

Role of Energy Exchanges for Power Trading in India¹

G. P. Girish^{1*}, S. Vijayalakshmi²

¹Department of Finance, IBS Hyderabad, IFHE University (a Deemed to-be-University under Section 3 of UGC Act 1956), Hyderabad, Andhra Pradesh, India, ²Department of Finance, IBS Hyderabad, IFHE University (a Deemed to-be-University under Section 3 of UGC Act 1956), Hyderabad, Andhra Pradesh, India. *Email: gpgirish.ibs@gmail.com

ABSTRACT

The Indian Electricity Act 2003 defines power trading as “the purchase of electricity for resale thereof.” In this study, we review various facets of power trading, Indian electricity market, power exchanges and the day-ahead spot electricity market of India. The power exchanges are attributed with inherent features like being nationwide, ensuring anonymity, offering transparency, being automated and enabling efficient price-discovery, we believe that, power trading in India is all set to undergo a paradigm shift in terms of volume of transaction through power exchanges, price discovery, number of participants and will eventually ensure in playing a major role in addressing the biggest concern of supply-demand mismatch of electricity in India.

Keywords: Power Trading, Energy Exchanges, Indian Electricity Market

JEL Classifications: C01, C22, C53

¹ The Research Paper was presented in-absentia in the 2014 “4th International Conference on Power and Energy Systems (ICPES 2014)” which was held during November 21-23, 2014 in Singapore.

1. INTRODUCTION

Electricity sector of many countries world-wide in the last two decades has witnessed deregulation, liberalization with a synchronous thought-process and rationale of governments and policy makers that success obtained due to liberalization of other sectors and industries can be identically replicated for power industry too (Weron, 2006; Weron, 2014). However, it should be noted that, electricity is a different commodity and a unique one too since production and consumption of electric power should take place simultaneously as it travels at the speed of light making it practically and economically impossible for storing or holding inventories and stocks like other commodities (Weron, 2014; Girish and Vijayalakshmi, 2013; Girish et al., 2014).

Power trading is a big business world-wide. In Layman’s language, Power trading means buying and selling of electricity. In India, electricity trading is still at its nascent stage with volumes of only about 7% of total electricity generated. Bulk of the electricity is procured through long term power purchase agreements between generating electric utilities and distribution utilities. Power

trading is defined by the Indian Electricity Act 2003 as “The Purchase of electricity for resale thereof.” The guidelines and provisions made to promote power sector as a whole through enactment of the Indian Electricity Act 2003 has been successful in attracting large number of players in generation, recently in power trading and has been constantly encouraging Independent power producers and bulk industrial consumers to become open access consumers (Weron, 2006; Aggarwal et al., 2009; Girish and Vijayalakshmi, 2014; Weron, 2014; Girish and Vijayalakshmi, 2013; Girish et al., 2013; Girish et al., 2014; Cervone et al., 2014).

In this study we review various facets of power trading, Indian electricity market, power exchanges and the day-ahead spot electricity market of India. The rest of the paper is structured as follows: in Section 2, we give a brief overview of energy exchanges around the world and introduce Indian electricity market. In Section 3 we take a closer look at power trading in India including renewable energy certificate (REC) trading and discuss about the day-ahead electricity spot market in India and conclude our study in Section 4.

2. INDIAN ELECTRICITY MARKET

The Indian electricity market (Figure 1) has been divided into five regions namely Northern, North-Eastern, Western, Southern and Eastern region and the structure of Indian power industry is as shown in Table 1 (Girish et al., 2013; Girish et al., 2014).

The successful enactment of Indian Electricity Act 2003 has made electricity trading a separate and distinct activity. Power market participants can sell or buy power from energy exchanges or from power traders who are registered with Central Electricity Regulatory Commission (CERC) through over the counter transactions. Table 2 gives the timeline of emergence of power exchanges around the world.

3. POWER TRADING IN INDIA

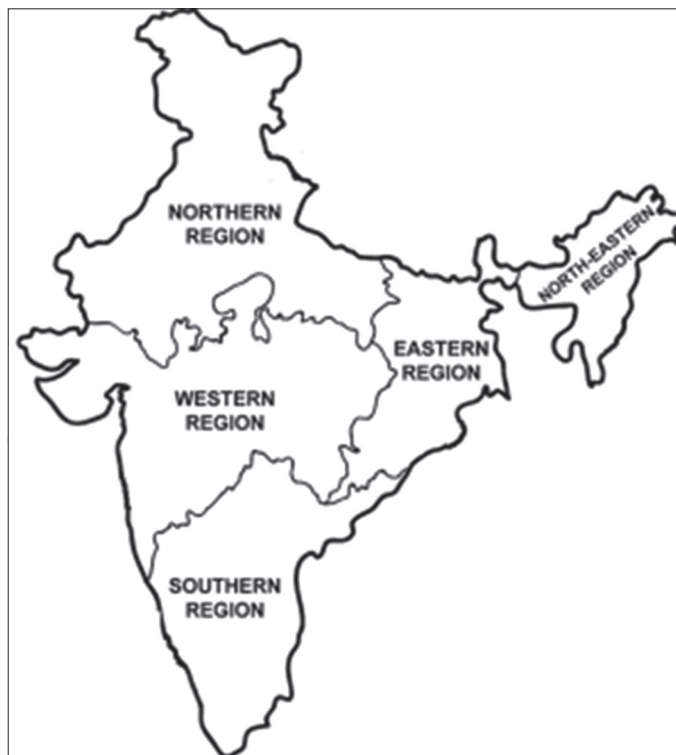
The activities of power exchanges i.e. Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL) are regulated by the Power Market Regulations 2010 which has been issued by the CERC for power trading. The power exchange offers transparency covering all the five regions of Indian electricity market, offering anonymity, being automated, enabling efficient price-discovery, risk management and attempting to address supply-demand gap. Table 3 gives details about the volume of short term transactions of electricity in India in comparison with the total electricity generation in India. We observe an increasing trend in the volume of electricity procured through short-term transactions.

India has two power exchanges namely the IEX and PXIL which started their operations in 27th June 2008 and 22nd October 2008 respectively. As seen in Figure 2, nearly 89% of the total electricity generated in India for the year 2012-13 was transacted through long-term power purchasing agreements. Volume of total electricity transacted by bilateral agreement between distribution companies accounted for 2% and unscheduled interchange transactions accounted for 3%. For the year 2012-13, bilateral transactions through traders accounted for 4% and transactions through power exchanges accounted for approximately 3%.

IEX was the first energy exchange ever to be established in India on 27th June 2008 and is the leading energy exchange with

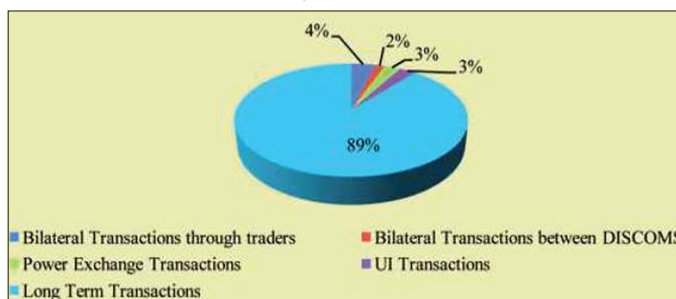
approximately 97% market share based on volumes of electric power traded in the financial year 2012-13 in the day-ahead

Figure 1: Indian electricity market



Source: Girish et al. (2013); Girish et al. (2014)

Figure 2: Share of different segments in total electricity generated for the year 2012-13



Source: Central Electricity Regulatory Commission

Table 1: Structure of power industry in India

State/Private	Centre	State/private	Cities
Policy	Ministry of Power	State Government	
Plan	CEA		
Regulations	CERC and CAC	SERC and SAC	
Generation	CGS and mega power projects	Gencos and IPP	Private licensees in Ahmedabad, Kolkata, Delhi, Mumbai, Noida and Surat
System operations	NLDC and RLDC	SLDC	
Transmission	CTU and transmission licensees	STU and transmission licensees	
Distribution	Distribution licensees		
Trading	Power exchanges (i.e. IEX and PXIL) and trading licensees	Trading licensees	
Appeal	Appellate tribunal		

Source: Girish et al. (2013); Girish et al. (2014). Gencos: Generation companies, SERC: State Electricity Regulatory Commission, CERC: Central Electricity Regulatory Commission, SAC: State Government Appointed Committee, IPP: Independent Power Producers, SLDC: State Load Dispatch Centre, STU: State Transmission Utilities, CEA: Central Electricity Authority, CAC: Central Government Appointed Committee, CGS: Central Generating Stations, NLDC: National Load Dispatch Centre, RLDC: Regional Load Dispatch Centre, CTU: Central Transmission Utilities, IEX: Indian Energy Exchange, PXIL: Power Exchange India Limited

spot market. The day-ahead electricity spot market operating in IEX and PXIL operates all 24 h and 365 days a year. It typically consists of 24 h auctions which happen simultaneously 1-day in advance (Girish et al., 2014; Girish and Vijayalakshmi, 2013). Table 4 shows that the price of Electricity transacted through power exchanges and trading licensees (expressed in Rs/kWh) has reduced over the years barring 2012-13 where it seems to have flattened out. We also observe that price of electricity transacted through power exchange is lesser than average price of electricity transacted through trading licensees further indicating the future prospects of power trading through exchanges.

Testimony to the fact of increasing power trading activity in India is the increasing volume of transactions as well as the growing number of open access consumers who are eligible to buy or sell power from the exchange without any discrimination owing to

Indian Electricity Act 2003. Table 5 gives total number of open access consumers in IEX for the year 2012-13.

REC's are exchange tradable, intangible attributes of electricity commodity which represents the attributes of power generated from renewable energy resources as defined by the Ministry of Power and the Power Exchanges (i.e., 1 REC = 1 MWh). The green attributes obtained by generating firm in the form of REC can be separately traded at IEX or PXIL i.e., power exchanges (Shereef and Khaparde, 2013). The REC is traded only in power exchanges which have been approved by CERC within a band/range of a floor price (minimum price) and the forbearance price (maximum price) as and when notified by CERC. Table 6 gives details of REC's transacted through power exchanges in India in the year 2012-13. The gap found between the volume of buy/sell bids of REC's placed using power exchange platform shows that in general there was more demand for Solar REC's when compared to the demand for non-solar REC's.

Table 2: Emergence of power exchanges around the world

Country	Year	Company
US	1998	California Power Exchange (CalPX)
US	1999	New York ISO (NYISO)
US	2000	Pennsylvania-New Jersey-Maryland (PJM) Interconnection
US	2003	ISO New England
US	2005	Midwest ISO (MISO)
UK	2001	UK Power Exchange (UKPX)
UK	2001	Automated Power Exchange (APX UK)
Canada	2001	Alberta Watt Exchange
Canada	1996	Power Pool of Alberta
Australia	1998	National Electricity Market (NEM)
New Zealand	1996	New Zealand Electricity Market (NZEM)
Germany	2000	Leipzig Power Exchange (LPX)
Germany	2000	European Energy Exchange (EEX)
Spain	1998	Operadora del Mercado Espanol de Electricidad (OMEL)
Finland	1998	Nord Pool
Denmark	2000	Nord Pool
Poland	2000	Towarowa Gielda Energii (Polish Power Exchange, PolPX)
Netherlands	1999	Amsterdam Power Exchange (APX)
Slovenia	2001	Borzen
Poland	2002	Platforma Obrotu Energia, Elektryczna, (POEE)
Italy	2004	Italian Power Exchange (IPEX)
Czech Republic	2004	Operator Trhu s Elektrinou (OTE)
France	2002	Powernext
Austria	2002	Energy Exchange Austria (EXAA)
Belgium	2006	Belgian Power Exchange (Belpex)
India	2008	IEX
India	2008	Power Exchange of India Ltd (PXIL)

Source: Weron (2006); Girish et al. (2013); Girish et al. (2014)

Table 3: Transactions of electricity in India

Year	Total electricity generation in India (BU)	Total volume of short term transactions of electricity (BU)	Total volume of short-term transactions of electricity as percentage of total electricity generation
2009-10	764.03	65.9	9
2010-11	809.45	81.56	10
2011-12	874.17	94.51	11
2012-13	907.49	98.94	11

Source: National Load Dispatch Centre, BU: Billion Units

4. CONCLUSION

Even though power traded through energy exchanges, whose price discovery is the most efficient (a well-documented fact in literature) and with utmost transparency of operations, accounts only for 3% of the total power transactions in India which is in spite of being in existence and operation for 5 years. We believe that with inherent attributes of a power exchange like transparency, anonymity, being nationwide, automated, enabling efficient price-discovery, offering risk management opportunity, ever increasing number of open access consumers and the fact of making an earnest attempt to address supply-demand gap, power trading in

Table 4: Prices of electricity traded through licensed power traders and power exchanges

Year	Price of electricity transacted through trading licensees (Rs/kWh)	Price of electricity transacted through power exchanges (Rs/kWh)
2008-09	7.29	7.49
2009-10	5.26	4.96
2010-11	4.79	3.47
2011-12	4.18	3.57
2012-13	4.33	3.67

Source: Central Electricity Regulatory Commission

Table 5: Total number of open access consumers in IEX for the year 2012-13

Month	Number of open access consumers
12-Apr	1314
12-May	1363
12-Jun	1406
12-Jul	1445
12-Aug	1489
12-Sep	1540
12-Oct	1644
12-Nov	1721
12-Dec	1812
13-Jan	1898
13-Feb	1997
13-Mar	2110

Source: Central Electricity Regulatory Commission, IEX: Indian Energy Exchange

Table 6: REC's transacted through power exchanges in India in the year 2012-13

Particular	IEX		PXIL	
	Solar	Non-Solar	Solar	Non-Solar
Total volume (in MWh)	10,443	1,980,546	3570	595,255
Volume of buy bid	77,277	2,435,188	12,173	655,146
Volume of sell bid	14,076	9,184,800	4592	2,489,921
Market clearing price (in Rs/MWh)	12,782	1731	12,615	1564

Source: Central Electricity Regulatory Commission, IEX: Indian Energy Exchange, PXIL: Power Exchange India Limited, REC: Renewable energy certificate

India through power exchanges which is still at a nascent stage is all set to shoot up and the traditional state run electric utilities will eventually be forced to embrace the new norm of short-term power transactions in Indian electricity market.

REFERENCES

- Aggarwal, S.K., Mohan, S.L., Kumar, A. (2009), Electricity price forecasting in deregulated markets: A review and evaluation. *Electrical Power and Energy Systems*, 31(1), 13-22.
Available from: <http://www.cercind.gov.in/>.
Available from: <http://www.iexindia.com/>.
- Available from: <http://www.nldc.in/>.
- Cervone, A., Santini, E., Teodori, S., Romito, D.Z. (2014), Electricity price forecast: A comparison of different models to evaluate the single national price in the Italian energy exchange market. *International Journal of Energy Economics and Policy*, 4(4), 744-758.
- Girish, G.P., Panda, A.K., Rath, B.N. (2013), Indian electricity market. *Global Business and Economics Anthology*, 1, 180-191.
- Girish, G.P., Vijayalakshmi, S. (2013), Determinants of electricity price in competitive power market. *International Journal of Business and Management*, 8(21), 70-75.
- Girish, G.P., Vijayalakshmi, S. (2014), Spot electricity price dynamics of Indian electricity market. *Lecture Notes in Electrical Engineering*, 279, 1129-1135.
- Girish, G.P., Vijayalakshmi, S., Panda, A.K., Rath, B.N. (2014), Forecasting electricity prices in deregulated wholesale spot electricity market – A review. *International Journal of Energy Economics and Policy*, 4(1), 32-42.
- Shereef, R.M., Khaparde, S.A. (2013), Current status of REC mechanism in India and possible policy modifications to way forward. *Energy Policy*, 61, 1443-1451.
- Weron, R. (2006), *Modeling and Forecasting Electricity Loads and Prices: A Statistical Approach*. Oxford, UK: Wiley Finance Publication.
- Weron, R. (2014), Electricity price forecasting: A review of the state-of-the-art with a look into the future. *International Journal of Forecasting*, 30(4), 1030-1081.