Challenges of energy and energy devices
Industry-Academia and Government consultative meeting

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Global Energy Scenario

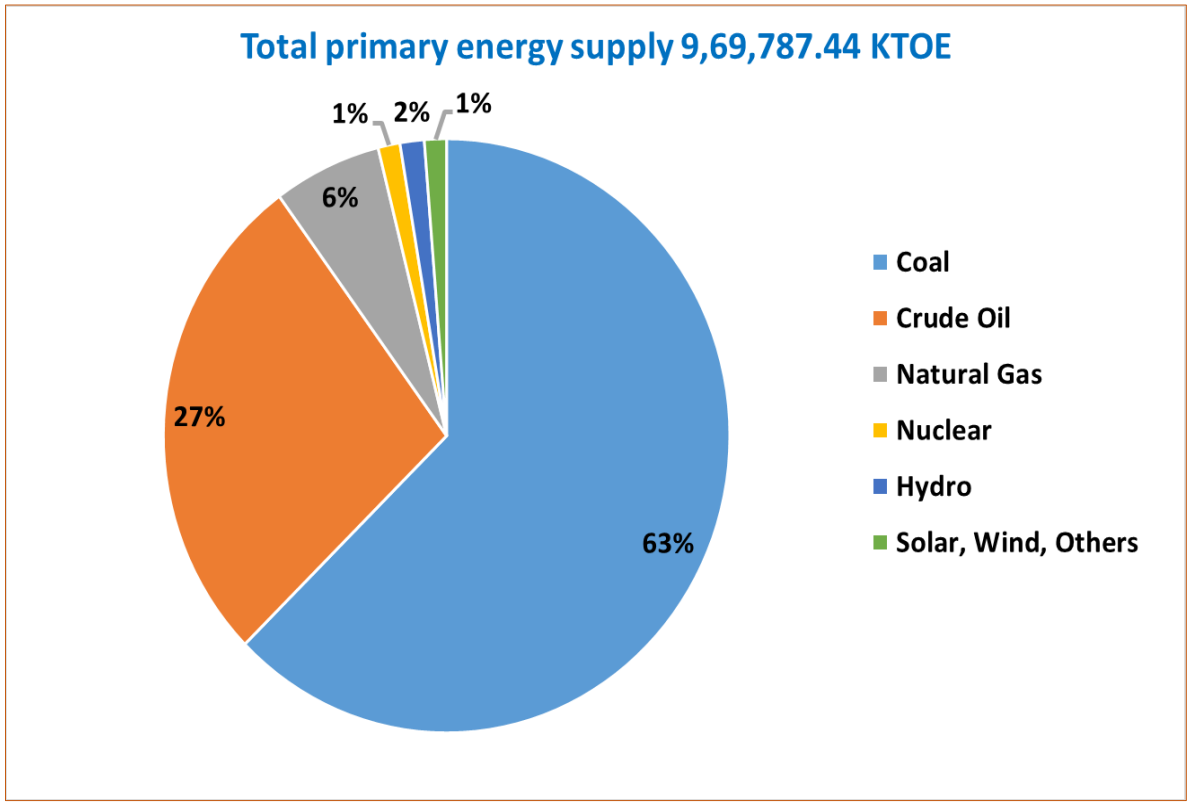
- More than 93% of the world primary energy is obtained from conventional fossil fuels (despite high fuel and environmental cost).
- In the year 2020 the world CO_2 emission stands at 33.9 Giga ton, where majority of share was from power and industry sector. In 2021 CO_2 emission was 36.3 Giga ton.
- By 2050, CO_2 may be 43.08 Billion ton.
- It seems world is finding hard to do away with conventional energy sources.

Need of the hour

-A collective plan and collective action
-Carbon neutral and sustainable growth of energy

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 CO_2 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.



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 **CO_2 gas emission, Air-land and water pollution, Huge maintenance cost and running cost**

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

Context of present discussion

Present constraints in energy generation

- Huge number of conventional power generation units (fossil fuel based)
- Replacing them with modern and clean technology is not financially 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.
- Indian context: 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 options

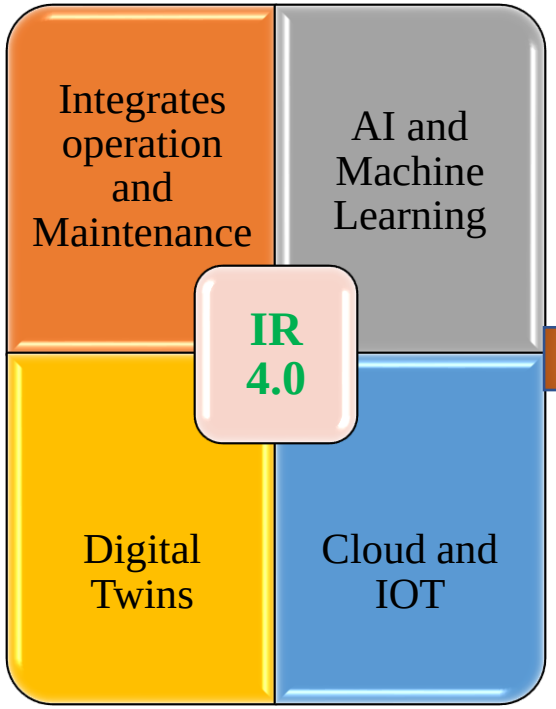
- Combined cycle power plants, Cogeneration
- Integration of different power plants with grid
- Integration of renewables to conventional power plants
- Use of biomass with coal in coal fired power plants.
- Gradual increase in the share of renewables in total power generation.

Solutions IR 4.0

- ✓ AI
- ✓ Machine Learning
- ✓ Twin Digital
- ✓ IOT

Intelligent power plant under IR 4.0

IR 4.0 Building Blocks



Expected solution domain

- Consistent and safe operations at full load, partial load and transient state
- Optimization at plant level and improvement in heat rate
- Asset prediction and preventive maintenance
- Asset health diagnosis and failure prediction
- Digital enablement and plant workers safety with AR/VR equipment.

- Efficiency Improvement
- Load matching
- Reduction in losses
- Reduction in GHG emission

Value addition clients will receive

- ✓ Reduction in CO_2, SO_X and NO_X emissions
- ✓ Reduction in operation and maintenance cost
- ✓ Detection of fault and Leakages as much as 36hrs in advance with more than 85% accuracy
- ✓ Huge financial savings and in terms of improvement in plant profitability

E.O.N,TCS, G.E.,SIEMENS

Future Energy Technologies

Need

- Carbon Neutral
- Sustainable power generation
- Economical

Solutions

- Carbon dioxide capture, utilization, and storage (CCUS)
- increase in the share of Renewable energy in energy portfolio.
- Integration of renewables with conventional energy for short to medium term
- Battery storage and new materials
- Emphasis on electric vehicles

CCUS

- **Japan –Tomakomai CCS demonstation project in Hokkaido 2016-2019. Hydrogen production unit of the refinery gives 50% CO_2 which is captured through active amine process. 0.1 Mt per year capture.**
- **Drax Power limited UK. It will be the first carbon neutral power station by 2027.**
- **Identified CCUS projects in Singapore, Malayasia, Indonesia**

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.
- Optimum utilization infrastructure including land and transmission systems

New Materials

Battery Materials

- Alkaline batteries for small electronic gadgets
- Lithium ion batteries for cars, laptops

Scope for development

- high-capacity batteries with long discharge times – up to 10 hours – could be valuable for storing solar power at night or increasing the range of electric vehicles
- 10% of Li and almost all cobalt reserve will be depleted by 2050

Solutions

- Recycling of Li and cobalt batteries is the area of cooperation between industry and research labs
- Replacing cobalt is trialed by Tesla
- Na to substitute Li

CSP:

- This technology is useful to improve the overall efficiency of TRPP. Thermal Energy storage material needs to be explored.






THANK YOU