

Impact of Electricity Trading through Power Exchange of India

Archana Singh, K. G. Upadhyay

Abstract: There is dependency on voluntary agreements for electricity trading in India as well as in various other developed countries. In developed countries, private initiatives are taken to standardize the commodities contracts which play an important role in increasing the trading volume to improve efficiency in overall. For electricity trading, workable spot market is necessary to develop competitive financial contract and so establishment of a viable National Power Exchange under the decentralized trading arrangement concept is formalized to obtain the least impact on existing procedures and practices for the regional system operators and states. In the paper materializing short-term trading in the spot market year wise with power exchange has been elaborated.

Keywords: Electricity Act2003, Power trading, Herfindahl-Hirschman index, Indian Energy Exchange.

I. INTRODUCTION

Electricity Market from economic, regulatory and engineering perspective is a very demanding system to control. There is a requirement of cost efficiency, lower impact of environment along with maintenance of security of supply for use of competition and regulation in the power system [1, 2]. Many countries have delved into restructuring of the electricity sector, failing to manage the adequate supply. Electricity Act 2003 has come into effect from June 2003 in India. As the act allows third party sales, it introduces the concept of trading bulk electricity. The Act has enabled the distribution companies and the consumers to have choice in the matter of supplies of electricity. Similarly, the generator also has the choice to select among the distribution companies [3, 4]. After the enactment of the Electricity Act 2003, the power sector in India has witnessed significant developments [fig.1]. The policy and regulatory efforts have also been synchronized to ensure rapid development of the power markets in the country [5-11]. The Electricity Act 2003 ushered in and legitimized the concept of trading within the country and also mandated upon the appropriate regulator to develop the power markets within the country in accordance with the National Electricity Policy (NEP) [12].

The NEP drafted by the Government of India gives shape and policy direction to the development of the power sector as also the power market within the country. Under section 5.7 of the NEP,

the Government of India compulsively defined that the development of power markets would need to be undertaken by the Appropriate Commission in a time-bound manner.

In the light of the above and latest developments like the notification of the Power Market Regulations 2010, notification of regulations for renewable energy certificates etc, it is evident that opening up of power sector has already started and it would now only gain pace with time [13-16].

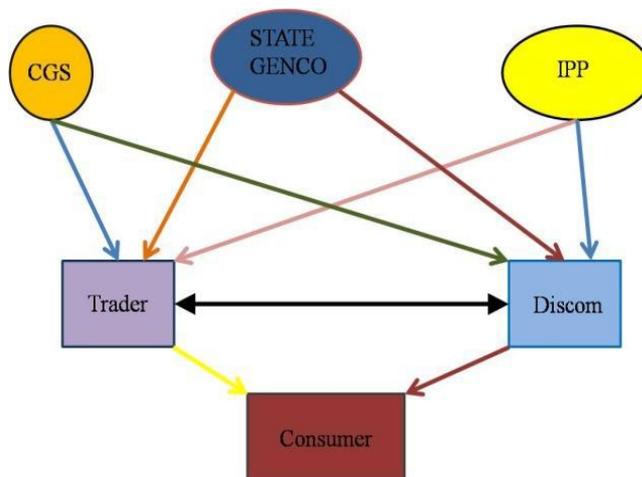


Fig.1: Indian Market Structure after Act-2003

Indian power sector is considered 4th largest in Asia and 6th largest in the world. In India predominantly is done on fossil fuels. As per CEA, energy demand is shown with energy availability according to Xth, XI and XIIth plan accordingly in chart1..

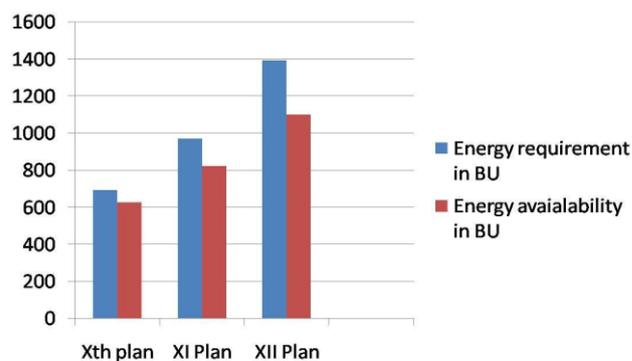


Chart1: Energy demand with energy availability as per plan

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As per Electricity act 2003, it is mentioned that the appropriate commission shall endeavor to promote development of power market in such manner as may be specified and guided by National Electricity Policy. On this Central Electricity Regularity Commission(CERC) Issued staff letter in July, 2006 and also issued guidelines by Feb 2007 for granting Permission to set up and operate Power Exchange. Suppliers, wholesale purchasers and traders see PX as a common neutral platform to bid for the prices and quantity of electric energy in spot and future markets [17].

II. POWER EXCHANGES IN DEVELOPED/DEVELOPING COUNTRIES

Recently, many power exchanges have started to operate in developed countries, particularly those in Europe (Fig.2).



Fig.2: Power exchanges scenario in different countries

With private initiative, multiple exchanges can be established in one electric system as power exchanges. There is likelihood that the system operator may or may not be involved in the operation of power exchange for eg. as in the case of UK where several power exchanges compete with each other [18]. As a matter of fact, the system operators in Europe have been involved to varying degrees in the operation of power exchanges. The nordic power market is dominated by hydropower .Nord pool organizes trade in standardized physical and financial power contracts with inclusion of clearing services to Nordic participants[19]. The competitive electricity market for California started in 1998 with CaISO and PX as the main operationally market facilitators but the CaISO with the PX as the day-ahead market ceased to operate in 2001[20]. Powernext has been established in France in 2002[21]. Recently, while APX of the Netherlands has been expanding its business into the energy derivative markets, it has also sold its operation of the day-ahead market to the system operator [22]. As spot prices have been highly volatile in the day-ahead market, several power exchanges have developed the standardized forwards and futures

market to provide market participants with tools for risk restriction [23]. The power exchanges have also developed other financial derivatives options.

III. POWER EXCHANGE MODEL OF INDIA

CERC/SERCs have prescribed stringent “non discriminatory open access” regulations and have also granted Inter-State Trading Licensees to 45 companies (as on July 2009)[24]. CTU/STUs have also defined detailed open access procedures to promote power trading operations in the country. The demand supply gap among various utilities during day and month provides opportunities for power trading. Electricity Act 2003 has distinguished "Power Trading" as a separate licensed activity with the objective of developing power market in India to maximize resource utilization by promoting healthy competition among power players [25]. For this reason, Power Trading is referred to as "purchase of electricity for resale thereof".

Furnishing the wholesale electricity market with recent initiatives and the enactment of EA 2003, Government of India, opened up the suitable channels for the overall development of wholesale electricity market, introducing, competition [26]. National power market is based on the decentralized trading arrangements, which strives to obtain its objectives, without impacting running procedures and practices, for the state and regional system [27]. Such a market concept is in resonance with the existing hierarchical structure of the industry of state versus regional/national levels in India, being reasonable and rational for Indian power market. Decentralized trading arrangement shall hold market operator with a separate entity from the system operator, but will have strong co-ordination with Load dispatch centers, for available Transfer capacity Information,(ATC),dispatch of Day-ahead schedules(DA) for transactions cleared through Power exchange and imbalance settlement under Unscheduled Interchange (UI) mechanism. Grid frequency relates to (UI) rate, encouraging grid discipline. Spot sale or purchase of electricity, into or out of electricity grid facilitated by UI mechanism, provides a sort of real time spot price, as a benchmark, for trading of electricity.

A Power Exchange (PX) would provide a common platform for trading. The design of the PX should be such that it dispenses short term power available for trading through competitive bidding by inviting simultaneous anonymous bids from buyers as well as sellers on day-ahead hourly basis (as shown in figure1).Power Exchange allows buyers and suppliers to participate in the bidding process in an equitable manner. A well designed and functioning Power Exchange providing payment security to participants has the capacity to energize the power sector and put it into realm of self-sustained growth [28]. PX, “A flexible bid-Based power pool”, enables short term transactions, thereby creating a pool market with spot price. PX may span from half an hour to years; but it is usually the day ahead to facilitate energy trading in advance before each operating day.

It seems quite logical to develop electricity market, after unbundling of the electricity sector, mandated by the electricity Act and the National Electricity Policy.

The time horizon for a PX may range from half an hour to weeks or years, but usually it is Day ahead to facilitate energy trading one day in advance before each operating day. Intra-day or real time (balancing) markets are required to redress the imbalances close to the real time. The participants will submit their bids/offers through Internet based trading platform and PX will publish daily market results called price index on an On-line bulletin board as shown in fig.3.

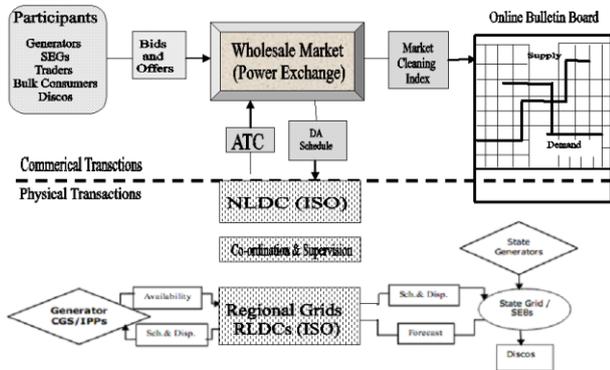


Fig.3: Power Exchange Model as per CERC

IV. VARIOUS POWER EXCHANGE FUNCTIONS

A national power exchange as a supplementary market for DA balancing is proposed for promoting inter-regional trading and maximum utilization of available resources. The Power Exchange (PX) concept is a national wholesale electricity market where all eligible participants will submit portfolio based bids for each hour on Day-Ahead (DA) basis. The PX characterize by hourly cleared physical delivery market should have uniform price double auction system with option of block bidding. The existing PPAs should be honored, means PX should be only a supplementary market to match unallocated surplus with likely requirements through DA auction based market.

In short, the main functions of the PX are

1. Self Regulatory Authority
2. Price discovery
3. A contract for Purchase and/or sale of electricity as prescribed by the Exchange and permitted by CERC.
4. All transactions in Contracts shall be cleared, registered and settled by the Exchange.
5. Exchange to prescribe trading days & trading session.
6. Exchange to act as a legal central counter party.

Presently Power Exchanges are catering to the following contracts as approved by CERC. Time line diagram is also shown in fig.4.

- Day-ahead contracts
- Region wise Day-Ahead Contingency Contract
- Region wise Intra Day Contracts
- Region wise Weekly Contracts



Fig.4: Power Exchange contracts schedule line.

For measurement of competition among trading licensees (interstate bilateral transactions traders and Power Exchanges transactions traders) market power Herfindahl-Hirschman index is used. Decrement in HHI indicates increase in competition whereas increase in HHI shows the opposite behavior. A HHI value between 0.15 and 0.25 indicates moderate concentration and a HHI above 0.25 indicates high concentration.

V. IMPACT OF POWER EXCHANGE MARKET

Short-term power market comprises approximately 10-14 per cent of the total electricity consumed as per CERC. 90% of the remaining population is being procured mainly by distribution companies through long-term contracts and short term intra-state transactions.

Volumes of electricity traded on the power exchanges has increased from 27 BUs in 2009-10 to approximately 53 BUs in 2013-14 as shown in fig.5. The maximum volume traded on the exchange is on the Day Ahead Market, which currently constitutes 97.5% of the total volumes traded at the exchange.

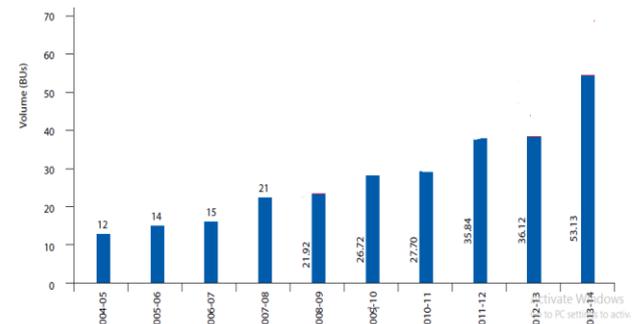


Fig.5: Volume of short term Electricity trading by Power Exchange as per CERC

The initial period of exchange was marked by infrequent trading activity with high degree of price volatility, however, over a period of time with increased number of players and higher volumes being traded. Over a period of time there has been a smoothening of price on the exchange as shown in fig.6. This can be attributed to factors such as, greater participation and relative increase in the supply compared to the past. Over time the participation by open Access customers has increased significantly.

It is observed in the fig.7 that currently as much as 40-45% of the overall trade on the day-ahead markets comes from direct customers availing open Access. Further it can be seen, from the Fig.8 below, that the corresponding continuous increase in number of open access consumer.



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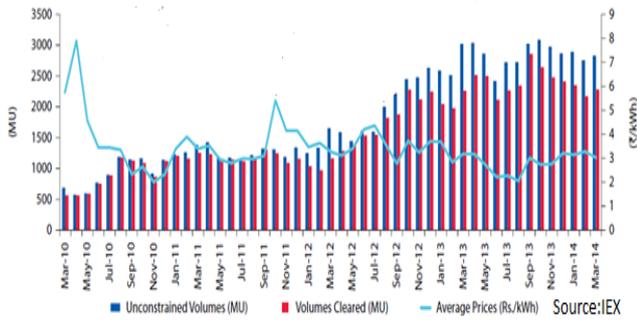


Fig 6: Prices and volume trends of IEX year wise from 2010 to 2014

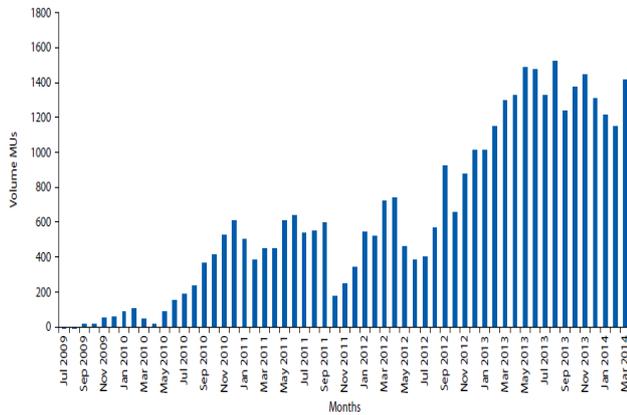


Fig.7: Participation of open access consumers in day-ahead market at IEX

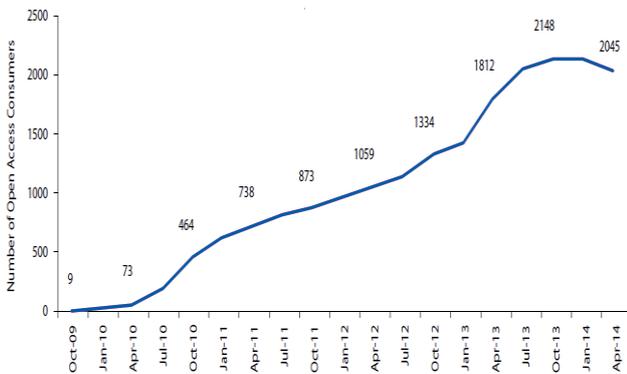


Fig.8: Open Access Consumers count for electricity trading at IEX

As the demand and supply of electricity varies from season to season, there seems that the trend might have emerged with the observation that the monthly variation in prices has also reduced over a period of time along with continuous increase in the number of open access consumers and volume traded of all segments of the short-term transactions of electricity [29, 30].

VI. CONCLUSION

Power exchanges generate strong investment signal and make power trading transparent and efficient with sufficient liquidity of supply. For the true realization of the benefits of open access and competition, it is essential to bring competitive Electricity Markets. Entry of Electricity Act 2003 and successive power sector reforms in India for over a decade has shown transformation in power system structure and operations. Competitive mechanism with multiple buyers and sellers are brought with benefits of

centrally planned and operated system. Indian Energy Exchange and Power Exchange India limited have been established in India as a vibrant, transparent market. Statistical data considered in the paper, shows a significant increase in short term electricity transaction.

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