

# Restructure of Electricity Market in India: A Business Prospective

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**Abstract**— In the regulated regimes many of the old, inefficient or obsolete plants may continue to function and recover investments while in the competitive regimes they may be out of the market. One of the important aspects of Electricity Act'03 is to bring about completion in Indian Power Market. Short term trading in electricity is an important step in this direction. The most basic factors that influence the prices in any market are demand and supply. But in case of electricity, the prices are essentially influenced by demand and not supply. It is because the generating cost of the sellers in a power market either remains constant or varies over a narrow range. While bilateral trading is in existence for quite some years, collective transaction through power exchange has become a reality only in 2008, with the commencement of Power Exchange in India. The purpose of bringing competition in the regulated Indian market is quite beneficial. So this paper fall the light on electricity business in India on the basis of power exchange prospective by considering the electricity Act 2003.

**Key words:** Power Trading, Power Exchange, Congestion, Deregulation

## I. INTRODUCTION

In the nineties decade, many electric utilities and power network companies world-wide have been forced to change their way of operation and business, from vertically integrated mechanisms to open market systems. This can be specifically observed in developed as well as under developed countries like UK, Sweden, Finland, Norway, US, Australia, New-Zeland, India and some countries of South America. The reasons for change have been many factors and have differed social, economic, Geographic conditions over regions and countries [1, 2].

For developing countries, the main issues have been a high demand growth coupled with inefficient system management and irrational tariff policies. This has affected the availability of financial resources to support investments in improving generation and transmission capacities. In such circumstances, many utilities were forced to restructure their power sectors under pressure from international funding agencies. So the private investors can resolve the above said problems regarding electricity in deregulated electricity environment [1, 3, 6].

On the other hand in developed countries, the driving force has been to provide electricity at lower prices and offer them a greater choice in purchasing economic energy. The goal of changing the way of operation, i.e. re-regulation, or deregulation, as we say, is to enhance competition and bring consumers new choices and economic benefits [4].

Under Deregulation, the former vertically integrated utility, which performed all the functions involved in power, i.e. generation, transmission, distribution and retail sales, is Dis-aggregated into separate companies

devoted to each function. The electricity bill for the end consumer now involves at least two components: one from the distribution and transmission network-operator responsible for the network and services, and the other from the company that generates the electrical energy.

All this seems to be very straightforward at first glance, but there are several complexities involved in restructuring and many issues have been raised. The term Deregulation means in restructuring of the rules, regulation and economic incentives that government set up to control and drive the electric power industry. So on the basis of above this paper propose the electricity business in India on the basis of power exchange prospective by considering the electricity Act 2003.

The rest of paper has been organized as follows: The next section describes problem formulation. Section 3 discusses the India Scenario of Deregulation and electricity act 2003; Section 4 describes in brief Products of Power exchanges in day-ahead electricity market; Section 5 discusses the concept of Power Exchange in India and finally Section 6 concludes the present work.

## II. PROBLEM FORMULATION

The demand of electricity is growing at a very fast rate so it is necessary to create competition in electricity sector to meet the gap between demand and supply. So this paper formulates the concept of power exchange in electricity markets. On the basis of world scenario this paper gives the details about concept of power exchange in India with the consideration of electricity act 2003.

## III. INDIA SCENARIO OF DEREGULATION

In India, the power sector was mainly under the government ownership 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.

In mid 1990s, Orissa began a process of fundamental restructuring of the state power sector. Under the World Bank (WB) loan, the state decided to adopt, what is known as WB-Orissa model of reform. 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. Soon afterwards, several other states such as Andhra Pradesh, Haryana, Uttar Pradesh and Rajasthan also embarked on similar reforms and also availed loans from multilateral development banks such as World Bank and Asian Development bank, etc. Meanwhile, some moderate steps were taken towards reforms until the Electricity Bill 2003 was approved by Parliament in May 2003. This unified

central legislation passed after 10 drafts. The Bill now replaces previous three acts on electricity of 1910, 1948 and 1998 [1-4].

#### A. 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 compliances 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
- Introduction of the SEBs on the basis of functions
- Compulsory metering of all consumers in order to improve accountability
- State Government 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 [6, 7].

#### IV. PRODUCTS OF POWER EXCHANGES IN DAY-AHEAD MARKET

- real-time balancing market (hour-ahead) market
- week-ahead market
- month-ahead market
- quarter-ahead market
- capacity market
- ancillary market

In addition, there are financial derivative markets being offered in the form of forward and future contracts, options and contracts of difference. In a balancing market, the deviations (actual from schedules) in the day-ahead market are adjusted and settled between participants. Typically, real time balancing market should exist with a day-ahead market (In NORDPOOL, the day-ahead market is called ELSPOT, and the balancing market is called ELBAS). In India, there is no balancing market and the deviations are settled through UI.

In term-ahead (weekly, monthly and quarterly) markets, contracts are offered for the terms in advance. The process of finding MCV and MCP in day-ahead market and term-ahead markets is same.

A capacity market is the market in which generation capacities can be acquired by the participants. PJM (Pennsylvania, New Jersey, and Maryland) of US

offers a capacity market. In PJM, an LSE (Load Serving Entity) has the obligation to own or acquire capacity resources greater than or equal to the peak load that it serves plus a reserve margin of about 18% [5]. LSEs have the flexibility to acquire capacity in a variety of ways. Capacity can be obtained by building units, by entering into bilateral arrangements or by participating in the capacity credit markets operated by PJM. Ancillary services are defined as all those required for the reliable delivery of electricity. In electricity industry, these services are complimentary services that complement the production of energy. Specifically, ancillary services are those functions performed by power systems with regards to generation, transmission and distribution of electricity to facilitate technical and commercial transactions. These services are provided by the same equipment that generate and transmit electricity. In power markets, the availability of sufficient ancillary services makes power systems reliable and transactions deliverable. In the power market PJM, the system operator procures the losses from the ancillary market and the buyer is charged for the same. In India, an ancillary market is not developed yet. The transmission losses are paid by the participants in kind. Derivative contracts are used for price hedging and risk management in electricity trading. NORDPOOL offers derivative instruments in the form of standardized forward and future contracts. The forward contracts are short term contracts (days, weeks) whereas the future contracts are for longer term (months, quarters and years). Unlike futures in options buyer does not have any obligation to exercise the contract. Options can also be used to hedge the risk of price fluctuations. The only difference being that an upfront payment of premium has to be made in case of an option whereas a trader does not need any upfront payment in case of futures.

#### A. Benefits Provided By Power Exchanges

- No need to search for buyers and sellers thus eliminates search cost.
- No need to book the transmission corridor as well as to deal with the system operators like NLDC, RLDCs, SLDCs in India.
- Sell / Buy all across the nation.
- No need to negotiate for the prices unlike in Bilateral Contracts.
- Power exchanges act as counterparty, thus a participant needs not to assess the risk profile of the other participant.

#### B. Concepts related to Power Exchanges

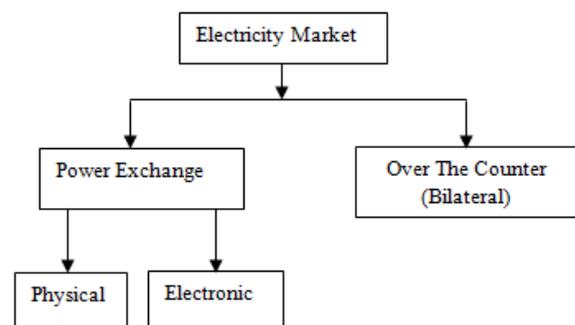


Fig. 1: Electricity Market in Deregulated Power System

### C. Double Side Bidding Vs Only Supply Side Bidding

In some electricity markets, only supply side bidding is permitted. In Supply side bidding, only suppliers submit their offer to supply various quantities of electricity with corresponding prices. This type of design is usually adopted where centralized dispatch is in vogue. The central dispatcher or the integrated system operator (ISO) matches the forecasted demand with the sale bids starting from the lowest sale price.

On the other hand, in case of Double side bidding, buyers also submit their demand at various prices. This means that in double side bidding, buyer's demand is sensitive to prices. Double side bidding is more suited for markets where decentralized dispatch (like in India) is in vogue.

### D. Ex-Ante Vs Ex-Post Price Settlement

In Ex-ante price Settlement, the price settlement is done before delivery, on the basis of the market/area clearing price and cleared volume discovered in exchange. But in Ex-post price Settlement, settlement is done after the delivery of power.

Deviations from schedule are settled again using different mechanisms. In India, it is done through UI price mechanism, where the deviations are charged according to the frequency based UI charge at the time of power flow. But advanced electricity markets have real time balancing market or ancillary markets for this purpose.

### E. Zonal Pricing Vs Nodal Pricing

In zonal pricing, the entire market is divided into a no of zones and all participants (buyers/sellers) belonging to a single zone pay or receive a uniform price, irrespective of the congestion occurring in the transmission line inside the zone. Zonal prices differ from one zone to another depending on congestion in transmission lines between the zones. On the other hand, in nodal prices, the participants pay or receive a price, which depends on the node or the point of connection in the transmission grid, through which the participant injects or draws power. Price at each node depends on congestion in the transmission lines. In India, zonal pricing system is followed and the entire country is divided into 10 zones or areas.

### F. Time Block for Contracts

Most of the electricity exchanges offer hourly contract, i.e. there will be 24 contracts in one day. Each contract specifies the amount of power to be traded (either to be sold or to be purchased by the participant), and the price for each hourly contract is discovered in the trading platform. In India, hourly contract system is followed. Time block can be of half-hour duration (as offered in NEMMCO- Australia) or of more than one hour duration (as offered in EEX-Germany).

### G. Congestion Management

When the schedule of power flow in a particular transmission corridor discovered in power exchange is more than the transfer capacity of that corridor, then congestion is said to occur. The entire power scheduled cannot flow in the line, as it would endanger the entire transmission system. In order handle congestion, the quantum of power flow is reduced by using suitable mechanism in different electricity

markets. One of the methods is called, market splitting, which is used in India.

### H. Auction Type

Most of the power exchanges across the world work on the principle of uniform pricing. In this method, the clearing price and clearing volume of electricity corresponds to the point of intersection of the Aggregate Demand curve and Aggregate Supply curve. All the suppliers are paid based on the clearing price, irrespective of their offer. This means that price is set by the last accepted offer of supply. In the alternative approach, referred as discriminatory pricing or "payas- bid" method, each supplier is paid as per its bid. Each buyer pays a price, which is the weighted average of the price for all suppliers cleared by the PX (as used by BETTA, UK). OMEL (Spain) uses a different kind of pricing mechanism in which the buyer of the highest bid gets the electricity at the second highest bid price [1-3, 6].

## V. POWER EXCHANGE IN INDIA

Like a stock exchange for creating competition in electricity industry, the government sets up, a trading exchange for electric power. The buyers and sellers enter their needs into the power exchange. For example, a buyer would say, "I need up to 200 MW at 1600 hours IST. I would pay Rs. 3.5/kwhr", whereas, the seller would enter his demand as, "I have 400MW and would like to sell it at Rs.4/KWhr".

When different market participants transact business into the power exchange, the different market players for the power exchange are buyers & sellers and they are really talking to the marketplace and not the individual buyers and sellers. As in stock exchange, the power exchange constantly updates and posts a market clearing price (MCP), which is the current price at which the transactions are being done. The details of implementation of these three mechanisms can vary a great deal, too, from a political jurisdiction to another.

Likewise, the time period of power sales trade through the power exchange varies from one deregulated system to another. Many Power Exchange permit trading of power for only day ahead and an hour ahead trading. Anyone wanting longer term purchases must find an entity with which to make 'bilateral deal'. Whereas other power exchange permit buyers and sellers to make deals of power for longer periods, even months or years. But regardless, every competitive power industry establishes 'a power marketplace' with some form of one or more of the three structures discussed.

### A. Function of Exchanges

Exchanges historically had two functions. The first was to achieve a liquid and effective market by bringing together buyers and sellers. The second was to restrict access to members who could be trusted to honor their deals. An effective market uses orders – stylized instructions for buying and selling such as "buy JPM at the market" or "sell IBM limit 30". These orders, which are now usually matched by computers for smaller volumes, allow trade to take place quickly with a minimal risk of error. It would slow things down unacceptably if each time you traded you had to check the creditworthiness and credibility of your counterparty (the other member you were trading

with). Restricting membership to people who were believed to be trustworthy and solvent made this checking unnecessary. Occasionally somebody might still default or abscond without delivering the shares they promised to sell but this cost could be met through mutual insurance through the exchange. London Stock Exchange members were required to take exams and to be of “good character”. Of course, like any club, an exchange can become a means of keeping out the riff raff, with the risk of becoming inbred and closed to new talent.

The private benefits of exchanges are clear – each trader gets the best price available at any moment in time by having access to the largest volume of potential counterparties. There is also a public benefit because the exchange publishes prices that show the going rate – the market price – of each security. Outsider users of this data, including companies, investors, regulators and governments know that these market prices are the best guide to the current market value of the securities, because they emerge from a large and liquid market.

Anything which diverts trade to other markets or fragments trades therefore risks reducing the credibility of the market prices. If the exchange accounts for only a portion of trading in a security then it might not be showing a fully representative price. This is what has happened with the move to trading off-exchange.

#### B. Off-Exchange Trading

The plunge in IT costs in the last twenty years has allowed competitors to exchanges to spring up. These at first took the form of relatively simple order matching mechanisms for out of hours trading, which didn't compete too much with the exchanges. But in the last decade the competition has become very real in the form of dark pools and internalization of flow by the largest investment banks.

A dark pool is an electronic mechanism for bringing buyers and sellers together, away from the exchange. It's “dark” because everything is anonymous and traders needn't disclose their orders, even long after they've been completed. This is different from exchanges, which publish trade data, with some lag in timing to allow larger orders to be fulfilled safely. Dark pools deny public information on trading prices and volumes.

Internalization is where a bank matches buy and sell orders entirely through its own book, using market making to smooth out differences between buy and sell volume at any moment in time. This can only be done effectively if carried out on a large scale so only the largest trading houses, known as ‘flow monsters’, are in a position to do this. The banks achieve two things. First, they get a lot of liquidity which can be useful in reducing the costs of hedging other trades. For example access to large amounts of cash equities flow can help cut the cost of hedging equities derivatives trading.

Second, the bank gets an insight into the direction of flows. In other words, it can see which way the market is moving and trade on its own account accordingly to maximize profits. This is not insider trading, since it doesn't depend on specific information affecting a stock. But having the knowledge of short term trading flows in aggregate is undoubtedly a profitable piece of information. Even if trading on the bank's own book (proprietary trading) is

banned by the Volcker Rule, the bank can still make money in its market making function, where it is permitted to tilt its position long or short to allow it to maximize profit consistent with providing liquidity to the market. Internalization, like dark pools, reduces the information available to public traders in equities. Confusingly, some dark pools are operated by exchanges, as part of the competition for customer business, though they tend to prefer the less dramatic term “non-displayed” market [3, 7, 9].

## VI. CONCLUSION

An electricity market is a system for affecting the purchase and sale of electricity using supply and demand to set the price. The Indian power sector is in the path of reaching its adolescence state. When the developed countries have undergone various modern and up-to-date systems to operate and the function power sector along with various instruments and products of power trading, India follows them and trying to be one of the leaders in the power market operation. The journey of Indian power sector is definitely a credit worth. The Indian power sector now is growing in the same pace as was the development of the information technology sector in India.

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