Module 7 : Power System Structures

Lecture 34 : Indian Scenario

Objectives

In this lecture you will learn the following

- Indian Scenario
- Electricity Act 2003

Indian Scenario: Ownership Issues

In India, the power sector was mainly under the government ownership (>95% distribution & ~98% generation) under various states and central government utilities, till 1991. The remarkable growth of physical infrastructure was facilitated by four main policies:

1) centralized supply and grid expansion
2) large support from government budgets
3) development of sector based on indigenous resources
4) cross subsidy

Cross-Subsidization means that a certain class of customers are charged higher prices for energy usage, while another class is charged less. This is done with a social objective in mind

In mid 1990s, Orissa began a process of fundamental restructuring of the state power sector. This consisted of a three pronged strategy of:

1) Unbundling the integrated utility in three separate sectors of generation, transmission and distribution,
2) Privatization of generation and distribution companies and,
3) Establishment of independent regulatory commissions to regulate these utilities. Meanwhile, some moderate steps were taken towards reforms until the Electricity Bill 2003 was approved by Parliament in May 2003.

The Electricity Act 2003:

The conceptual framework underlying this new legislation is that the electricity sector must be opened for competition. The Act moves towards creating a market based regime in the power sector. The Act also seeks to consolidate, update and rationalize laws related to generation, transmission, distribution, trading and use of power. It focuses on:

- Creating competition in the industry
- Protecting consumer interest

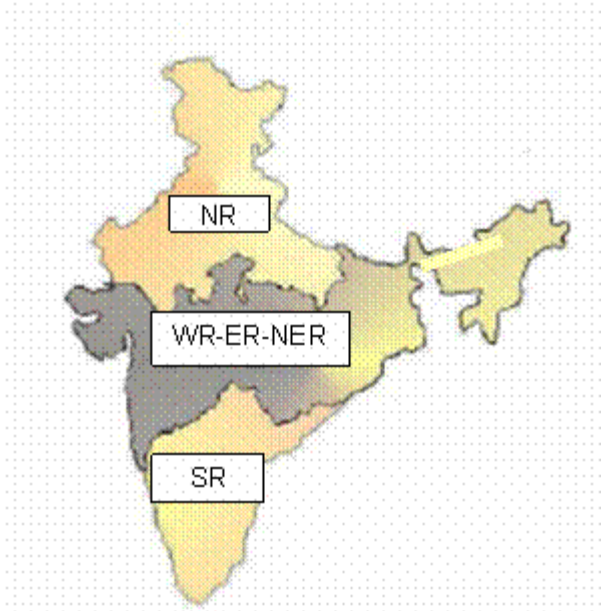
- Ensuring supply of electricity to all areas
- Rationalizing tariff
- Lowering the cross-subsidization levels.

Some of the major provisions of the Electricity Act are:

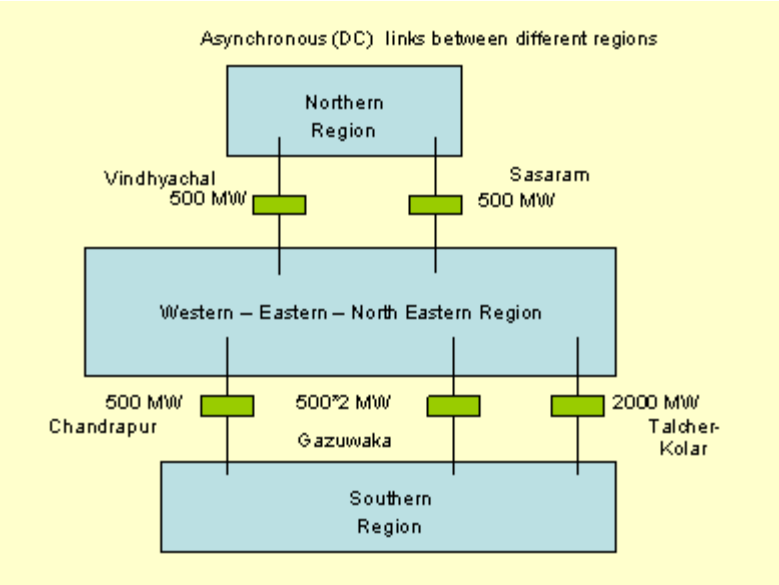
- Elimination of licensing for setting up a generating station, subject to compliance with technical standards. This excludes Hydro-Electric power station
- Removal of captive power plants from the ambit of licensing and other permissions
- Provision for issuing more than one license for transmission and distribution in the same geographical area.
- Provision of 'Open Access' with respect to transmission for all generators (subject to technical constraints)
- Introduction of a spot market for bulk electricity
- Unbundling of the SEBs on the basis of functions (Generation, Transmission and Distribution)
- Compulsory metering of all consumers in order to improve accountability
- State Governments will have the freedom to decide the sequence and phases of restructuring, and also retain the integrated structure of the SEB for a limited period.

Indian Scenario: Power Transmission System

As mentioned in the first Module, the Indian Power System is made of 3 synchronous grids, the Northern Region, Western-Eastern-North Eastern Region (W-E-NE R), and the Southern Grid. The installed capacity is greater than 110 GW and a demand of 70 GW is met (2005). The synchronous regions are interconnected by asynchronous (HVDC) ties. Therefore, it is possible to operate the three grids independently since the power through the HVDC links can be independently controlled.



Synchronous Grids in India (2005)



All DC links as shown in the figure are back to back, except for the one at Talcher-Kolar, which is a long HVDC line.

Most of the power generation is likely to come up in the coal rich central-eastern region and the hydro-potential rich north eastern region. Therefore adequate capacity transmission is necessary to transmit this power to the load centres.

Plan for a National Grid

The plan for formation of national grid includes synchronous interconnection of the Northern Region with the W-E-NE-Region around 2006. Synchronous operation will allow for subsequent interconnection at several other locations using AC lines, thereby increasing the power exchanges between regions. Of course, one may increase the number and capacity of asynhronous links and achieve the same thing. Eventually, it is a tradeoff between the technical considerations and costs.

What are the challenges in the integration of 2 large systems synchronously ? Among the problems which one will encounter are control of power flows between the interconnected regions and ensuring the maintainance of synchronism between interconnected generators subsequent to disturbances.

Challenges of Synchronous Operation : A practical example of emergency control

The Talcher - Kolar HVDC link is a high capacity link which transfers power from Talcher in the Eastern Region to Kolar in the Southern Region. In case the link trips, the W-E-NE Region is left with surplus power. Most of the surplus power rushes towards the western region (which has a large load) through relatively weak AC tie lines. The ensuing power swings (relative motion between generators) are not stable and the system separates into two regions due to loss of synchronism.

Therefore, in order to prevent ER-WR system separation, the following emergency scheme was concieved:

In case due to an unexpected contingency, the heavily loaded HVDC link trips, *then a few generators at Talcher are also tripped* immediately. This ensures that the W-E-NER system is not left with too much surplus power.

Note that the other asynchronous links to the Southern Region (e.g. the one at Gazuwaka) are of limited capacity and *cannot* suddenly push the excess power to the Southern Region unless they are lightly loaded. Moreover power flow through these links is *regulated*. Therefore, power can be ramped *slowly* by manual intervention. However, a strategy specifically suited to deal with this situation can be concieved.

The proposed plan for synchronous operation of NR and WR-ER-NER brings out interesting questions:

What will be the role of the existing back-to-back HVDC links (which asynchronously interconnect the two systems at present), when NR and WR-ER-NER systems are synchronized ?

Can the back-to-back HVDC links regulate the *total* power exchange between the two regions once they are synchronized ?

Recap

In this lecture you have learnt the following

- Indian Scenario
- Electricity Act 2003

Congratulations, you have finished Lecture 34.