

## A Basic Overview And Study About Deregulation & Restructuring Concept For Indian Power Sector

Prof. M.B Zala

Assistant Professor, Electrical Department, GEC-Bhuj, Gujarat, India

**Abstract-**This paper is a discussion about the introduction of restructuring and deregulation in Indian Power System. In modern era, deregulation has an important impact on power sector. The competition in the wholesale generation market and the retail market together with the open access to the transmission network can give many advantages to the consumers. These advantages are lower electricity prices and better services. However, this competition also brings many new technical problem and challenges to the operation of restructured power systems. This paper devoted to the development of computational tools for effectively and efficiently operating such restructured systems. In this paper, recent use of deregulation in Indian Power Sector has been described and measures to be taken in order to improve deregulation are also suggested.

**Key words:** Deregulation, Restructuring, Power Sector, CERC, TSO, RLDC

### INTRODUCTION

In current time, due to rise in power demand and supply, it is a difficult task to manage the generation and cost concurrently for one single party. To reduce monopoly of one organization and to provide quality and continue reliable power supply at reasonable cost, it is necessary to encourage competition in power market. This can be possible by introducing restructuring and deregulation in electrical power sector. Deregulation involves unbundling of different components of power system, availability of components for sale and also forming new set of rules for operation and sales of electricity [1]. A main and important aspect of deregulation is restructuring. Restructuring means unbundling of power system into both horizontal and vertical components. Vertical integrated utilities are mainly broken up into three main components, i.e. Generation, Transmission and Distribution.

This introduces competition in generation, transmission open access with retail competition in distribution. Competition in generation reduces cost of power, Transmission open access provides access to transmission grid for the various generations, which enhances reliability of power supply. Retail

competition in distribution provides choices for buyers to select between power suppliers, which provide good quality of power. The general structure of deregulated power system is shown in fig. 1.

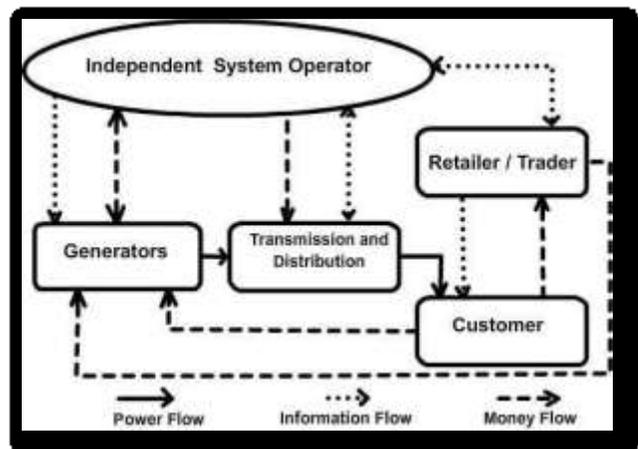


Fig. 1: Deregulated power system

Many countries like England, United States of America, Canada, Australia, Peru, New Zealand, Chile, Argentina, Colombia and Scandinavian have already adopted deregulated power structure since long. In India, till independence the entire power sector was under the control of private sector. After the enactment of new Electricity Act in 1948, the entire power sector is mostly owned by State Governments and is largely managed by vertically integrated electricity business through State Electricity Boards (SEBs). In 1975, Government of India (GOI) entered in the field of generation and transmission through their Central sector power stations and management.

However, distribution sector continued to remain with SEBs as a monopoly business. Over the period of operations, unfortunately, the sector developed techno company's inefficiencies. Restructuring therefore was felt as mandatory option to cure. Accordingly, the power generation was opened up in 1991 followed by transmission in 1998. Electricity Regulatory Commissions Act was enacted in 1998

for establishing regulatory commissions in various States. And then the Electricity Act 2003 has been notified by Government of India in June 2003. The objective of this act is to accelerate the power sector reforms.

Modern power industry operation is difficult to understand due to dichotomy between electricity's business and physical manifestations. From business point of view electricity power is exchangeable commodity which can be traded like rice, wheat. But, in its physical manifestation, electricity is quite different from other tradable commodities. Reason for above difference is: electricity cannot be stored. The institutional debate and issues provides the context for a review of the market rules that can support a logic of competitive electricity market. The competition in the generation market and the retail market can affect the total cost of energy supply. Reliability is the second important thing which is demanded by customers. The key factor of the reliability is response time. In other words reliability and competition is likely to work well for actions that occur half an hour or more in the future. Given this lead time, buyers and sellers can find the price level for each service that will balance supply and demand.

Interconnections through the transmission grid create the necessity for regional organizations that can accommodate competition in services and generation, This preserve the reliability of the transmission system. Alternative models are many, but can be grouped under the general headings of "Transcos," "Gridcos," "ISO/PX," "ISOs," and finally, organizations for transmission loading relief. The different models present alternatives for the mix of responsibility of the necessary system operator. At one end of the spectrum, a Transco is an independent entity both owning the transmission assets and controlling system operations. By contrast, a Gridco is an entity owning the transmission assets but not responsible for system operations. System operations may be separated into a power exchange (PX) and transmission operations, or combined under an independent system operator (ISO).

And finally, whatever regional choices are made, there must be institutions for coordinating transmission loading relief (TLR) across the regions. In this paper it is discussed the main aim and the potential benefits of the deregulation of the power industry. Deregulation will greatly increase power transfers between areas and change the pattern of inter-area transfers and the network will be utilized in a way not envisioned in its design. Electric

deregulation is the process of changing rules and regulations that control the electric industry to provide customers the choice of electricity suppliers who are either retailers or traders by allowing competition. Deregulation improves the economic efficiency of the production and use of electricity. Due to competition in the electric industry, the power prices are likely to come down which benefits the consumers. The important concepts of deregulation are:-

#### *A. Competition*

The competition is at two levels in deregulated power industry: Wholesale (Generation) and retail (Distribution).

#### *B. Deregulation*

The rules governing the electric power industry are changed. The new structure introduces competition into the market, in place of a few large regulated companies.

#### *C. Open Access*

In deregulation of power system the Independent Power Producers (IPP) are permitted to transmit the power using utility transmission and distribution systems.

The benefits associated with deregulation are:

- Optimization of energy supply will take place.
- Systems capacity will be used efficiently.
- Price of the electricity will become clearer.
- Consumer choice will be improved.
- Bad technologies are ignored and good technologies will be adopted to attract the choices of consumers..
- Electricity prices will decrease due to competition.
- The usage efficiency is improved due to restructuring in price signals.
- Power flow will take place from surplus areas to shortage areas.
- The cost of ancillary services is reduced by reserve sharing.

In the deregulation process, some new entities are expected to appear and hold major roles in power industry. The structural components representing various segments of the deregulated electricity market are:-

Companies:-

- Generation Companies (GenCos.)
- Transmission Companies (TransCos.)
- Distribution Companies (DisCos.)
- Independent Power Producer (IPP)
- Independent System Operator (ISO): Power Exchange (PX) & Retail Energy Service Companies (RESCos.)

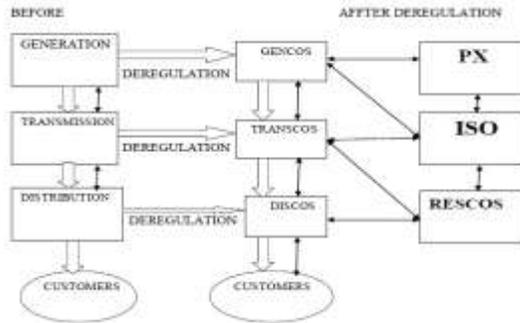


Fig 2- Structure of Deregulation

In the deregulated electricity market, increased infrastructure utilization increases capital returns and increased competition increases economic energy transactions. Due to introduction of less costly sources, there will be new power flow patterns.

New transmission difficulties will be created and some existing transmission constraints will be binding more often and with more economic significance. The interconnections are used at their capacity due to increased interchanges in power markets.

#### SYSTEM OPERATION IN A COMPETITIVE ENVIRONMENT

Regardless of the market structures that may emerge in various parts of the world, one fact that seems always to be true is that transmission and generation services will be unbundled from one another. The generation market will become fully competitive, with many market participants who will be able to sell their energy services (or demand side management). On the other hand, the operation of a transmission system is expected to remain a regulated monopoly whose function is to allow open, non-discriminatory and comparable access to all suppliers and consumers of electrical energy. This function can be implemented by an entity called the Independent System Operator (ISO). Although electricity markets may have many different ISO designs and approaches all over the world, there are nonetheless elements that are necessary to all types of ISOs in order to meet their common basic requirements.

Basically, the ISO has responsibility for the reliability functions in its region of operation and for assuring that all participants have open and nondiscriminatory access to transmission services through its planning and operation of the power transmission system. The minimum functions of the ISO should include the operation and coordination of

the power system to ensure security. In this case, a separate market operator (for example, the Power Exchange) is needed to perform the market-related functions. On the other hand, the maximum functions of the ISO will include all the reliability-related and market-related functions mentioned above and in addition the ISO is the transmission owner (for example, the National Grid Company). The functions of the ISO at various sizes and time scales are shown in Figure 3.

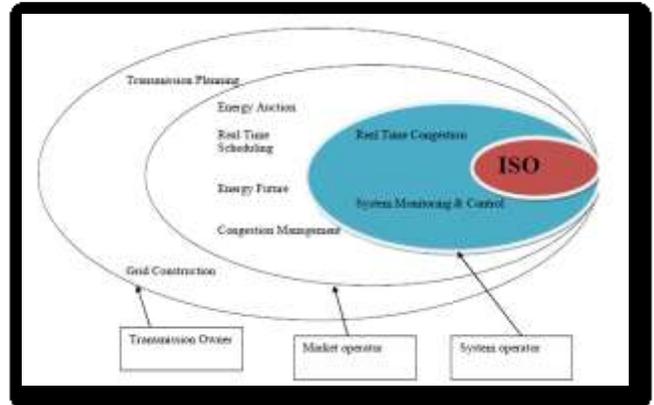


Fig.3- Functions of ISO

#### POWER SECTOR REFORMS

The Government of India has been taking several initiatives to invite private sector participation in generation and transmission. Understanding the difficulties faced in the process of reforms, GOI in consultation with the States initiated measures to unblock the difficulties

##### A. Unbundling of SEB

A number of States have initiated the power sector reform process, starting the unbundling, tariff rationalization and corporatization of generation, transmission and distribution. Practically this brings the accountability at each level of operations in the power business. The results were not much encouraging although not so adverse to consider. Self-sustainability is not achieved through this makeup unless privatization is introduced in stages starting from urban areas.

##### B. Setting up of Regulatory Mechanism

The Central Electricity Regulatory Commission (CERC) along with State Electricity Regulatory Commissions (SERC) have been established in 19 states under the Electricity Regulatory Commissions Act, 1998, to discharge the following functions :-

- Regulation of the tariff of generating companies owned or controlled by the Central Government.
- Regulation of the tariff for generating companies other than those owned or controlled by the Central Government if such generating companies enter into or otherwise have a composite scheme for generation and sale of electricity in more than one State.
- Regulating the Inter-State transmission of energy including tariff of the transmission utilities.
- Promoting competition, efficiency and economy in the activities of the electricity industry.
- Advising the Central Government in the formulation of tariff policy which shall (i) Provide justice to consumers (ii) Facilitate mobilization of adequate resources for the power sector.
- Association with the environmental regulatory agencies to develop appropriate policies and procedures for environmental regulation of the power sector.
- Framing of guidelines in matters relating to electricity tariff.
- Resolving the disputes involving generating companies or transmission utilities.
- Assisting Government of India on any other matter referred to the Central Commission by that Government.
- Licensing any person for the construction, maintenance and operation of Inter-State transmission system.

### **REGIONAL ELECTRICITY BOARDS IN INDIA**

As per the statute, the Central Electricity Authority (CEA) is possible for power planning at the national level. CEA advises the Ministry of Power on the national power policy and planning, whereas the central electricity regulatory commission is looking after the regulatory issues. Day-to-day operation of the regional grid is carried out by Regional Load Dispatch Centers (RLDCs), which are under the operational control of CTU, i.e. PGCIL.

The main function of RLDC is, to carry out the integrated operation of the power system in that region and that of Regional Electricity Board (REB),

to facilitate integrated grid operation. Presently five REBs namely, Northern REB, Southern REB, Western REB, Eastern REB and North-Eastern REB exist to promote the integrated operation of the regional power systems. The responsibilities of REBs are to review project progress, to plan integrated operation among the utilities in the region, to co-ordinate the maintenance schedules, to determine the availability of power for inter- state utilities transfer, to prescribe the generation schedule and to determine a suitable tariff for the inter-utility exchange of power.

Power sector across the world is undergoing a lot of restructuring; India is no exclusion to this. The need for restructuring the power sector was felt due to the lack of financial resources available with Central and State Governments, and necessity of improving the technical and commercial efficiency. In some States of India there are multiple private utilities, which are technically and financially in a position to enter the phase of a competitive electricity market. Hence, in 1998 the Regulatory Commissions were formed under the Electricity Regulatory Commissions Act 1998 (Central Law) to promote competition, efficiency and economy in the activities of the electricity industry. Ministry of Power has undertaken Accelerated Power Development and Reform Program (APDRP) from the year 2000-01 with the twin objectives of financial turn-around in the performance of the power sector especially in electric distribution and improvement in quality of supply. Electricity Act 2003 has come into force from June 2003. As the act allows third party sales, it allows the concept of trading bulk electricity. The act also provides open access to transmission as well as distribution of electricity.

### **PROPOSED MODEL FOR RESTRUCTURING IN INDIA**

In many parts of the world everywhere unbundling taken place, the two models are more established for system operation. The first one is Independent System Operator (ISO) model and the other is Transmission System Operator (TSO) model. In ISO model, transmission companies are also permitted to own, manage and control generation and distribution companies, an independent system operator is created to facilitate open access and competitive markets.

In TSO model, operation of the grid and ownership of the grid are integrated in a single entity, which is responsible for development of transmission system

and to provide unbiased open access to all eligible market participants. Neutrality is an important feature of the TSO to ensure an efficient market. In view of this, TSO model seems to be most suitable for future restructured electricity market in India. This is because the government owned Transmission Company is merely responsible to provide non-discriminatory open access.

Some of the developed countries are also moving away from ISO model by formation of Regional Transmission Organizations (RTO), which will finally converge as a TSO model. Even though the conditions in Indian power market are not yet ripe for introducing retail competition, the necessities in a deregulated power market can be summarized below:-

- Non-discriminatory open access to transmission network is a pre-requisite for ensuring competition in wholesale power trading.
- The system operation functions at the national level can be handled by central transmission utility while state transmission utilities can manage State Load Dispatch Centers (SLDCs) similar to TSO concept.
- The regional electricity boards will have the responsibility of managing the power exchanges while the Regional Load Dispatch Centers (RLDCs) will manage the overall integrated operation of power system like outage planning, relay coordination, islanding schemes, etc.

#### RECENT INITIATIVES

The Electricity Act 2003 makes thermal power a licensed activity, freely permits captive generation and makes the setting up of state regulatory commissions mandatory. It recognizes the trading as a distinct commercial activity and suggests measures like preparation of National Electricity Policy for planned development of the sector. In line with the policy objectives, the act provides a drive to complete rural electrification and provide for management of rural distribution by cooperative societies, non-government organization, franchisees etc. The progressive policies would open new opportunities for setting up merchant generators, utilization of captive generation and electricity market development. A load dispatch center at the national level i.e. layers such as SEBs and utilities. It is a predetermined contracted transaction and there is non-existent of spot market. Currently, State load dispatch Centers (SLDCs) are carrying out the optimum scheduling of the state generating units and

the RLDCs are responsible for scheduling of central sector generating units only. SLDCs send the requisition to the RLDCs against their entitlements out of available power from central sector generation (CGS) and the RLDCs allocate total available power to various states in the ratio of their entitlements. Day-to-day operation of the regional grid is carried out by RLDCs, which are under the operational control of Central Transmission Utility (CTU), i.e. Power Grid Corporation of India Ltd. all amount of power (about 2.5% of total generation).

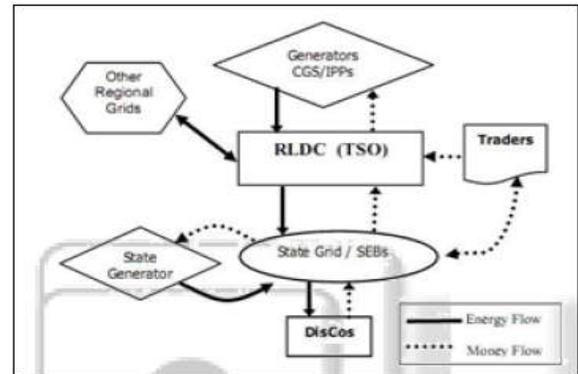


Fig. 4: Current electricity market

#### MARKET-RELATED FUNCTIONS

First of all, an ISO must be a market enabler with no commercial interest in the competitive generation market. The market-related functions of an ISO must be carried out according to transparent, understandable rules and protocols. The following operational functions are necessary to enable a competitive generation market:-

- Determine Available Transmission Capability (ATC) for all paths of interest within the ISO region.
- Receive and process all requests for transmission service within and through the ISO region from all participants, including transmission owners.
- Schedule all transactions it has approved.
- Operate or participate in an Open Access Same Time Information System (OASIS) for information publishing.
- Establish a clear ranking of transmission rights of all the participants on the ISO transmission system. Facilitate trading of transmission rights on its grid among participants.
- Manage transmission congestion in accordance with established rules and procedures for generation re dispatch and its cost allocation.

- Assure the provision of ancillary services required to support all scheduled delivery transactions.
- Market settlement and billing functions.

#### **BENEFITS OF DEREGULATION**

The main objectives of the deregulated power market:

- To provide electricity for all reasonable demands.
- To encourage the competition in the generation and supply of electricity.
- To improve the continuity of supply and the quality of services.
- To promote efficiency and economy of the power system.

#### **CONCLUSION**

The main purpose of the deregulation is: to break monopoly of generation, transmission and distribution of the electric power and create competition. The philosophy and technique of planning and operation established over past decades and have begun to change and meet the challenges. Electricity reform process in India is already in action although at a slow pace. Several state electricity boards are being unbundled into three distinct corporations namely Generation, Transmission and distribution. The distribution system are being horizontally broken down into manageable Discos with separate accountability and privatized for better efficiency in metering, billing and revenue collection. The system operation functions at the regional/national level can be with central transmission utility, while state transmission utilities may manage load dispatch centers in line with TSO.

#### **REFERENCES**

- [1] Mohammad Shahidepour, Muwaffaq Alomoush "Restructured Electrical Power System": Operation, Trading, Volatility. Marcel Dekkar Pulications Inc; 2001.
- [2] William W. Hogan, "Restructuring The Electricity Market: Institutions For Network Systems"1999.
- [3] Proceeding of the International Conference on " Present and Future trends in Transmission and Convergence",New Delhi,2002, pp X26-X41.
- [4] Loi Lei Laai, Power System Restructuring and Deregulation, John Wiley & Sons, England, 2002.
- [5] Malik O. P., "Control Considerations in a Deregulated Electric Utility Environment", IEEE Canadian Review, Fall 2000, pp. 9-11.
- [6] Yog Raj Sood, Narayana Prasad Padhy, H. O. Gupta, "Wheeling of Power Under Deregulated Environment of Power System – A Bibliographical Survey", IEEE Transaction on Power Systems, paper no. 2001 TR 109.R1.
- [7] Khaparde S. A., Kulkarni, S. V., Karandikar R. G. and Agalgaonkar A. P., "Role of Distributed Generation in Indian Scenario", Proceedings of South Asia Regional Conference, New Delhi, India, February 2003.

[8] Vindal, S. S., Saxena, N. S., and Srivastava, S. C., "Industry Structure Under Deregulated Wholesale Power Markets in India", Proceedings of International Conference on Present and Future Trends in Transmission and Convergence, New Delhi, India, December 2002.

[9] Government of India, "The Electricity Act, 2003", The Gazette of India, Extraordinary, 2003, Part II Section 3 Sub-section (ii), New Delhi, Ministry of Power, June 10, 2003.

[10] Kothari D. P., Nagrath I. J., Power System Engineering, 2nd Edition, Tata McGraw Hill, New Delhi, 2011.