

Future Hydrogen Society: India and the World

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Why hydrogen?

- Hydrogen is expected to be a “game changer” in energy production and consumption and greatly contribute to net zero emission pathway.
- Why?
 1. As “a free energy carrier” (IRENA 2019), hydrogen can be produced from many energy sources
 2. It can be utilized in many sectors such as power, transportation, manufacturing, and other related sectors
 3. It also contributes to the efficient use of renewable energy (like solar and wind) by storing energy to adjust the variable output

Energy in India

- According to government of India
 1. By 2030, nearly 50 percent of India's power generation will depend on coal, despite exponential growth in renewable energy.
 2. By 2040, the power sector will be responsible for nearly 80 percent of India's total carbon emissions.
- It is critically important for India but also for the world to encourage the country's energy mix through utilizing hydrogen
- This paper carries out a critical analysis of the opportunities and challenges in India from the global perspectives

National Hydrogen Strategies (NHS)

- The number of countries with a hydrogen strategy doubled in 2021, from 13 to 31. (as of August 16, 2022)
 - Six Asia and the Pacific countries have adopted the NHS (see Table)
 - Others: 4 Americas, 1 African, 1 Middle-eastern, and 19 European countries
- Asia and the Pacific region includes
 1. energy importers,
 2. technology exporters, and
 3. potentially energy exporters due to ideal settings for hydrogen production.

Table. Countries with NHS in Asia and the Pacific

Country	Adopted in...
Australia	2019
PRC	2022
India	2022
Japan	2019
New Zealand	In preparation
Singapore	2022
Rep. of Korea	2019

Source: BNEF Global Hydrogen Strategy Tracker, BloombergNEF (2022)

Investments

- Global investment in hydrogen was only \$1.5 billion in 2020, which is still less than 0.5% of renewable energy investments.
- Asia-Pacific region is the major investor in hydrogen (73% in 2018-2021).
- India is expected to sharply increase their investment given large energy demand.

Source: Energy Transition Investment, BloombergNEF (2022)

Investment

- Encouraging hydrogen investment is necessary to meet the Sustainable Development Scenario (see figure).
- India also needs to increase their annual investment from 4 billion USD in 2019 to 14 billion USD in 2025-2030 (IEA 2020).

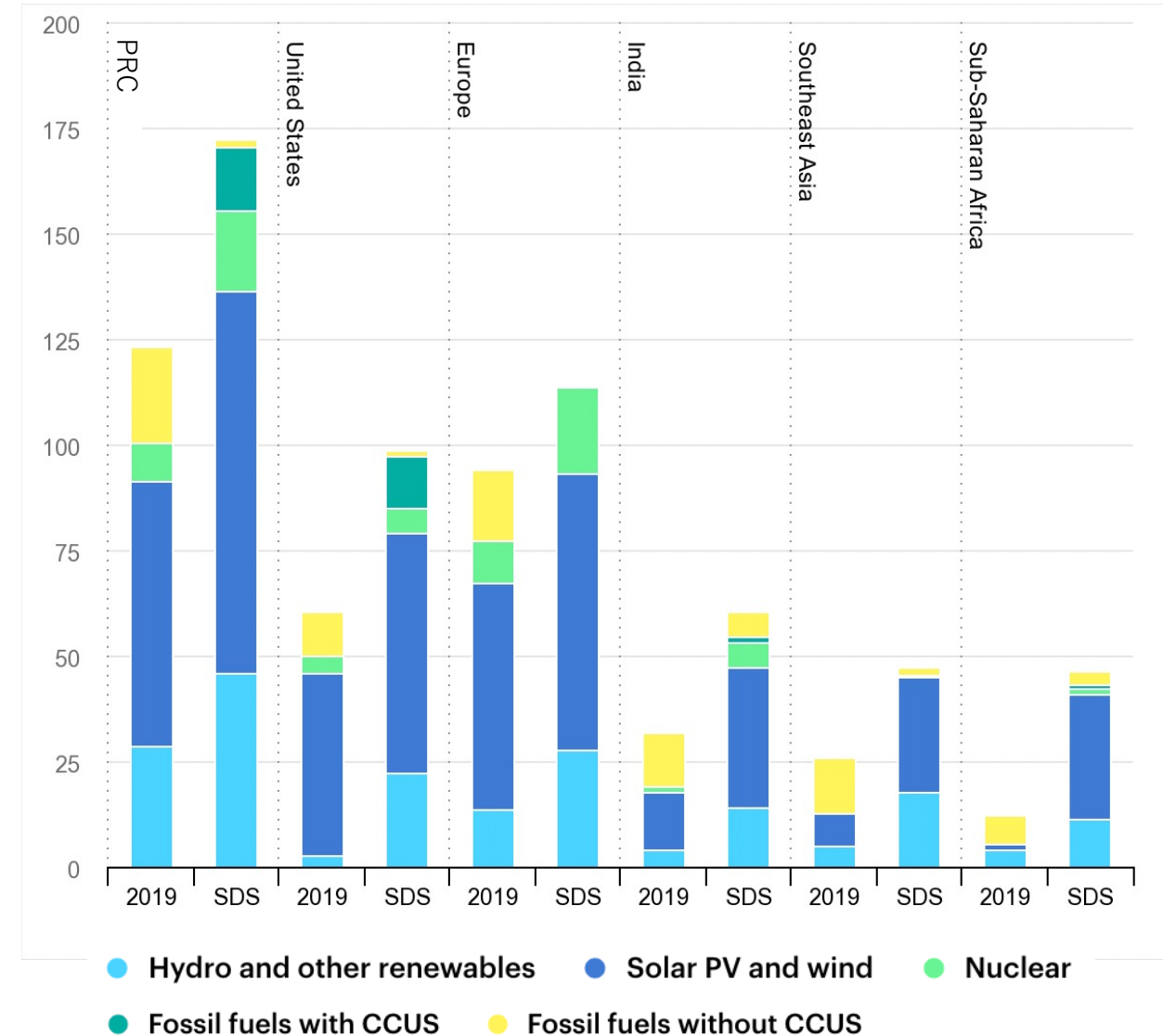


Figure: Power generation investment by region in 2019 compared with annual investment needs in the Sustainable Development Scenario, 2025-2030. Source: IEA (2020)

Key challenge: High production cost

- Main constrain for the green hydrogen penetration is high production cost.
- The production cost for green hydrogen is expected to be competitive to other types of hydrogen and some natural gases with a price less than USD/kg 1.
- Key policy question is how to accelerate this trend.

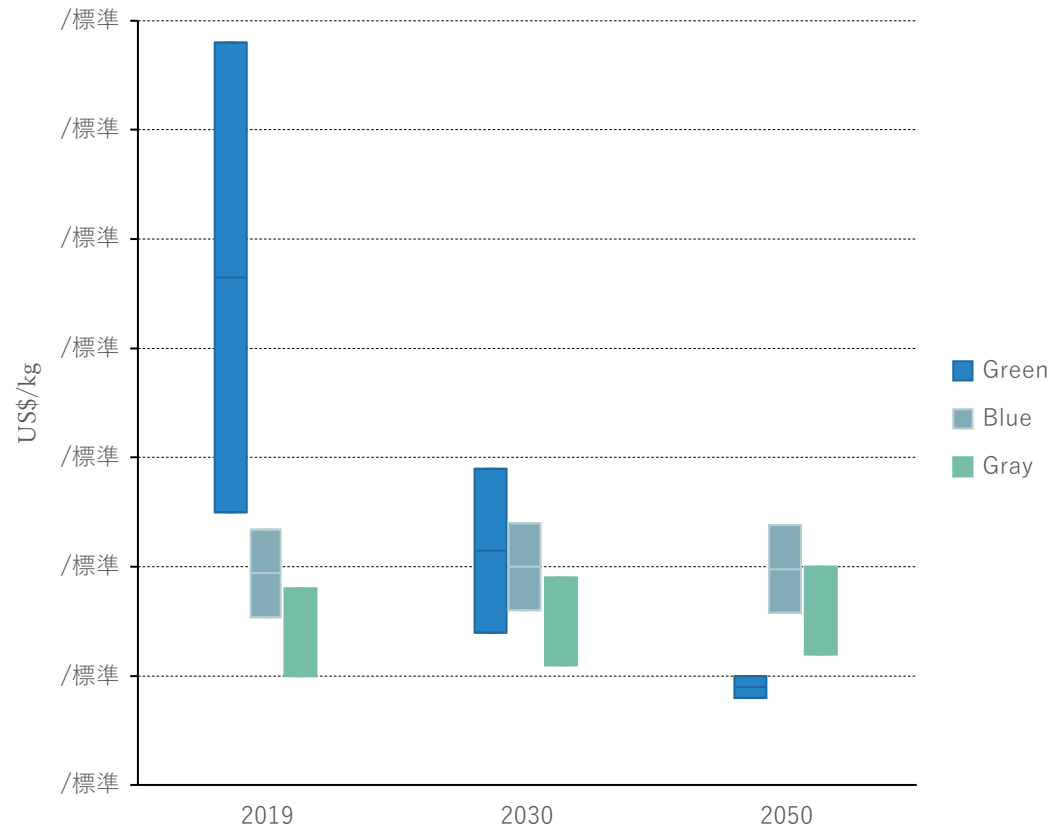
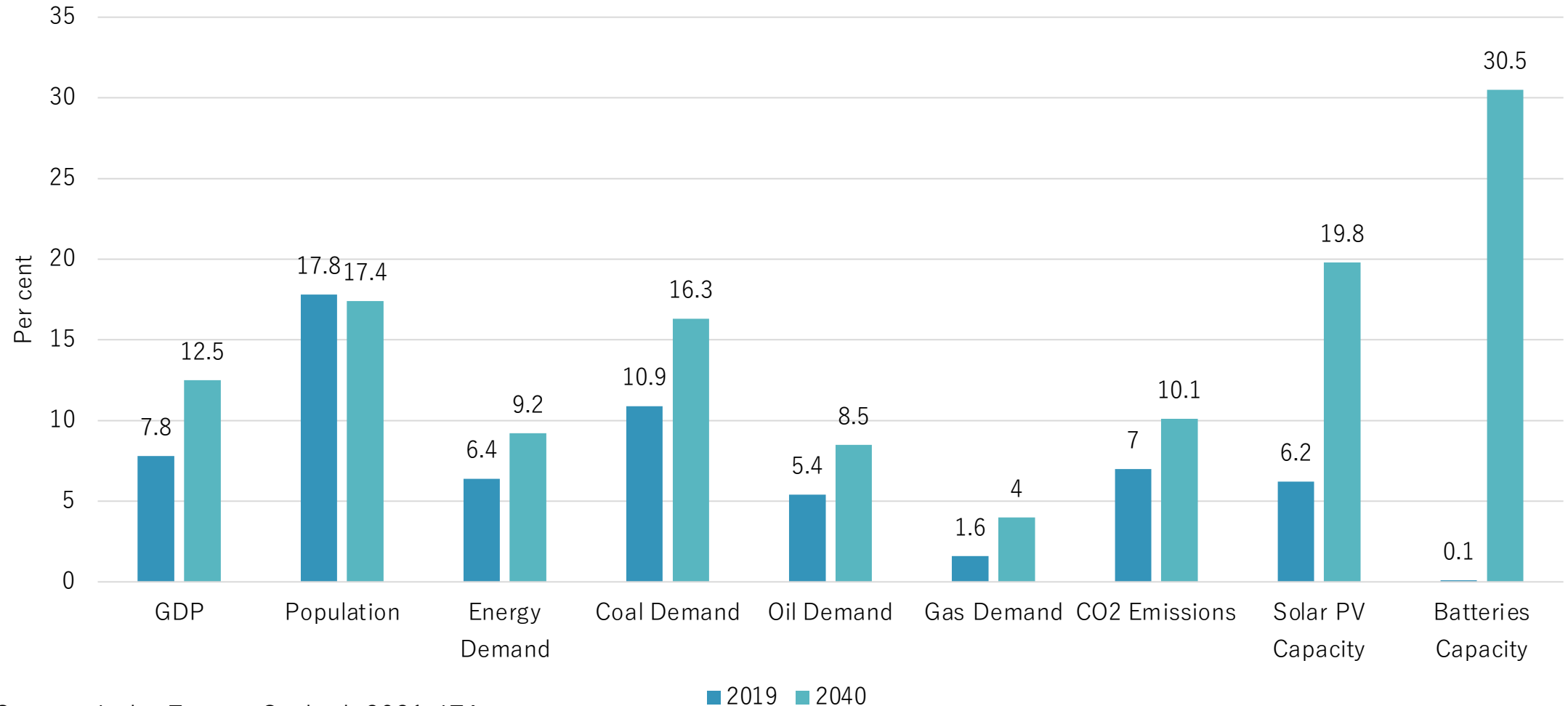


Figure: Production costs of grey, blue, and green hydrogen (USD/kg).

Source: KPMG (2022)

Why India's energy choices matter?

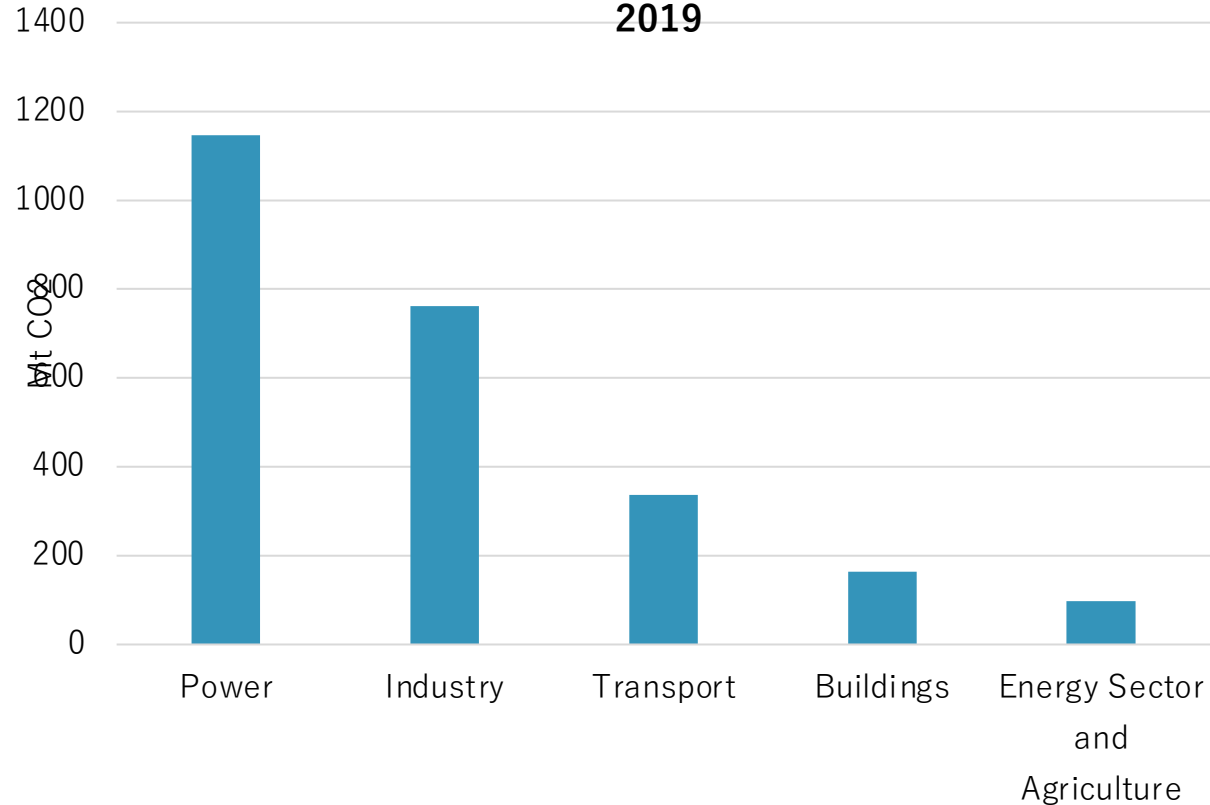
India's share of selected global indicators



Source: India Energy Outlook 2021, IEA

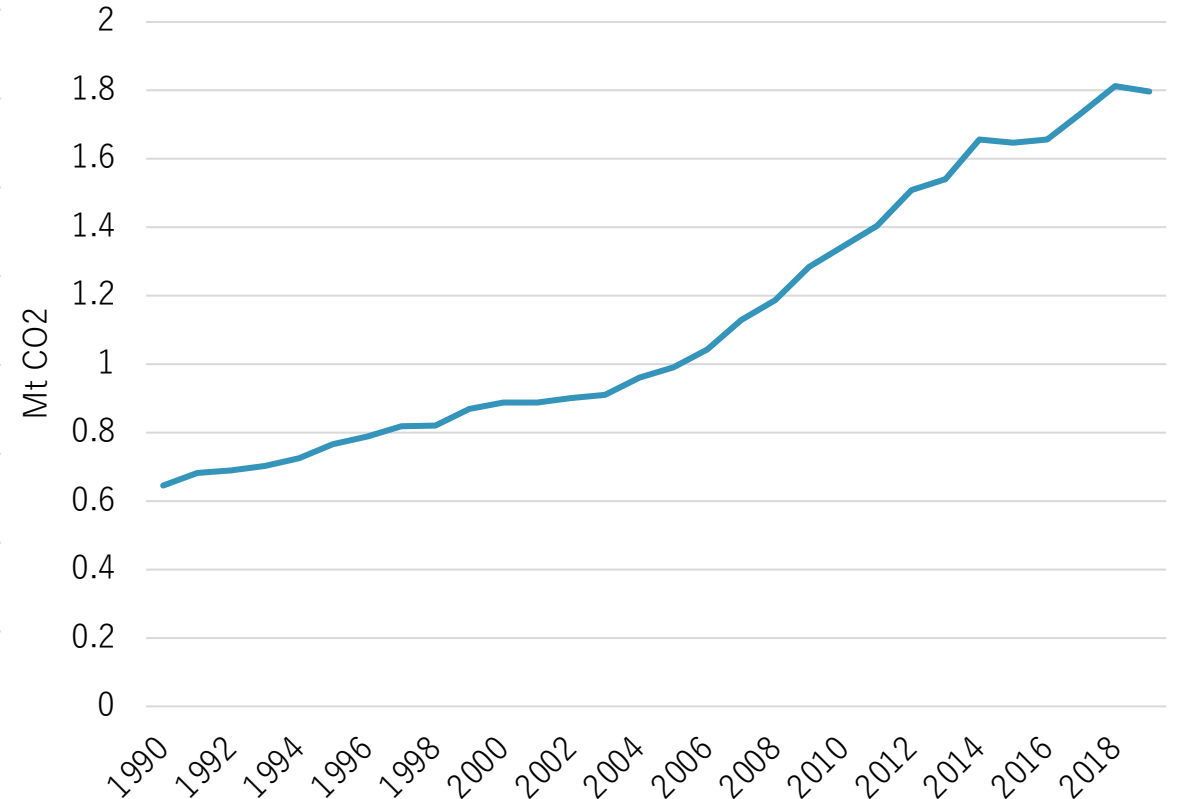
Why India's energy choices matter?

CO2 emissions from the Indian energy sector,
2019



Source: India Energy Outlook, 2021, EIA

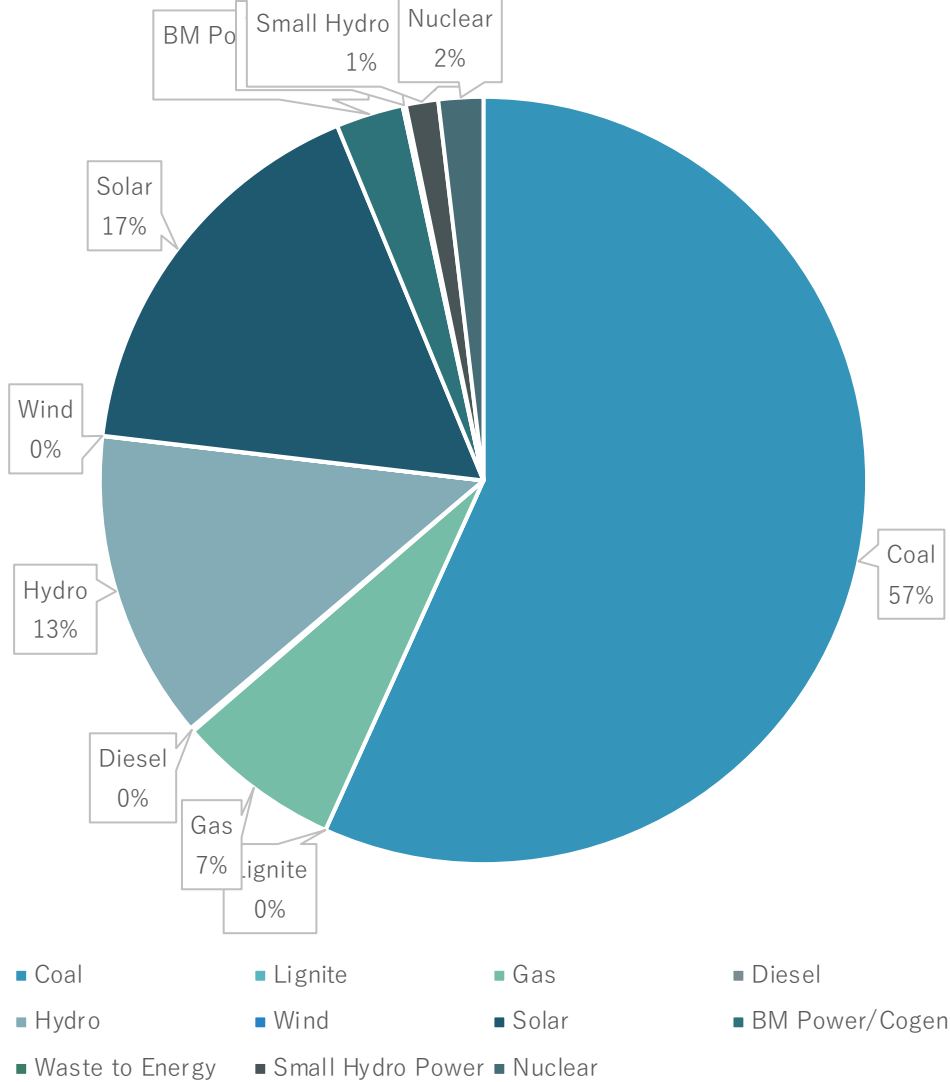
CO2 Emissions Per Capita, India



Source: World Bank

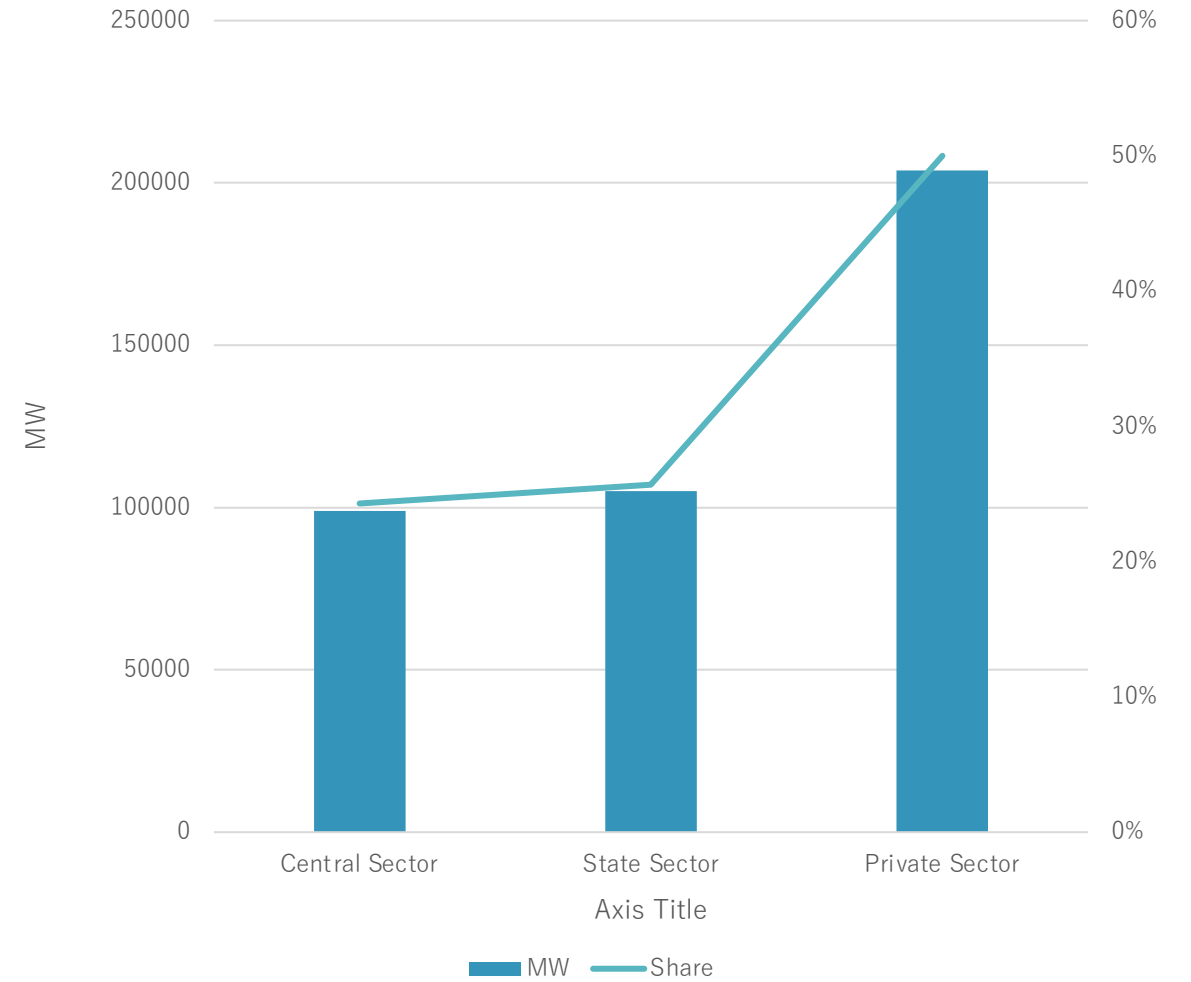
Energy Mix, India

Installed capacity (MW) in India, 2022

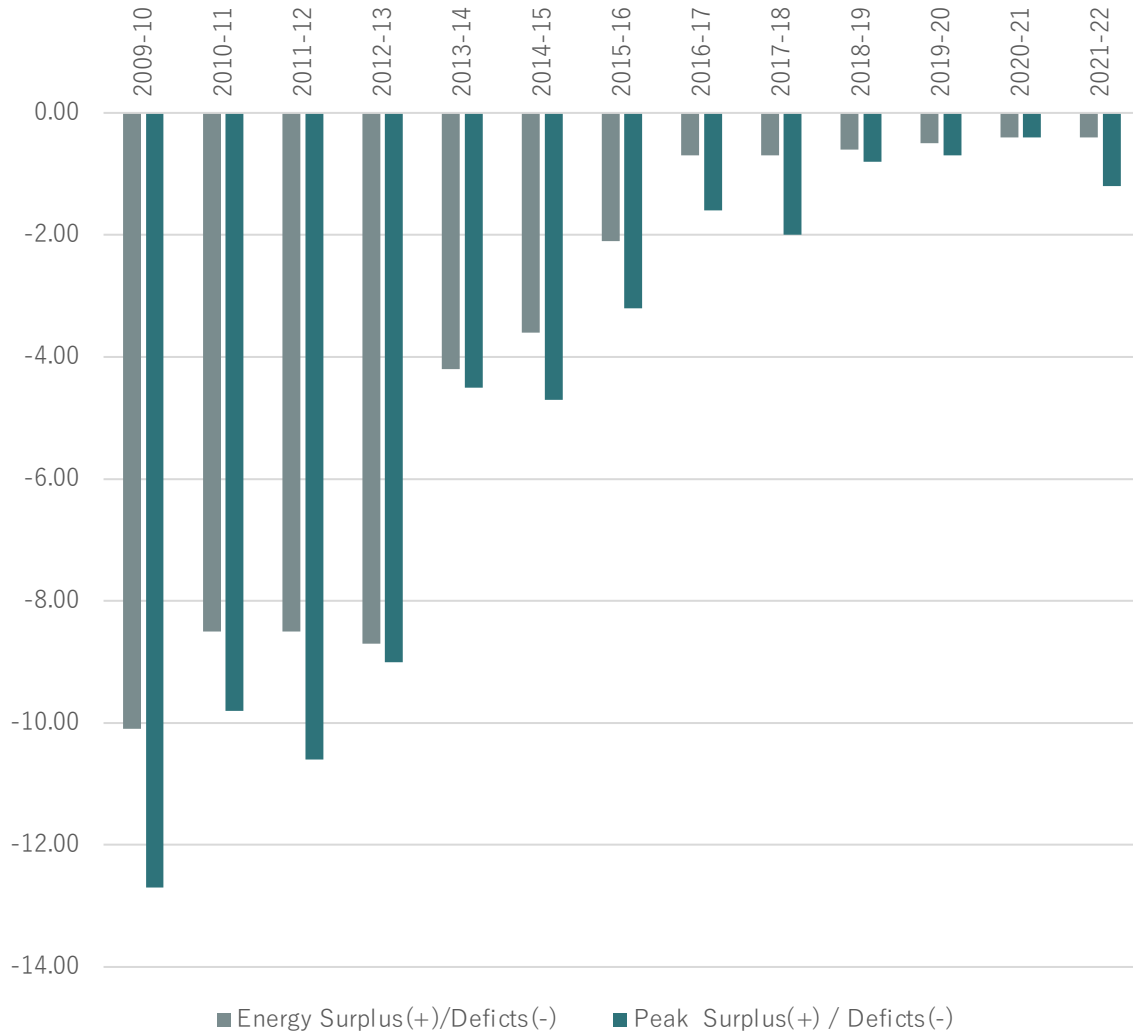


Ownership by sector

Total Installed Capacity, sector

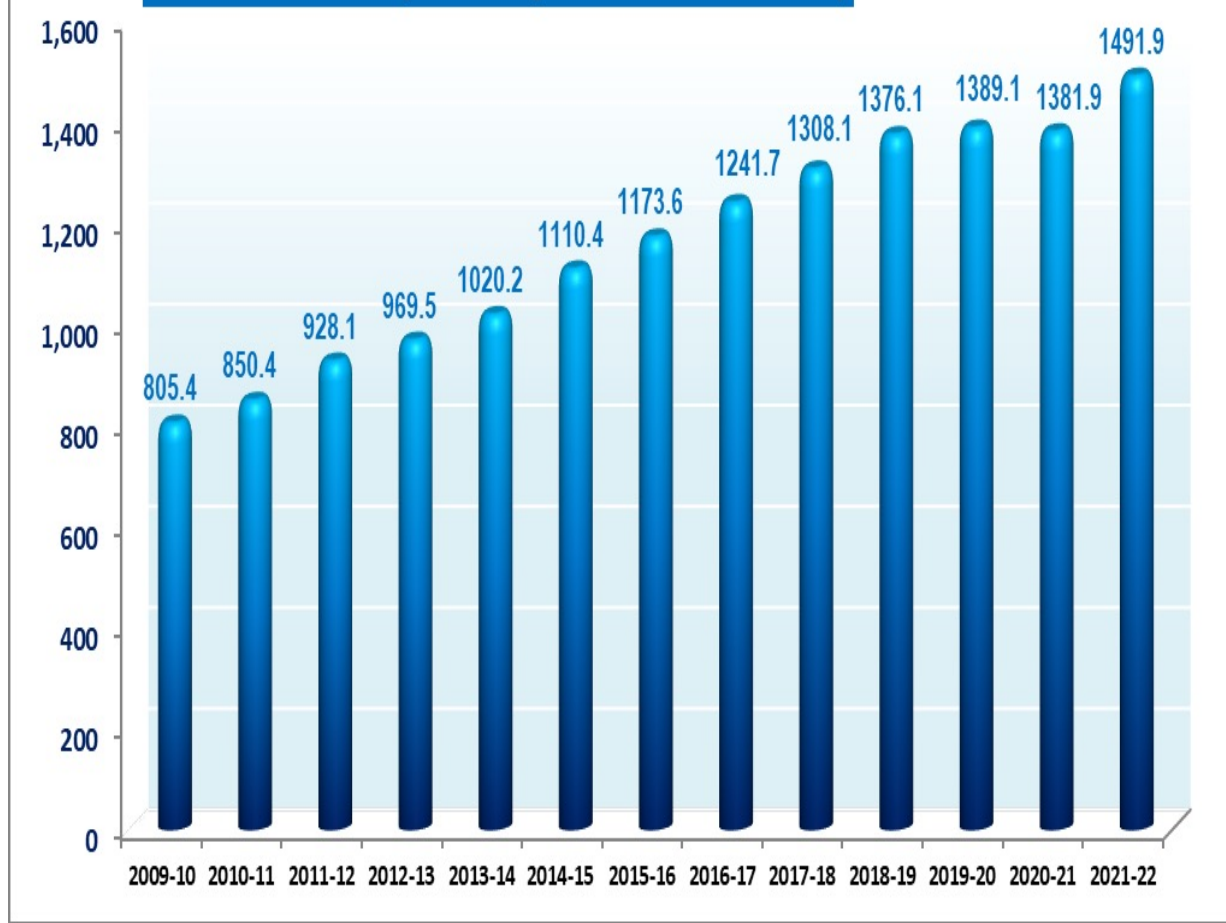


Energy Demand



Total Generation (Including Renewable Sources)

(In Billion Units)



India's National Green Hydrogen Mission 2022

India's climate actions announced during COP26 Glasgow

- 500 GW of non-fossil energy capacity by 2030
- 50% of electrical energy capacity from renewable energy sources by 2030
- Reduce 45% carbon intensity of economy by 2030
- Achieve net-zero emissions by 2070

Waiver of inter-state transmission charges

- Granted for a period of 25 years for projects commissioned before 30 June 2025
- long-term cost reduction of green hydrogen production for the industry

Grant of ISTS connectivity

- Connectivity granted on priority under the Electricity (Transmission System Planning, Development and Recovery of Inter State Transmission Charges) Rules 2021

Land acquisition for green hydrogen production

- Allotment of land in renewable energy parks for green hydrogen/ammonia production

Manufacturing zones

- Manufacturing zones proposed to be set up for cluster-based development of green hydrogen supply chain

Pipelined Mega-projects

- In the private sector space, Reliance Industries, as part of its commitment to invest USD 10 billion (INR 750 billion) in new energy businesses, announced plans to build a giga–factory to manufacture electrolyzers.
- Adani group has plans to invest \$70 billion in this decade to become the world's largest renewable energy company and produce the cheapest hydrogen on the Earth.

Policy recommendations

- Reducing the cost of renewable power generation and supply for GH2 production.
- GIS mapping and identification GH2 clusters for development
- Enhance public funding support towards R&D programs calling for demonstration of projects that support competitiveness of GH2 supply chain and end-use
- Production linked incentives and fiscal benefits for high efficiency and durable electrolyzed systems
- Extended investment in hydrogen transport infrastructure: Pipeline

Thank You

