

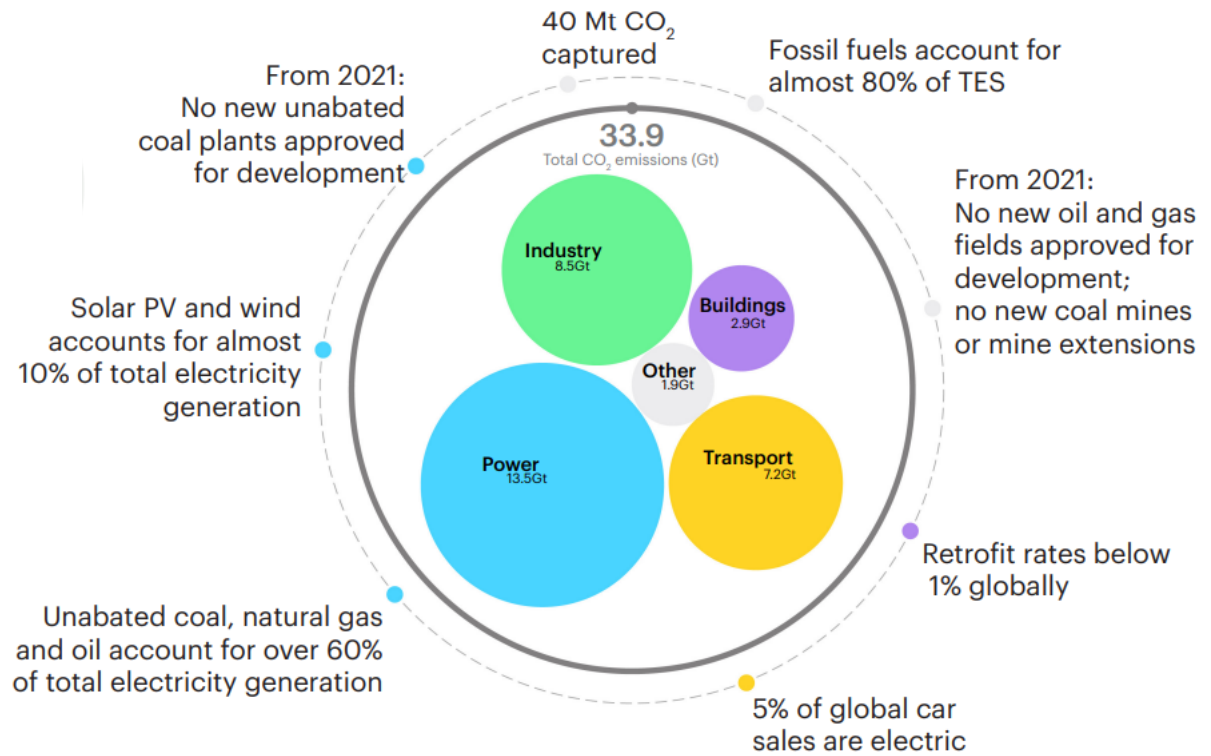
EMERGING TECHNOLOGIES IN ENERGY FOR CLIMATE CHANGE MITIGATION- REGIONAL PRIORITIES AND CHALLENGES



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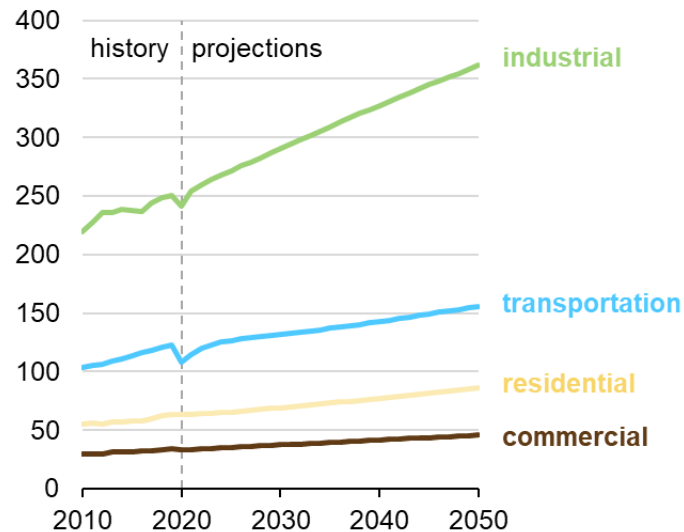
Global Energy Scenario

- Till last year 2021: More than 93% of the world primary energy is obtained from conventional fossil fuels (despite high fuel and environmental cost).
- In the year 2020 the world CO₂ emission stands at 33.9 Giga ton, where majority of share was from power and industry sector. In 2021 CO₂ emission was 36.3 Giga ton.
- It seems world is finding hard to do away with conventional energy sources.

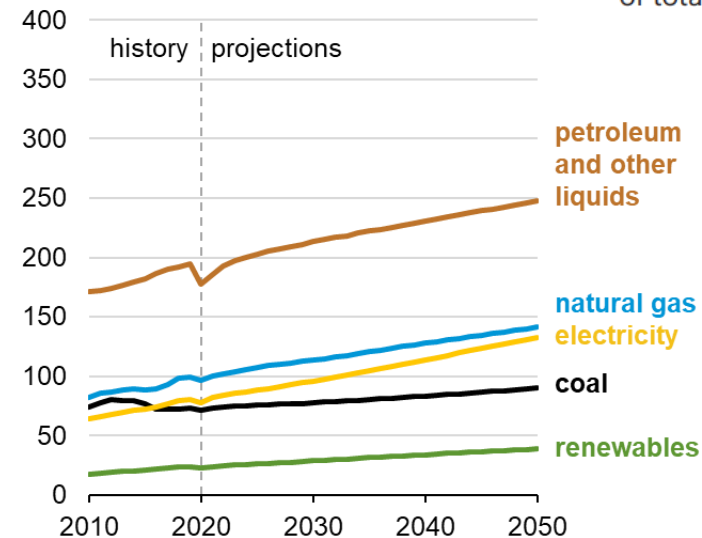


Source: Net Zero Emissions by 2050 Interactive [iea.li/nzeromap](https://www.iea.li/nzeromap)

End-use energy consumption by sector, world
quadrillion British thermal units



End-use energy consumption by fuel, world
quadrillion British thermal units



Source: EIA 2021 statistics

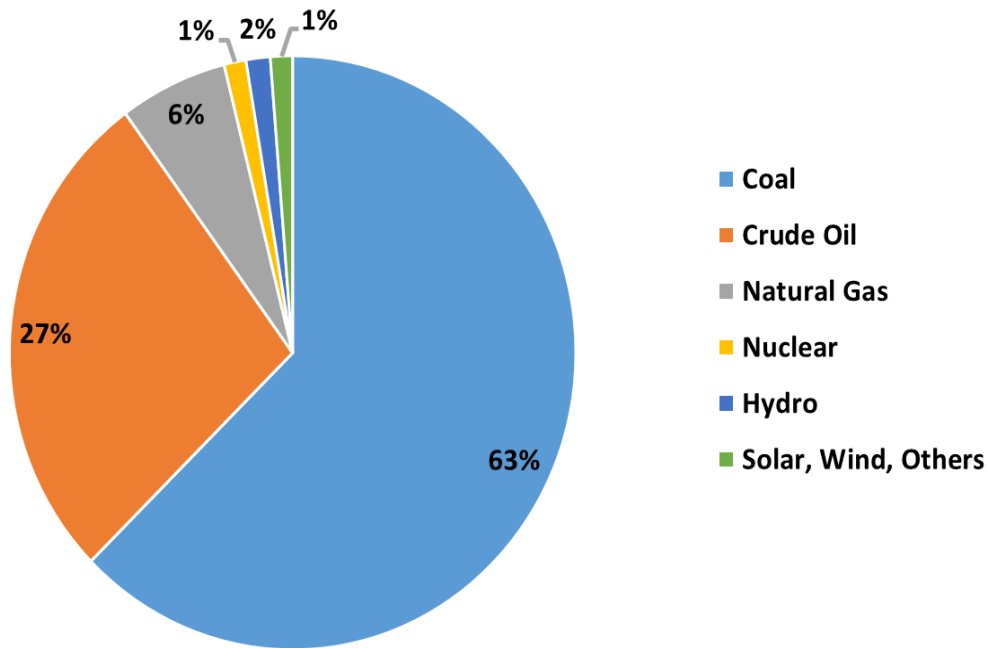
Need of the hour

A collective plan and collective action

India Energy Scenario 2020-2021

- In FY 2021, 75% of India's Electricity production is achieved through coal thermal power plants (whereas Fossil fuel based generation capacity share is 60%).
- India's Total CO₂ emission in 2021 is about 2.5 billion tones and out of which contribution from combustion of coal is 1.7 billion tones (nearly 64%).
- India has proven coal reserves of about 111 years.

Total primary energy supply 9,69,787.44 KTOE



Highlights of 2020-2021 energy balance of India

- Coal and crude oil are major primary energy source.
- 71.4% of total coal consumed is domestically produced.
- 87.6% of crude consumed in India is imported.
- Coal dominated primary energy supply in India.
- Nearly 49.6% of primary energy demand is import dependent.

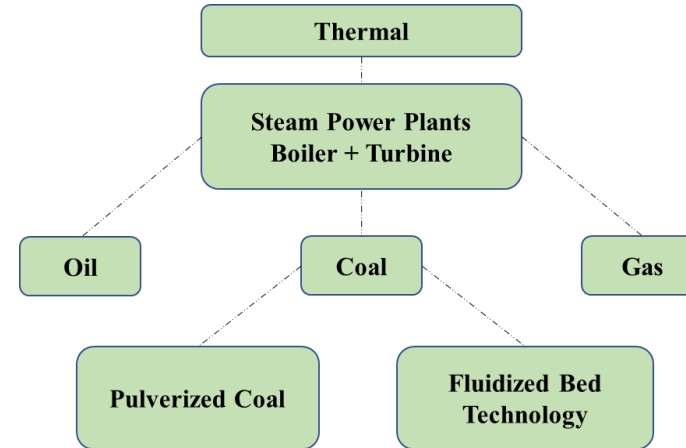
Problems with fossil fuel based power generation is huge **CO₂ gas emission**, **Air-land and water pollution**, **Huge maintenance cost and running cost**

Source: Ministry of Statistics and Program Implementation, Govt. of India

Present Energy Technologies and Constraints

Conventional power generation in India

- Coal fired thermal power plants
- Gas and Liquid fuel based power plants
- Large hydro electric power plants



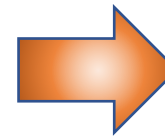
Total electricity generation installed capacity as on October 2021 is **390.8 GW**.

Present constraints in energy generation for India

- Huge number of conventional power generation units (fossil fuel based)
- Replacing them modern and clean technology is not financial viable
- Shifting completely to renewable quickly is not possible due to various constraints.
- Thermal and electrical storage technology at large scale is financially and technologically intensive.
- India also have to match the world and think about global issues like GHG emission and global warming.
- PM commitment at COP-26: India will meet 50 percent of its energy requirements from renewable energy by 2030 and by the year 2070, India will achieve the target of Net Zero.

Technological Interventions for Climate change mitigation

- Combined cycle power plants, Cogeneration
- Integration of different power plants with grid
- Integration of renewables to conventional power plants
- Use of biomass with coal in coal fired power plants.
- Gradual increase in the share of renewables in total power generation.



Modern Clean Energy Technologies- India

Solar Energy:

- India has now 50 GW of cumulative installed solar capacity, as on 28th February 2022.
- India added a record 10 Gigawatt (GW) to its cumulative installed capacity in 2021.

Biomass Energy:

- Biomass availability in India is estimated at about 750 million metric tones per year with power generation potential of about 28 GW.
- Additional 14 GW power could be generated through bagasse based cogeneration in the country's 550 Sugar mills.

Wind Energy:

- As on 31st March 2021 total wind energy potential is 3,02,251 MW.
- Total grid connected installed capacity is 37,743.8 MW.

Small Hydro Energy:

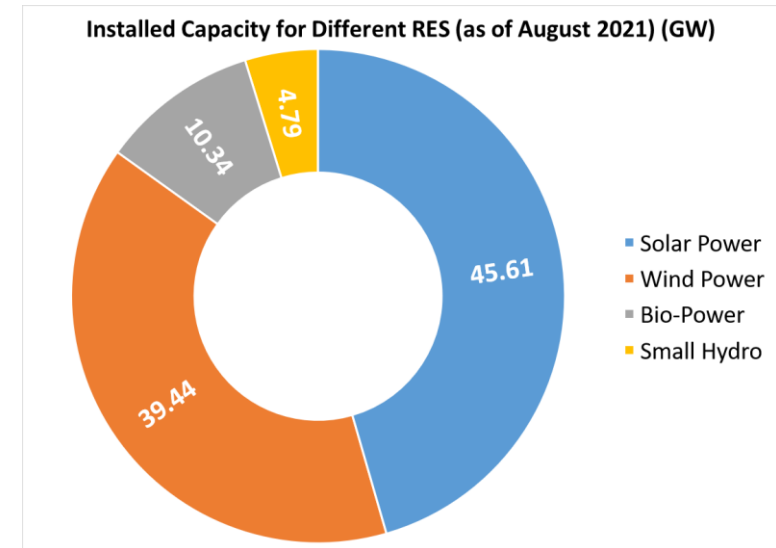
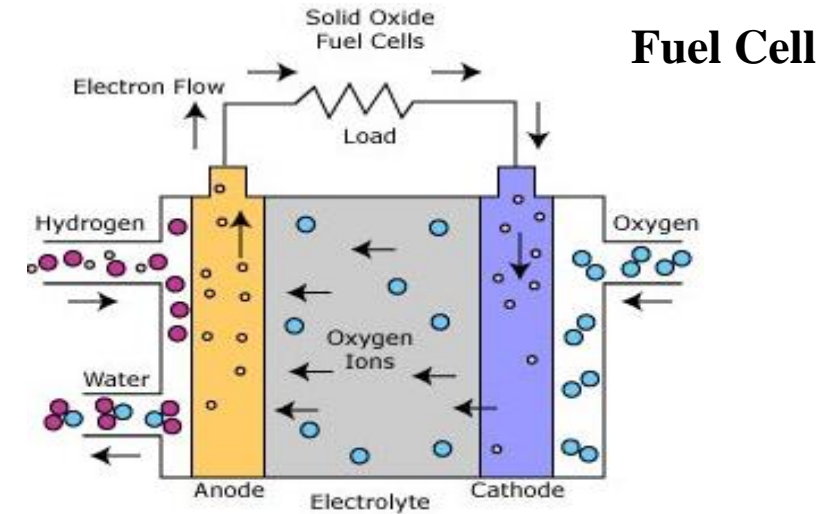
- As on 31st March 2021 total small hydro potential stand at 21,134 MW

CHSP:

- This technology is useful to improve the overall efficiency of existing TPP

Energy Storage:

- It can be chemical, thermal or mechanical. More research is needed to make it economical.



Cumulative Installed Capacity of Grid Interactive Renewable Power by Type (in GW) as on August 2021.

(Source: MNRE, Govt. of India)

Future Energy Technologies

Green hydrogen:

- Govt. of India has framed Green Hydrogen Policy for Implementation as one of the tool to meet climate change target and making India a hydrogen hub.
- Green hydrogen is produced by the electrolysis of water using renewable energy.
- India plans to manufacture 5 million tonnes of green hydrogen per year by 2030.

Ethanol:

- Ethanol can be blended into petrol to reduce the quantity of petrol required to run a vehicle, thus reducing dependency on imported, costly and polluting petroleum.
- In 2021-22, India has achieved 9.45% ethanol blending, as on March 13, 2022. The Ministry of Petroleum and Natural Gas (MoPNG) aims to take this to 10% in ESY 2021-22, and in December 2020 the government advanced its target of achieving 20% blending from 2030 to 2025.

Fuel Cells:

- Fuel cells are energy conversion devices that produce electricity from hydrogen with water as a byproduct and can be used in a wide range of applications, including transportation, material handling and emergency backup power.
- Fuel cell and hydrogen technology is emerging as one solution through its clean operation and critical decarbonization methods.

Hybrid technologies:

- Wind –Solar hybrid policy aims to achieve a capacity of 10GW by the end of year 2022.
- Co-gasification of biomass and coal integration to conventional energy generating plants.
- Aim is to reduce variability.
- Optimum utilization infrastructure including land and transmission systems

North-East India: Regional Priorities and Challenges

Energy Potential at Regional Level

- **HYDRO ENERGY:** The NE Region is blessed with huge hydro potential of about 58,971MW(Including big, small, mini and micro).
- **SOLAR POWER** is the most underutilized source of renewable energy in the Northeast. The region has a combined potential for installation of almost 60 GW of solar power.
- **BIOMASS:** As per MNRE, the current availability of biomass in India is estimated at about 750 million metric tonnes per year.
- **BIOGAS:** India has the potential to generate 29–48 billion m³/year of biogas and 350 million tons of manure from the 980 million tons of dung that are available annually.
- **WIND ENERGY** potential (50m and 80m Hight combined) is about 810 MW. Both Mizoram and Tripura do not have any reported potential for wind. Wind potential has yet to be validated with measurements.
- **NATURAL GAS** potential is 195.68 BCM against 1380.63 BCM of reserves in the country.
- **COAL** reserves are about 1,630 Million tones against National reserve of 326.49 Billion tones.

Challenges at Regional Level

- Low temperature solar energy applications in the area of Drying and Domestic hot water requirements
- Biogas and Biomass gasification potential of the region need to be tapped
- Small and micro hydro energy has huge potential in the region and very less realized. Govt support is required to encourage PPP model.
- Wind energy has good potential at 50m and 80m height. But this is yet to be explored.
- Entire North-East region has hilly terrain and un-even topography. Entire region is also ecologically sensitive. So small interventions to harness energy will be successful as it will have minimal impact on environment.



THANK YOU

