

Flexibility in Indian Power System

Atul Bali, NSGM-PMU, INDIA

Indian Power Sector – Overview



- Installed Capacity – 329 GW
 - Thermal: 66.7%
 - Hydro: 13.5%
 - Nuclear: 2.1%
 - **Renewables: 17.7%**
- Peak Demand – 157 GW
- Renewables – 58GW
- Short Term Market – 9-10%
- Growth rate: 7 – 8% per annum

Source:

http://www.cea.nic.in/reports/monthly/installedcapacity/2017/installed_capacity-08.pdf

Flexibility in Indian Power System

- India has set a target to achieve **40% cumulative electric power capacity from non-fossil fuel based energy resources by 2030.**
- **Target of 175 GW of Renewable Energy (RE)** by 2022 by Govt. of India for ensuring energy security of the country of which 30% goal has been achieved till date.
- The MNRE, GoI is already implementing a scheme for development of at least **25 solar parks with an aggregate capacity of 20,000 MW.**
- Rs.380 billion **Green Energy Corridor** is being set up to ensure evacuation of RE.
- **Variable and Intermittent output** of wind and solar generation ask for **Load – Generation balance**
- This necessitates the **conventional generation to be ‘flexible’** enough to ramp up and ramp down.

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- Earlier, only load used to peak and change. With RE coming into the picture in big way, **both generation output from the renewables and demand will vary** and that may result in difficulty in managing the grid even after harnessing diversity.
- **Fast ramp up and ramp down of demand**, lower generation levels, quick start and stops in generation, variability and **intermittency of renewables**, distributed generation, electric vehicles, and energy storage etc. factors **demand the flexibility** in power systems.
- To induce flexibility at generation, **multiple methods of power generation may be considered** such as pumped storage, coal fired stations, gas turbine stations, solar parks, wind generation, hydro power plants etc.
- In 2016, GoI had released **Guidelines for flexible utilization of domestic coal** for reducing cost of power generation.
- **Spinning existing reserves** and **imparting flexibility in real time operation and planning**, using **demand response** to manage power generation and supply, forecasting as well as **demand supply imbalances** shall help in planning load factor and better services.

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- **Central Electricity Regulatory Commission (CERC)** of India proposed w.r.t coal stations that
 - The technical minimum may initially be kept as 55% of Installed Capacity/ Machine Continuous Rating of unit/units for old as well as new plants in due consideration of Central Electricity Authority (CEA) recommendations.
 - However, the operation at 55% loading has commercial implication for the generator in terms of increase in heat rate, secondary fuel oil consumption and auxiliary energy consumption, thereby increasing the actual energy charges. The generator will have to be compensated for this increase in energy charges.
- Considering the other portfolios like transmission, system operations, scheduling, market operation etc. Govt. of India had taken steps to induce flexibility.
- **HVDC** systems, **FACTS** etc. have been in operational and planning for transmitting bulk power with fewer losses. Infact, **1200 KV system** has been commissioned in India.
- **Load forecast, renewable forecast, scheduling, telemetry and reserves** – all these essential services are designed and implemented for the system operators to give command to flex the generation both up and down to maintain the load generation balance

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- Many initiatives have been planned and some have kick started for implementation to provide flexibility in power systems via:
 - More pumped storage and hydro power plants, gas turbines, more renewables, better operational norms
 - **Ramp rates in coal fired stations**, incentives and shifts of generation
 - Better transmission through **flexible HVDC links**
 - Controlling reserves, ancillary framework services, automatic generation control, better market design
 - Necessity to identify and target load factors, better incentives for scheduling, dynamic tariffs
 - Newer technologies with wind and solar, **data analytics and lower UI charges** etc.
 - Seasonal adaption of renewables, better power trading and lower tariffs etc.
 - Smart Grids, **Large scale PMU installation** and **establishment of REMC** etc.

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- **Scheduling on a regular basis** eliminates sharp discrete changes and resulting frequency fluctuations. **Good load forecast** is a prerequisite. More granularity in scheduling helps in load management and renewable integration. **Smart Grids** are under implementation in India to test this functionality and successful demonstrations have begun in these projects.
- Scheduling policies encourage **flexibility associated market operation**. Presently 15 minutes time frame is the least count of the market clearance process. **Sub-hourly market** has addressed the issue of abrupt behavior in generation/ load at the hour boundaries, thereby, **smoothing the interchange scheduling curve** and provided **economic signals to the state utilities** to respond to fluctuations in load.
- Flexibility in generation, transmission and distribution along with ancillary services **reduce overall system costs and consumer prices**.
- Flexibility also improve environmental impacts of power system operations via **increased optimization of demand response**, more efficient use of transmission, and reduced renewable curtailments
- With the **central bodies like CERC and CEA in India formulating the policies** to provide flexible access in generation, providing incentives and implementation, India will soon stand as an example

Thank You

