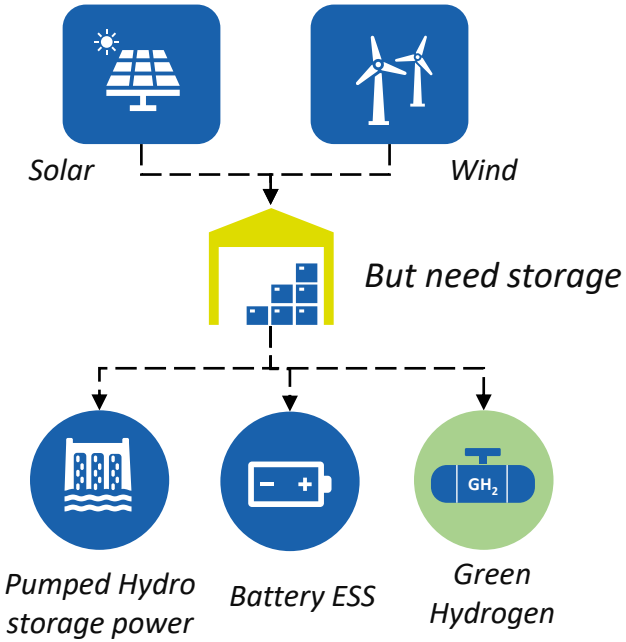

Decarbonization is need of the hour

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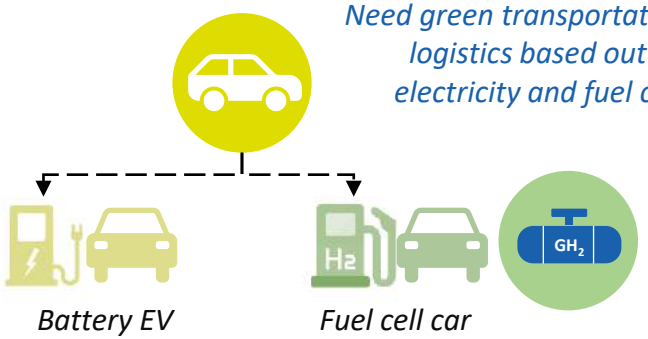
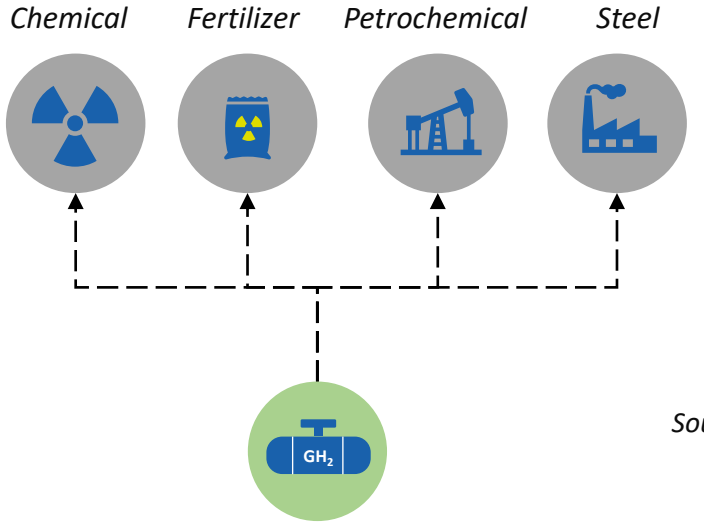
Need green transportation and logistics based out of electricity and fuel cells





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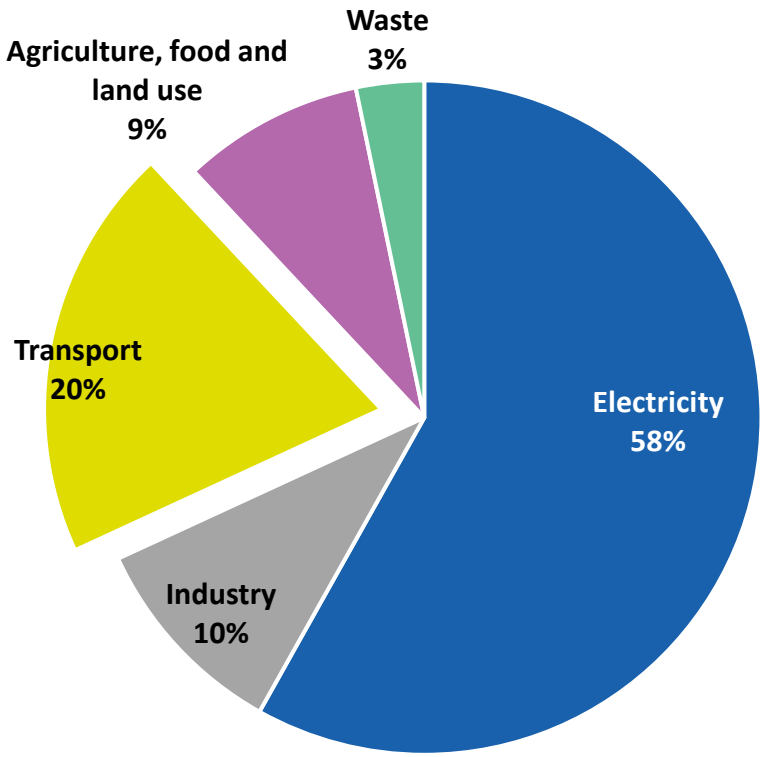

Source: Council on Energy, Environment and Water

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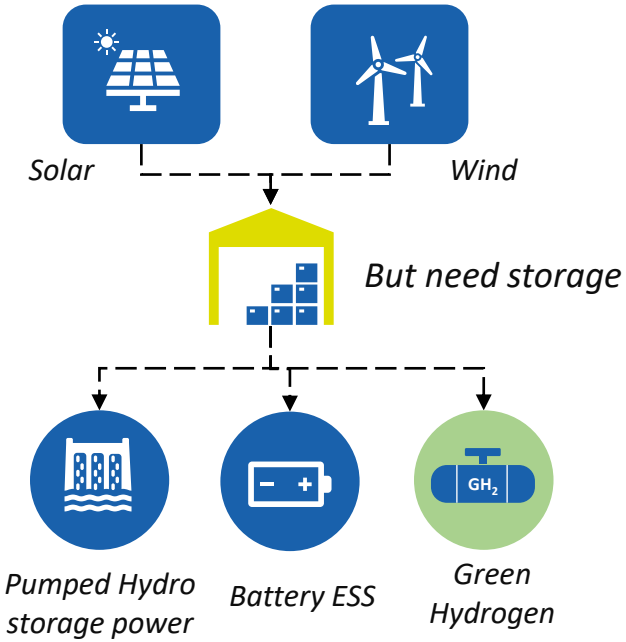

Battery provides a short-term decarbonization solution for transport

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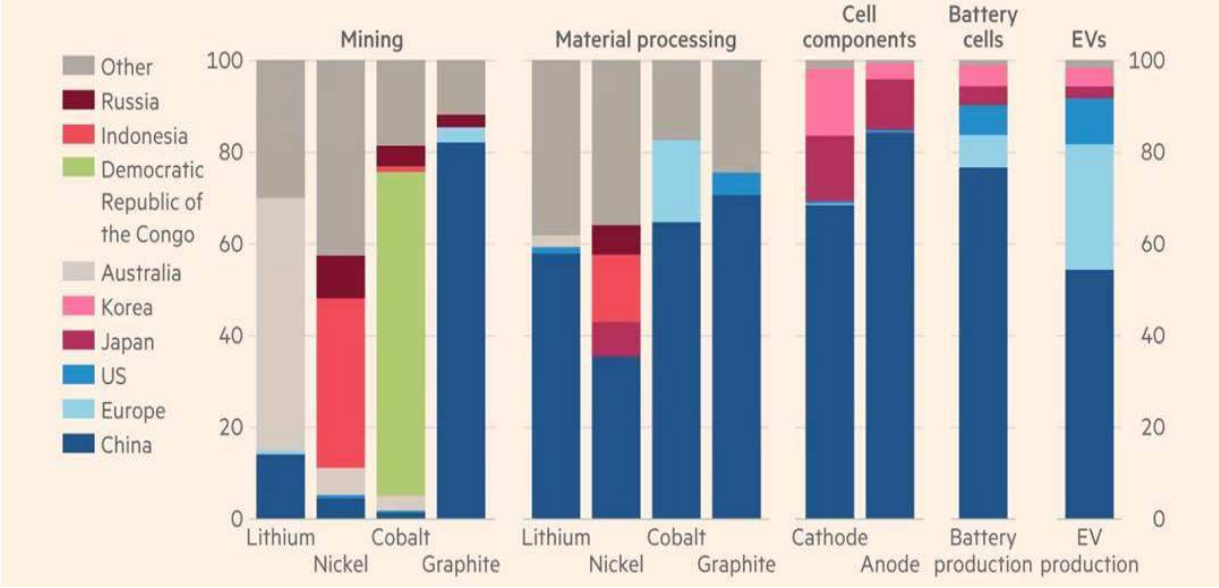
Electrification of vehicles has its own challenges

1. Dependency on Imports for battery components

Facilities and raw materials are based out of India



Source: IEA

2. Charging challenges & range anxiety

- Capacity fade due to fast charging
- Overcharging & deep discharges
- True range vs claimed range
- Charging facilities during long route

3. Need E-waste management

- No formal sector for e-waste recycling
- Recycling process is currently expensive
- Globally, only 5% of batteries are recycled

As first step, usage of Grey Hydrogen could be shifted to Green Hydrogen

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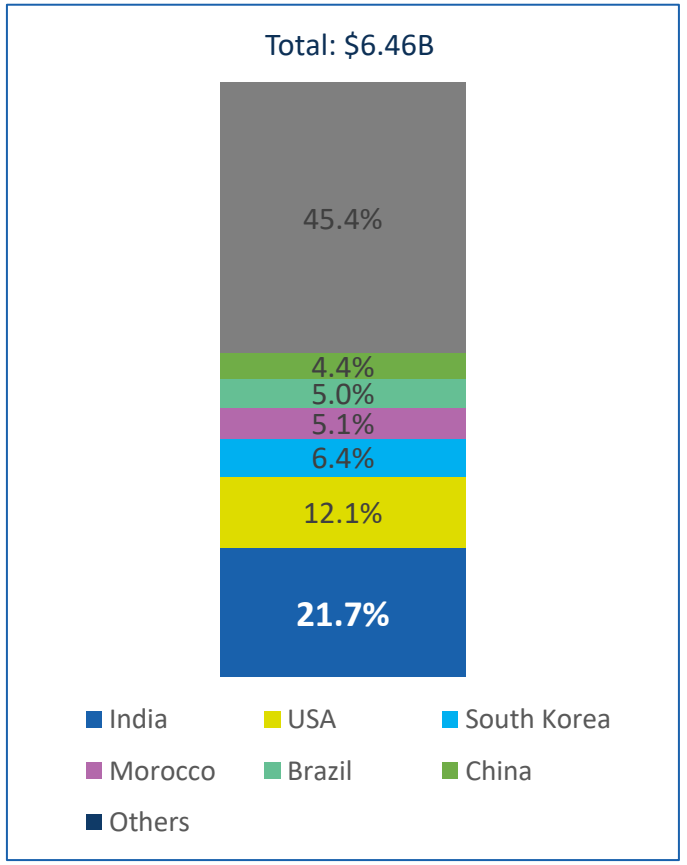
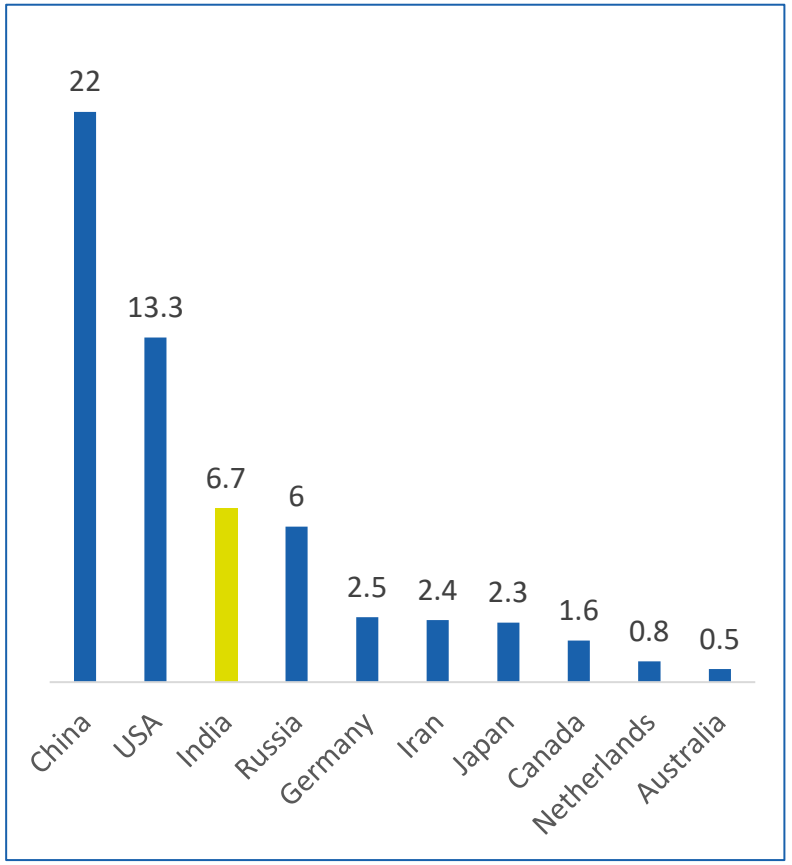
India - largest importer of grey hydrogen-based ammonia (2020)

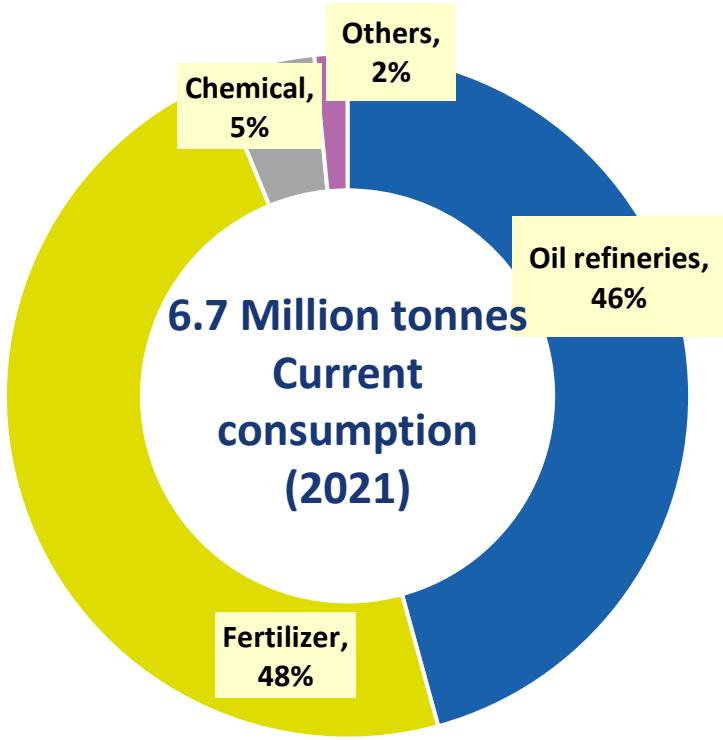


Source: IGEF

India - 3rd largest grey hydrogen producer in the world (MMT/year)



India's current usage of grey hydrogen



Source: EY, TERI, IGEF

History suggests that capital flow would not be a constraint if bankable business model is developed

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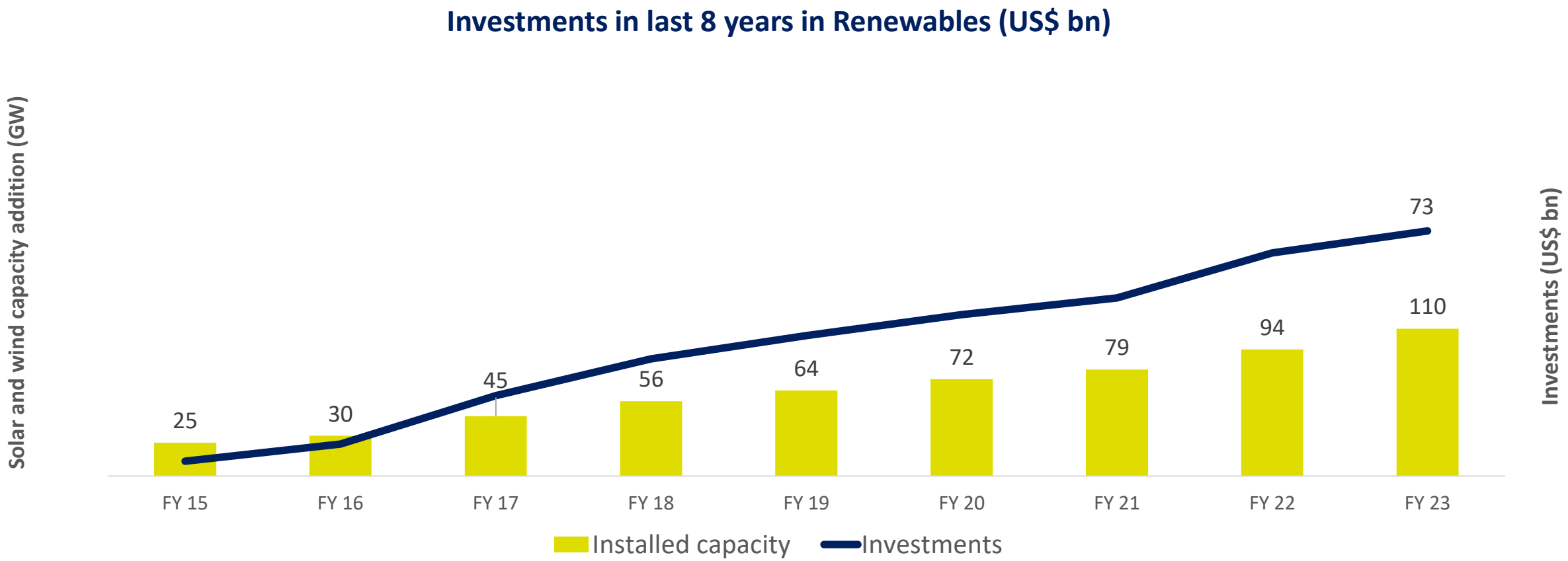

Source: CEA, MNRE and TCCL Research

Investment required in Green Hydrogen is estimated to be between US$ 70 – 80 bn to meet government target by 2030

Market lacks uniformity in definition of Green Hydrogen

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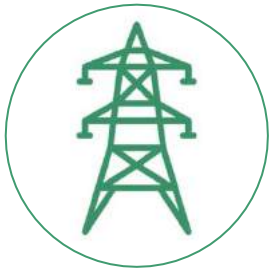
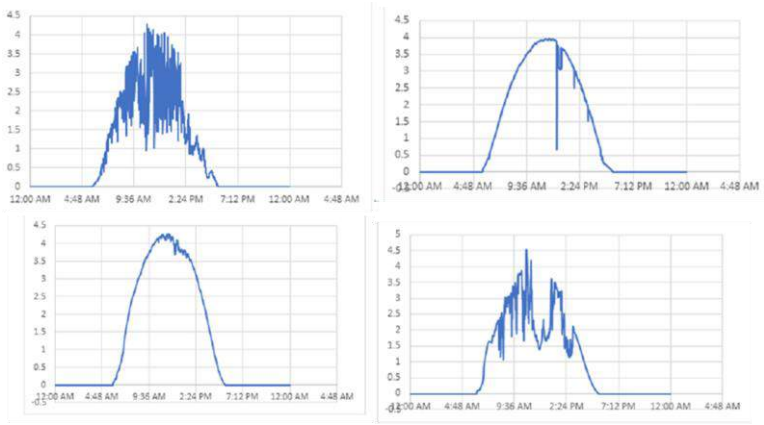


Grid connected

Off grid

Electrolyser utilization	High	Low
Energy accounting	??	✓



Turn Down ratio

Ramp rates

To scale up green hydrogen, learnings from solar & wind sector should be applied

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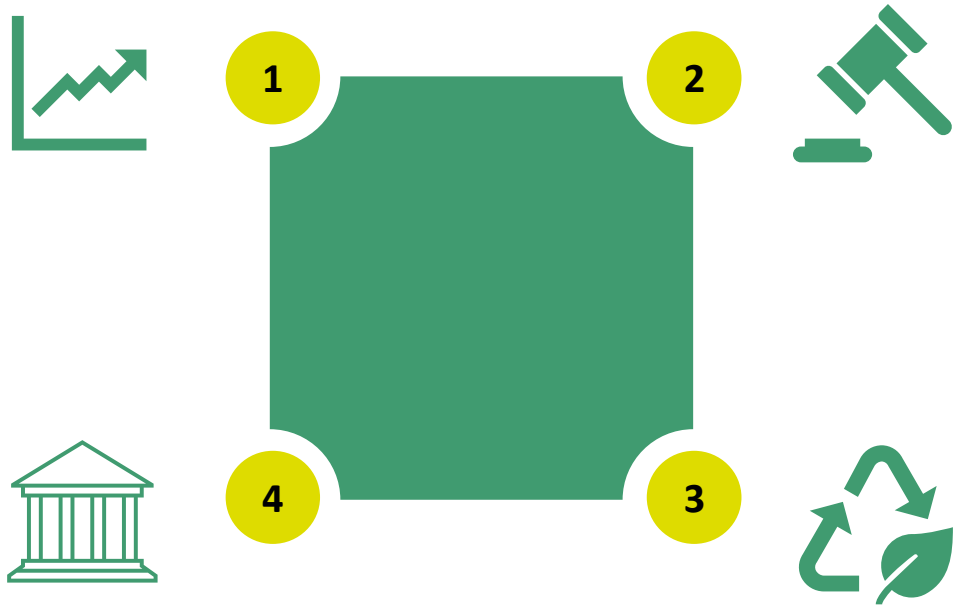
Ensure bankability and avoid contract reneging

Payment security mechanism

Practical bidding methodology

Avoid project postponements



- Purchase obligation
- Contract for Difference
- Adequate Production Linked Incentive

Policy consistency

Manufacturing ecosystem

From electrolyser manufacturing to hydrogen storage and distribution

But the market needs orderly growth of Renewable energy

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Power requirement for 5 MMT Green Hydrogen

~250 Billion Units

Equivalent to share of India's power demand in FY'23

~16.7%

Share of solar and wind generation in India in FY'23

~11.5%

Sufficient Solar and wind capacity addition to meet the increasing hydrogen demand

Or does pyrolysis of Biogas present an opportunity?

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Thank You