India Energy Policy and Major Market Players

New Energy and Industrial Technology Development (NEDO)

Webinar

Grant Thornton Bharat LLP

18 March 2025

Strictly Private and Confidential

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Agenda

Time (IST)	Program	Speaker
11:00 – 11:05	Welcome & Opening Remark	**Mr. Masafumi Senda**, Chief Representative NEDO, New Delhi Office
11:05 – 11:40	**Session 1:** Presentation on :India Energy Policies and Major Market Player – Key Findings & Recommendations	**Mr. Amit Kumar**, Partner & Leader – Energy & Climate, GTBL **Mr. J. Elamathi Raja**, Associate Director, New Energies and Transition Finance, GTBL
11:40 – 12:25	**Session 2:** Panel Discussion on India Energy Market Landscape and Outlook	Moderator – **Mr. J. Elamathi Raja**, Associate Director, New Energies and Transition Finance, GTBL
	Panelist 1	**Mr. Jeevan Kumar Jethani**, Scientist(F) – New Renewable & Energy, MNRE, Govt. of India
	Panelist 2	**Mr. Saurabh Diddi**, Director, Bureau of Energy Efficiency (BEE), Govt. of India
	Panelist 3	**Mr. Chintan Shah**, Group President and Global Head of Strategic Business Development & Policy Affairs, ReNew Power
	Panelist 4	**Mr. Raghvendra Upadhya**, CEO, Wind Independent Power Producers Association (WIPPA)
12:25 – 12:30	Closing Remark	**Mr. Genryu Hattori**, Representative NEDO New Delhi Office

Agenda

01 Webinar Coverage

Focus Area of Study

"The study focused on comprehensive assessment of India's energy landscape from 2024 to 2070"

Key emphasis areas for webinar

1
Present Energy Mix and Demand- Supply Position in India

2
Future Energy Demand and Supply Position in India (2030, 2047, 2070)

3
Major Energy Users and their Decarbonization Pathways

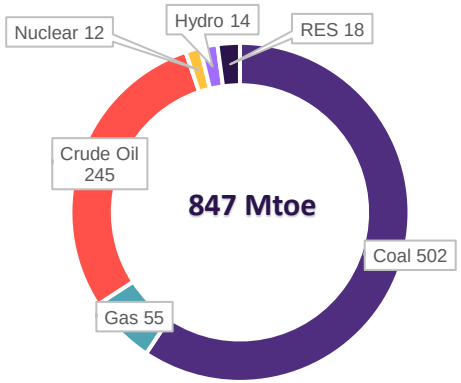
02 Key Insights

Current Energy Mix in India: Primary and Secondary Energy

In FY23, India's total primary energy supply is about 847 million tonnes of oil equivalent (Mtoe) and energy consumed by demand segments is 553 MTOE with overall efficiency loss of 35% across various conversion process

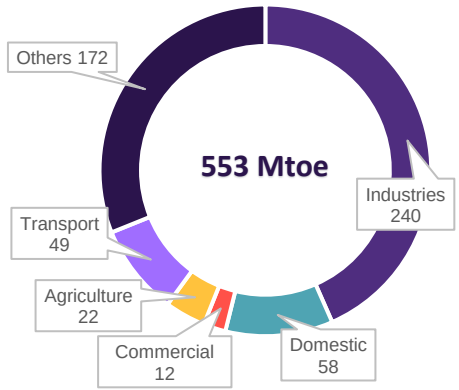
Primary Energy Source: Coal, Oil, Natural Gas, Nuclear, Hydro, and Renewable Energy

Primary Energy Supply Mix (Mtoe) FY 23



Coal (59%), Crude Oil (29%), Gas (7%), Hydro (2%), RES (2%), Nuclear (1%)

Energy Demand Mix (Mtoe) FY 23



Industries (43%), Domestic (10%), Commercial (2%), Agriculture (4%), Transport (8%), Others (31%)

Energy Demand in India

70%	30%
Thermal Energy	Electrical Energy

- Coal is the most consumed energy source in India, accounting for 59% of total energy
- **Use:** Electricity Generation, Industrial heating processes (major industrial consumers: Iron and steel, chemical, cement, etc.)

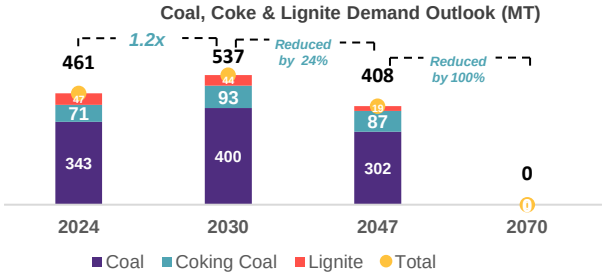
- Second major source of energy is crude oil, 29%
- Consumed by residential, agriculture, transportation (road, railways, aviation) and industrial sector for both energy and non-energy use.

"Conversion efficiency **65%**, offers significant opportunity in **redefine the energy system and use"**

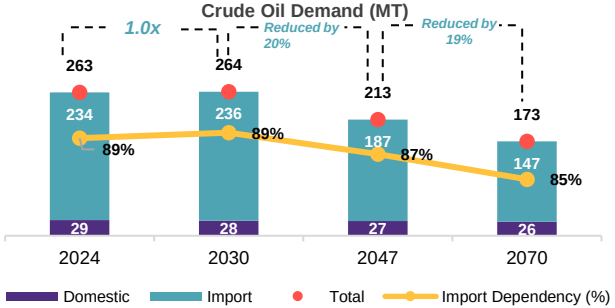
India Energy Outlook: Present (2024) & Future (2030, 2047 and 2070) ..(1/2)

India offers strong opportunity across value chain in renewable based as well as low- carbon based energy molecules

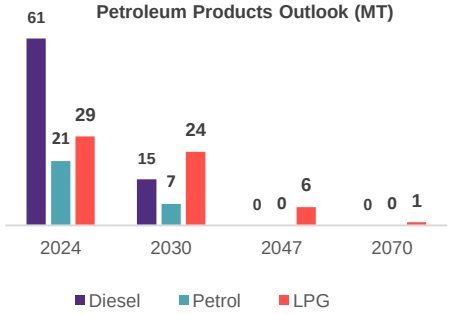
Coal: Demand rising till 2030, driven by the high dependence of the thermal power plants and steel industries, and the limited cleaner fuel. Demand is phasing out by 2070 due to switch to the alternative fuels.



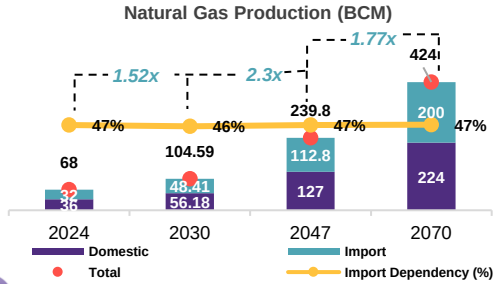
Crude Oil: Crude Oil production expected to decrease & imports made mainly with focus on refined products for export market post 2035



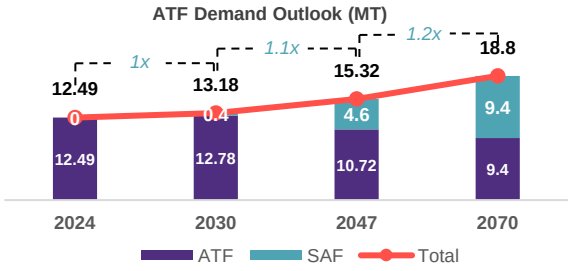
Refined Petroleum Products: Domestic demand for petrol and diesel will reach zero by 2047 while negligible demand for LPG remains up to 2070



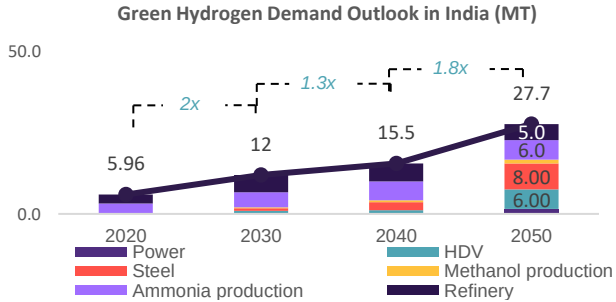
Natural Gas is expected to grow significant, driven by demand from industries, domestic use, and fertilizer industries



ATF: Growing economic activity drives demand for ATF along with SAF blending



Green Hydrogen: GH_2 is essential for hard to abate sectors



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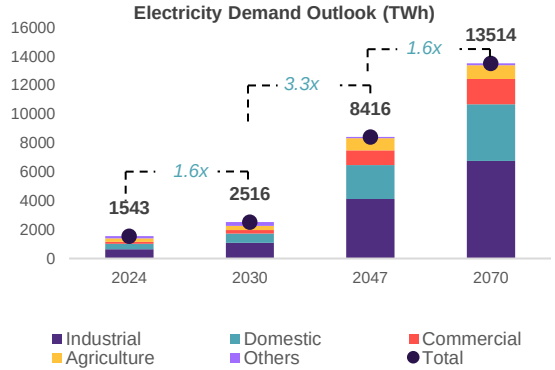
India Energy Outlook: Present (2024) & Future (2030, 2047 and 2070) ..(2/2)

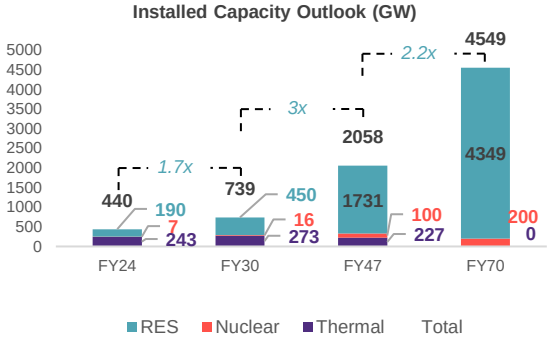
Transitioning to electron-based fuels/energy source coupled with growing economic activity will drive electricity sector growth in the country

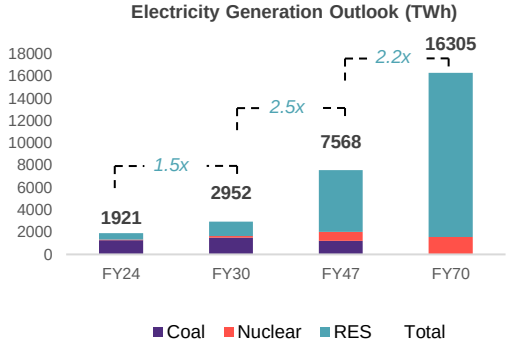
Electricity Demand: Demand growing rapidly with increase in manufacturing, rising per capita income and shift to electrical energy.

Power Capacity: Continued focus on RE as cleaner and cheaper source of energy driving the demand for RES.

Power Generation: Intermittency issues related to RES needs to be addressed through energy storage to achieve the net-zero target.







03 India’s Energy Landscape From 2024 to 2070

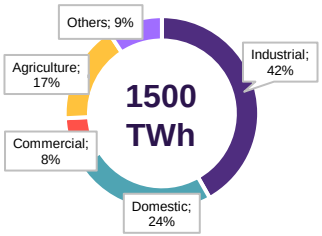
Electrical Energy			Thermal Energy		
Electricity Demand	Thermal & Nuclear	Renewable	Coal, Coke & Lignite	Oil and Refined Petroleum	Green Hydrogen

India's Electricity Demand

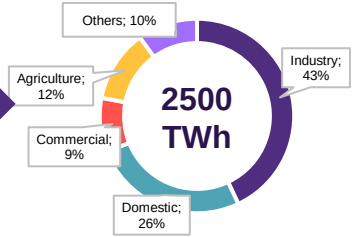
Demand to grow significantly over the next few decades reaching 13,500 TWh by 2070, driven by economic expansion, urbanization, and increasing electrification in end use cases

Demand across various sectors

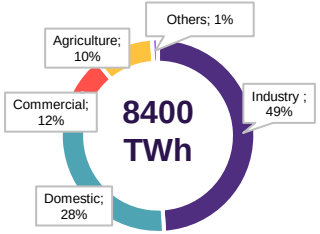
Sectoral Energy Demand 2024



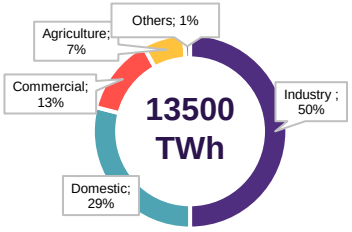
Sectoral Energy Demand 2030



Sectoral Energy Demand 2047



Sectoral Energy Demand 2070



Per Capita Consumption (kWh)	~1300	~1650	~4000	~8000

Industrial Energy demand share increasing to ~6700 TWh (49%) by 2070:

- Increased manufacturing activities
- Rise of machinery use replacing manual workforce

Domestic Consumers:

- Rising per capita income leading to more usage of electrical appliances.

Commercial Consumers:

- Rise of data centers/AI, IT Parks, Global Capability Centers, Office Parks

Agriculture:

- Advanced agricultural practices will lead to reduction in energy requirements

Thermal Power and Nuclear Energy

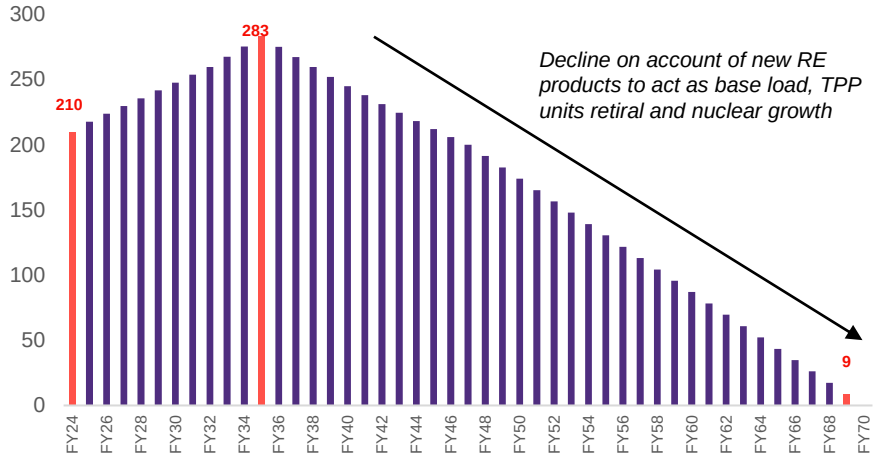
Thermal Power Plant capacity to peak in 2035 and Nuclear to take the role of transition system (for base load) in India new 2-3 decades

Capacity is expected to peak ~280 GW by 2035

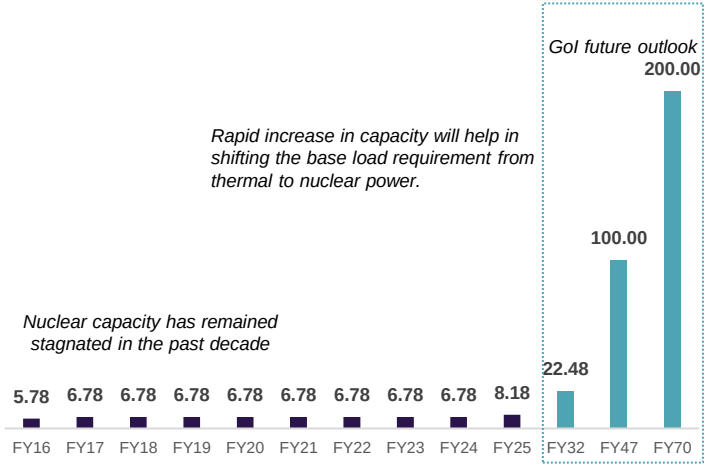
Amendments to the Atomic Energy Act and the Civil Liability for Nuclear Damage Act aim to boost private sector involvement in design, construction, and operation.

GoI fiscal support of INR 20,000 Cr (USD 2.3 Bn) for SMR R&D and operationalization, targeting at least 5 SMRs by 2033.

Thermal Power Plant Installed Capacity Outlook (GW)



Nuclear Energy Installed Capacity (GW)

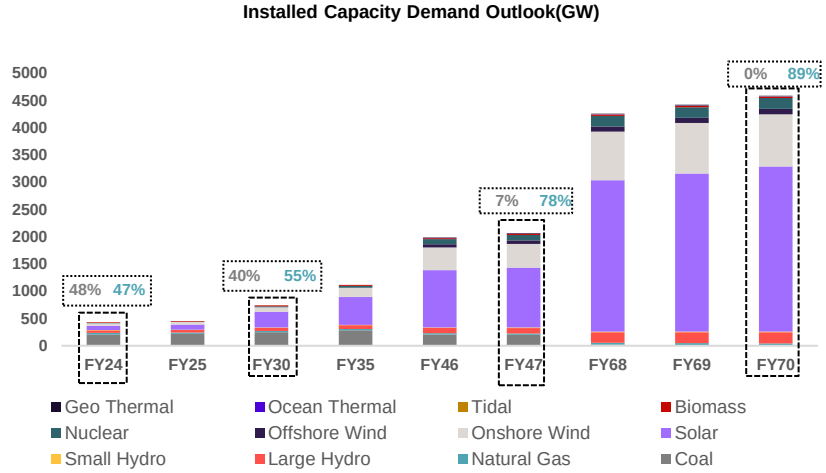


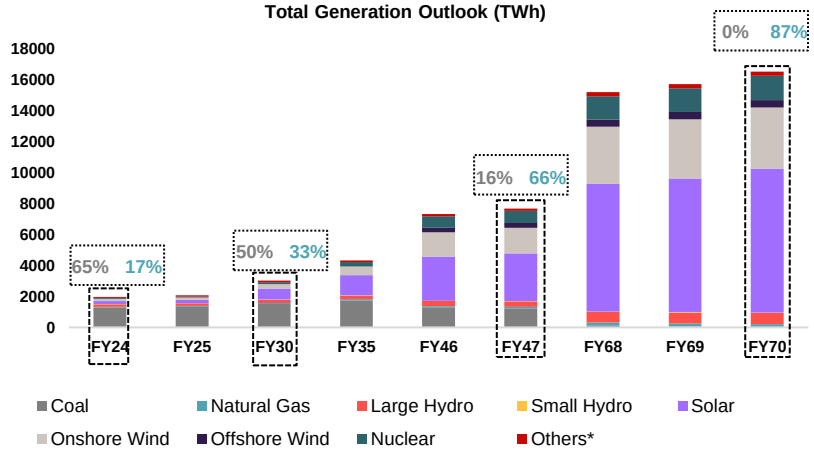
Renewable Energy Outlook

India's base load will be majorly met with RE sources in coming decades while operational issues such as land, connectivity needs to be addressed for long term capacity growth

Share of RE installed capacity is expected to increase rapidly from current level of 214 GW (47%) to 3,768 GW (88%) by FY70.

RE total generation is expected to increase from 621 TWh (17%) to 12,674 TWh (87%) by FY70.





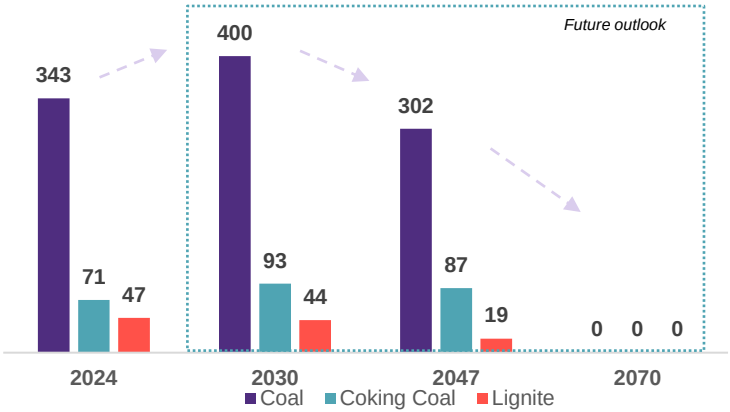
Note: Percentage share of COAL and RES has been mentioned for 2025, 2030, 2047,2070

Coal, Coking Coal & Lignite

India's net zero goal by 2070 necessitates reduction in the reliance on the current dominant sources of energy like coal, coke & lignite which are primarily used for industrial purposes.

- Thermal coal demand stands at 343 MT in FY24 and is projected to rise to 400 Mt by 2030, driven by the continued dependence of the steel and cement industries on coal and limited cleaner fuel alternatives.

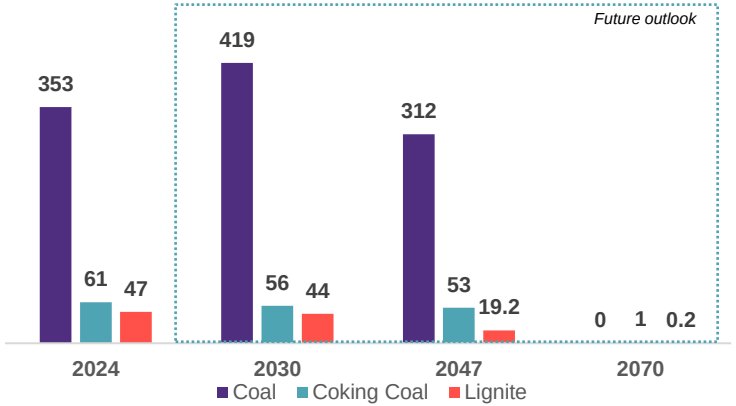
Demand Outlook (Net Zero Scenario) (MT)



- Coal consumption is expected to decline after 2030 as consumers transition to cleaner fuels, driven by increasing adoption of cleaner technologies and renewable energy in power generation.

- Production of coal is expected to decline after peaking in 2035, due to increasing stringent environmental regulations and growing focus on the cleaner alternatives.

Supply Outlook (Net Zero Scenario) (MT)



- Supply of thermal coal in FY24 is 353 MT and is anticipated to grow over the next 5-7 years due to increasing demand and decline thereafter.

Note:
- *The steel industry is expected to shift to cleaner technologies like hydrogen-based reduction to reduce its thermal coal consumption .*
- *The cement industry reduction in coal consumption is drive by the push towards alternative fuels, CCS to comply with emissions regulations.*

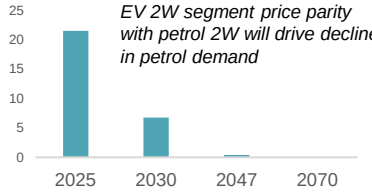
Oil and Refined Petroleum Products

India refinery capacity to reach ~ 310 MMTPA by 2028 and 450 MMTPA by 2035, however with decreasing domestic demand under Net Zero initiatives, India has the potential to become a global export market

Demand for petrol is expected to increase due to GDP growth and population rise. Ethanol blending targets are set at 20% by 2025 (11.6% achieved), 30% by 2030, and 50% by 2055

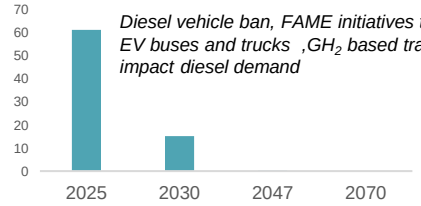
Demand (MT)

Petrol



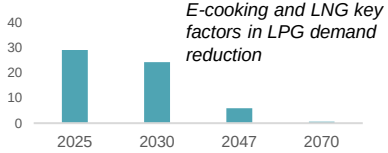
EV 2W segment price parity with petrol 2W will drive decline in petrol demand

Diesel



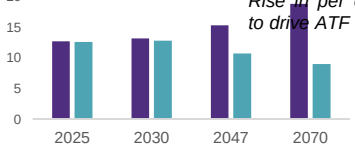
Diesel vehicle ban, FAME initiatives to adapt EV buses and trucks ,GH_2 based transport to impact diesel demand

LPG



E-cooking and LNG key factors in LPG demand reduction

ATF



Rise in per capita income to drive ATF demand

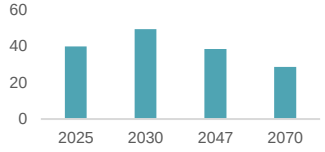
Diesel consumption is expected to decrease through biofuel blending targets, starting at 15% by 2025, and the replacement of 2 lakh diesel buses and 1 lakh e-trucks by 2030.

LPG consumption will decrease driven by electrification

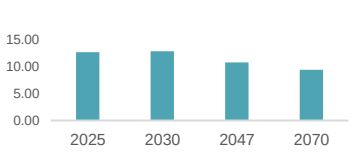
As demand for refined petroleum products declines, the addition of new refineries expected to **gradually cease beyond 2035**

Supply (MT)

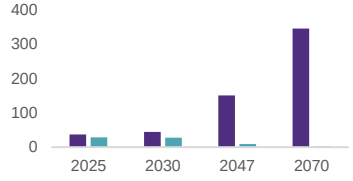
Petrol



Diesel

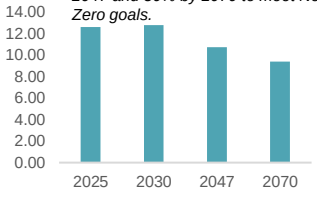


LPG



ATF

SAF blending will ramp up to 30% by 2047 and 50% by 2070 to meet Net Zero goals.



Exports will expand as domestic demand declines by 2043-44, while alternate fuel/system and biodiesel production grows.

LPG import dependency will move to zero as demand reduces, but minimal LPG dependency will persist for few years beyond 2070

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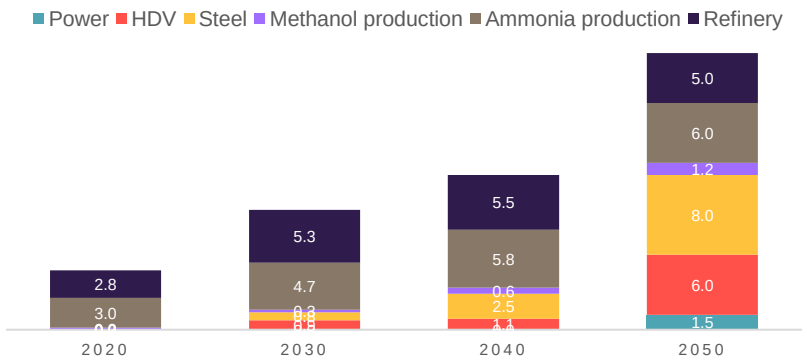
BAU : Business As Usual ; NZ : Net Zero; All nos. in million tonne

Green Hydrogen Outlook

Green Hydrogen market to get accelerated in India between 2030 and 2035 with increased domestic adaptation

- Refining and fertilizers industry are expected to have the highest share for green hydrogen demand in India in next 5 years and long term

Green Hydrogen Demand Outlook in India (MT)

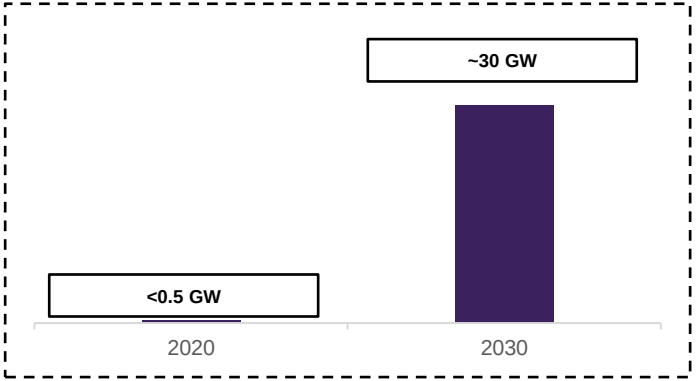


- G-H2 production cost in India is between 3.8 and 4.5 USD/kg in 2024, which is expected to be ~ 2.85 to 2.91 USD/kg by 2030

- Fuel Cells to find applications in C&I consumers operations to boost up the RE penetration (primarily driven by carbon liability exposure)

- About 25 MMTPA green ammonia capacities are announced in India (until 2024) to cater export and domestic market which requires about 18-20 GW of electrolyzer capacity upto 2030
- With 5 MMTPA GH2 target (NGHM), electrolyzer demand is ~ 25-30 GW
- **By 2047, electrolyzer demand is expected to be ~ 100 GW and nearly 200 GW by 2070**

Electrolyzer Demand Outlook in India



Decarbonization Outlook for Major Energy Users

India's major energy intensive industry aims to decarbonize by switching to cleaner energy sources like RE, GH_2 etc. & by adopting energy and carbon efficient technologies.

Decarbonization Pathway	Iron & Steel	Fertilizers	Textile	Paper & Pulp	Cement	Chlor Alkali	Refining
Change of process	• Coal based furnace to electric arc furnace • Scrap use	• Haber Bosch process to Electrolysis	• Heating through green electron (low to medium heat applications)	• Fossil fuel-based boilers with biomass-fired boilers	• Gas based clinkering • High efficiency grate cooling with enhanced heat recovery	• Gas separation membranes to artificial photosynthesis systems	• Conventional Refining to CCUS-Integrated Processes
Change of Fuels	• Natural Gas to GH_2 • Grid/captive coal power to RE	• Natural Gas to Green Ammonia • Grid/captive coal power to RE	• Coal to Biofuels • Conventional Power grid to GH_2, RE	• Coal to Biomass & Biofuels • Grid/captive power to RE	• Kiln firing from coal/petroleum coke to natural gas & GH_2	• Natural Gas/ Fuel Oil to Biofuels • Coal/Oil based electricity to RE based electricity	• Grey Hydrogen to Green Hydrogen

04 Key Recommendations

Key Recommendations

Current source of thermal energy particularly coal and oil will be replaced by cleaner alternative such as CBG/CNG, ethanol, green hydrogen, SAF, etc. will lead to decarbonization and emission reduction. However, scaling up of the technologies and market needs initial support from the Govt.

For accelerating Net Zero transition in transportation sector, focused programs (with fiscal/non-fiscal support) is required to adopt fuel cell/H_2 based vehicles, and alternate fuel use (ethanol, bio-diesel, CBG)

Policy and program intervention from government is necessary to accelerate the emerging new energy markets including CCUS, SAF, Geothermal, Tidal & Wave Energy

Major hard to abate sectors would adopt decarbonization measures including sourcing power through RE; adopting cleaner fuel sources; process change, use of energy efficient technologies; CCUS and afforestation. Ease of policy and regulatory measures (like open access for electricity – banking, settlement) is necessary to boost decarbonization among end users.

Manufacturing ecosystem such as solar cells & modules, WTG, electrolyser, and ESS needs to be strengthened for accelerating the pace of energy transition achieving net-zero target.

Clean coal technology i.e. coal gasification and CBM to be accelerated to transition towards gas-based economy and leveraging the coal resources of India

Creation of domestic demand for Green Hydrogen & its derivatives and SAF are necessary to attract sustainable investments in the market in short term