

**Electricity Generation Planning in South  
Asian Countries and perspectives for clean  
energy transition and advancing Cross  
Border Energy Trade in South Asia**

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# **Generation Planning in India**

## **Objective**

To obtain an optimal generation capacity mix in the least cost manner to meet the demand at every instance of time while ensuring the most efficient use of resources.

The planning studies require accurate performance parameters of all types of generating units to assess their availability and energy generation capabilities.

# **Power Sector and Economic Development**

- ❖ Universal access to affordable power in a sustainable manner has been the guiding principle for the Power sector.
- ❖ Power sector will play a key role to address the challenges related to climate change and meet the various commitments made by India at the global forum,
- ❖ India is reducing its dependence on fossil based energy and shifting to cleaner and renewable energy sources.
- ❖ Initiatives to transform the country from power deficit to power surplus nation which includes connecting the whole nation into one grid, strengthening the distribution system and achieving universal household electrification.

## **National Electricity Plan (NEP)**

As per section 3(4) of the Electricity Act, 2003, Central Electricity Authority (CEA) has been mandated to prepare a National Electricity Plan (NEP) in accordance with the National Electricity Policy and notify such plan once in five years.

- ❖ NEP provides a framework for a sustainable and resilient power sector, considering factors such as energy security, affordability, accessibility, and environmental sustainability.
- ❖ The importance and relevance of power development within the confines of clean and green power is crucial for sustainable economic growth. Such a development depends upon the choice of an appropriate fuel / resource for power generation.
- ❖ NEP takes into account the development of renewable energy sources including Hydro projects along with other measures and technologies promoting sustainable development in the country.

## **Emphasis on RE capacity addition**

- ❖ India has made the massive strides towards renewable energy sources and exhibited a remarkable increase in RE sources installed capacity since FY 2006–07.
- ❖ The contribution of RE sources (including Large Hydro) to the installed capacity has increased from 5.8% in 2006–07 to 39% in 2021-22 till 31.03.2022 and further increased to around 41% as on 31.03.2023.
- ❖ Promotion of energy conservation and increased use of renewable energy are the twin planks of a sustainable energy supply.

# Elements of generation planning

- ❖ Load Forecasting
- ❖ Relationship Between Capacity Reserves and Reliability
- ❖ Resource Adequacy of the generation assets
- ❖ To achieve objectives of all policies of Government of India.
- ❖ To achieve sustainable development.
- ❖ To fulfil desired operational characteristics of the system such as reliability and flexibility.
- ❖ Most efficient use of resources.

## **Options Available for Power Generation**

- Conventional Sources – Coal and lignite, Nuclear, Natural gas;
- New and Renewable Energy Sources- Solar, Wind, Biomass, large and small Hydro, Geothermal, Waste to energy, etc;
- Storage Sources – Pumped Storage Systems, Battery energy Storage System, Green Hydrogen etc

# Generation Planning in India

## Key performance factors required :

- ❖ Auxiliary power consumption;
- ❖ Heat rate;
- ❖ Capital cost of the generating units;
- ❖ Fuel cost;
- ❖ Gross calorific value;
- ❖ Plant Load Factor/ Capacity Utilisation factor;
- ❖ O&M cost, etc.



## **Need of Flexibility**

- ❖ To support variability and uncertainty from RE sources like solar and wind additional flexibility is required to maintain a reliable and stable system operation.
- ❖ Due to inherent modelling limitation, traditional planning approaches often fail to address the short-term variability and underestimate system flexibility need for reliable operation.
- ❖ Significant methodological revision is therefore required in countries like India where large scale RE penetration targets have been set up.

## **Need of Flexibility**

To support variability and uncertainty from RE sources like solar and wind additional flexibility is required to maintain a reliable and stable system operation. flexibility can be achieved in three essential ways:

- ❖balancing the generation portfolio;
- ❖load control; and
- ❖Energy storage.

## **Broader Outlook**

India is centrally placed in South Asian region and with cross border interconnections with neighboring countries, playing a major role in effective utilization of regional resources.

- ❖ To facilitate import/ export of electricity between India and neighboring countries, Ministry of Power, Govt. of India have issued the "Guidelines for Import/Export (Cross Border) of Electricity-2018" on 18th December, 2018.
- ❖ India have also developed expertise in high capacity high voltage transmission projects including AC 400 kV and 765 kV and HVDC systems. Presently, India is connected with Nepal, Bhutan, Bangladesh and Myanmar.
- ❖ India is planning to connect with Sri Lanka, Maldives and Gulf countries under the One Sun, One World, One Grid (OSOWOG) initiative.

# **Initiatives pertaining to cross-border grid Interconnection**

## **Interconnections**

- ❖ Presently, India is connected with Nepal, Bhutan, Bangladesh and Myanmar.
- ❖ The present power transfer capacity between India- Bangladesh, Bhutan, Myanmar and Nepal is 1160, 5500, 3, 1300 MW respectively.
- ❖ By year 2030 capacity between India-Bangladesh, Bhutan, Myanmar, Nepal is expected to increase upto 2600, 9600, 1000 and 6000 MW respectively.
- ❖ Further, it is envisaged that by 2030 India – Sri Lanka would also be connected through 500 MW HVDC link.
- ❖ Interconnection with Singapore is being envisaged.

# **BIMSTEC Grid Interconnection Master Plan Study**

## **BGIMPS**

- ❖ An MoU for establishment of the BIMSTEC grid interconnection was signed between member states ( Bangladesh, Bhutan, India, Nepal, and Sri Lanka and Two are from Southeast Asia i.e., Myanmar and Thailand).
- ❖ One of the major functions is to prepare BIMSTEC Grid Interconnection Master Plan Study (BGIMPS) through a committee (BGICC).
- ❖ BGICC to conclude the BGIMPS with the support ADB.
- ❖ India is lead country in Energy Sub-sector, therefore, MoP has constituted a High Level Committee (HLC) for carrying out BIMSTEC Grid Interconnection study, and provide technical inputs to ADB in formulating the BGIMPS.

# **Green Grids Initiative — One Sun, One World, One Grid (OSOWOG)**

- ❖ First proposed by the Prime Minister during the first assembly of the International Solar Alliance (ISA) in 2018.
- ❖ The concept behind the OSOWOG is ‘The Sun Never Sets’ and is a constant at some geographical location, globally, at any given point of time. The vision of “One Sun, One World, One Grid” articulated by India would help in transporting solar power from one country to another country during night.
- ❖ In May 2021, the United Kingdom and India agreed to combine forces of the Green Grids Initiative & the One Sun One World One Grid initiative and jointly launched GGI-OSOWOG at the COP26 summit.

# OSOWOG

To develop a transnational grid that will be laid all over the globe to transport the solar power generated across the globe to different load centres. The initiative will help to realize the “three transitions” of energy development.

- ❖ The transition of energy production from fossil fuel to clean energy dominance;
- ❖ The transition of energy allocation from local balance to cross-border and global distribution; and
- ❖ The transition from coal, oil, and gas in energy consumption to electric-centric consumption.

# **Requirements of Cross Border Trade of Electricity**

- a) Strategic and political framework
- b) Policy and legal framework
- c) Regulatory framework
- d) Technical and operational framework
- e) Commercial framework
  - i. Transmission line development methodology
  - ii. Transmission pricing and loss accounting
  - iii. Open access / wheeling of power
  - iv. Deviation settlement
- f) Institutional framework



# **Model framework for Trilateral and Multilateral Power Trade (MRFTMPT) in South Asia**

- ❖ Strategic and political framework: Regional agreements/treaty/framework for energy cooperation
- ❖ Policy, legal and regulatory framework
- ❖ Technical and operational: Technical guidelines, operational planning and coordination
- ❖ Commercial: Market platforms, wheeling charges, congestion pricing, deviation pricing, etc
- ❖ Institutional: Regional market platforms and dispute resolution
- ❖ Sustainability: Promotion of clean energy in regional energy trade

# **Benefits of Cross Border Trilateral and Multilateral Power Trade (CBTMPT)**

- ❖ Sharing of reserves, reduction of need for marginal generation capacity, increasing security of supply
- ❖ Sharing of non-firm surplus
- ❖ Power trade to make use of resource complementarities
- ❖ Increasing competition and choice

# Challenges and Suggestions

## Challenges:

- ❖ Management of congestion or transmission constraints
- ❖ market prices at both sides of the interconnector can be very different

## Suggestions:

- ❖ cooperation and co-ordination among interconnected countries electricity markets remain designed nationally with country-specific rules and regulations;
- ❖ participating countries may enable and encourage knowledge sharing and joint research related to power generation, transmission, distribution, energy efficiency;
- ❖ electricity markets, development and grid integration of renewable energy resources etc.

## **Way Forward**

- ❖ Increased coordination between different planning agencies and operational utilities.
- ❖ Requirement of improved tools, algorithms, advanced data maintenance and management practices.
- ❖ Challenges of RE integration for a developing country like India are unique, and they often include regulatory and social issues apart from technical ones.
- ❖ Likewise, methodological revision for RE planning activities should consider exclusiveness of the concerned energy system.

**THANKS!!!!**

