

Power Exchanges in India: A Catalyst for Energy Market Efficiency

Introduction

Electricity is generated at power plants and transmitted over vast distances through transmission lines. However, the generation and consumption of electricity are often geographically separated. Power exchange platforms allow energy to be bought and sold between different market participants, including utility companies, independent power producers. These transactions can occur within a regional or national grid or even on an international scale, depending on the infrastructure in place. One of the main objectives of power exchanges in electrical systems is to balance supply and demand. If demand for electricity exceeds supply, the system may experience blackouts or other disruptions. Conversely, if there is excess supply, resources may be wasted. Through power exchange, utilities can purchase or sell electricity to maintain system balance. The market prices of electricity are influenced by factors such as fuel costs, the availability of renewable energy, and the level of demand in different areas.

The concept of a "power exchange" in the electrical system emerged in the early 2000s, primarily driven by the liberalization of electricity markets in Europe, where the idea of a central platform for electricity producers and consumers to trade power directly through a standardized system was introduced, allowing for more transparent and market-driven pricing; with countries like England being among the first to implement such a system; the key development was the shift from bilateral contracts to a centralized exchange model for electricity trading, facilitating efficient price discovery and market competition. Nord Pool power exchange (Elspot) is being considered as a standard exchange design. Design and implementation issues of a power exchange or power market, in general, depend on the market supplies and demands, liquidity, economy etc.

Power exchange in India began in 2008 with the launch of the Indian Energy Exchange (IEX) on June 27, 2008. This was the first-ever power exchange in India, facilitating transparent and competitive electricity trading. Shortly after, the Power Exchange India Limited (PXIL) was launched on October 22, 2008, as the second power exchange in the country. Later, Hindustan Power Exchange Limited (HPX) was launched on June 30, 2021.

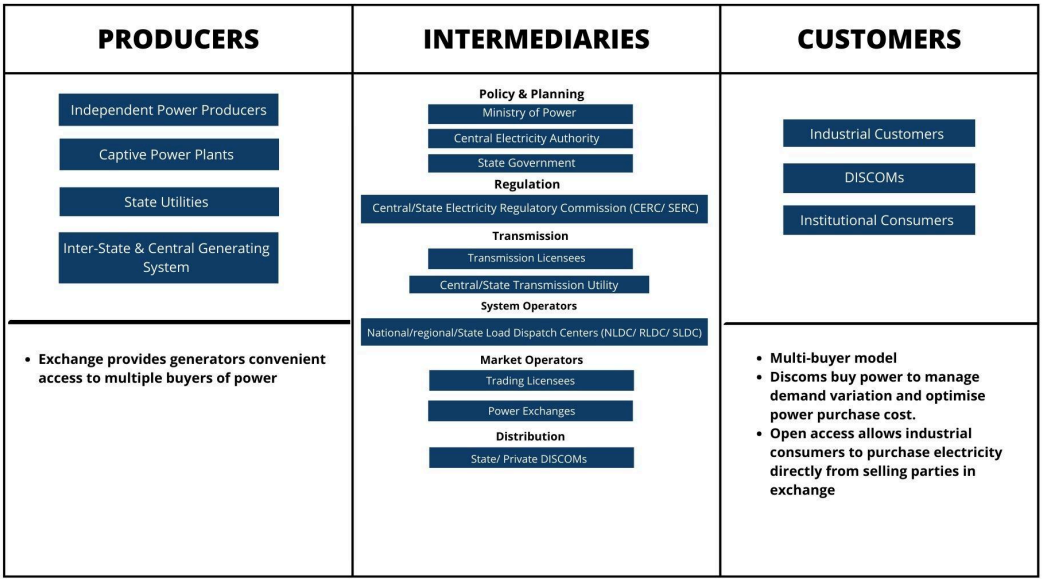
Advantages of a power exchange

- Facility for trading of electricity
- Foster the development of competition
- Transparent price discovery – Competitive bidding ensures fair pricing.
- Cost-effective power procurement – Enables cheaper power availability.
- Grid reliability – Real-time market helps balance demand-supply fluctuations.

- Boosts renewable energy adoption – Separate green market facilitates clean energy trading.
- Enhances liquidity in power markets – More buyers and sellers ensure efficient trade.

The idea of trading through an exchange enables traders to discover the best price in the market and to find the optimum buyer or seller for trade. In the electricity market, the exchange is synchronized with the Transmission System Operator (TSO) to get technical clearance for transacting power over the grid. Trading should be done in an efficient manner to provide quality and affordable power to end users. Power Exchange (PX) directly operates wholesale energy markets, such as day-ahead and hour-ahead markets, while the real-time market for energy balancing and the market for the ancillary services may be operated directly by the TSO or by PX on behalf of TSO and under specific technical requirements. The TSO controls and operates the transmission grid and facilitates transactions and transmission avoiding influence on the generation schedules created by the PX.

For PX, the day-ahead energy market is based on a single or double-side auction scheme. Single side auction allows either buyers or sellers to submit their bids or offers respectively. In double sided auction scheme, both power suppliers and consumers are allowed to submit volume-price offers and bids respectively. Auction process can be open or closed (sealed). In open auction participants repeatedly bid and know about the previous bids. In close or sealed auction, bids or offers are not opened to the market participants. In most of the PX, double sided sealed auction scheme is implemented. Participation in electricity trading through exchange can be mandatory or voluntary. Electricity flows on a transportation network and physical delivery of trades may cause congestion in the network. Issue of congestion should be handled in the market clearing mechanism. Some PX use market splitting method in case of network congestion. Most of the exchanges provide hourly and block bid products.



Key Players in Power Exchange

Market Segments in Power Exchange

(a) Day-Ahead Market (DAM)
Power trading for next-day delivery. Auction-based market where prices are determined using a double-sided closed auction. Bidding window: 10 AM – 12 PM, results published by 1 PM.
(b) Real-Time Market (RTM)
Market segment with physical delivery of electricity 1 hour after closure of the market. The market features a new auction session every half an hour with electricity to be delivered after 4 time-blocks or an hour after gate closure of the auction. There are 48 RTM sessions run by Power exchanges in a day. The price and quantum of electricity trading is determined through a double-sided closed auction bidding process just like I-DAM.
(c) Term-Ahead Market (TAM)
Contracts ranging from intraday to 11 days, Includes intraday, day-ahead contingency, daily, and weekly contracts.
(d) Green Market
Green Day-Ahead Market (GDAM): Next-day trading of renewable energy.
Green Term-Ahead Market (GTAM): Short-term renewable energy contracts.
(e) Cross-Border Electricity Trade (CBET)
Enables India's power trade with neighboring countries like Nepal, Bhutan, and Bangladesh.
(f) Long-Duration Contracts (LDC)
It is a product Segment under which the participants are allowed to trade for delivery of power upto 90 Days (Delivery Starting from T+2 to T+90 Days). Under this segment Uniform Price Auction & Anyday Single Side Reverse Auction Products have been allowed by H'ble CERC. Members can bid for any duration (round the clock delivery or any block of hours) as per their requirements.
(g) Renewable Energy Certificates
Trading of RECs takes place at Power Exchanges twice in a month (2nd and last Wednesday).
(h) Energy Saving Certificates
Trading of ESCerts takes place at Power Exchanges weekly (on every Tuesday). Bidding timing for ESCerts and REC at Power Exchanges are between 13:00 Hrs to 15:00 Hrs.

Power exchanges in India

- IEX

  The Indian Energy Exchange (IEX) is an Indian electronic system based power trading exchange regulated by the Central Electricity Regulatory Commission (CERC). IEX started its operations on 27 June 2008. Indian Energy Exchange pioneered the development of power trading in India and provides an electronic platform to the various participants in power market, comprising State Electricity Boards, Power producers (Gencos), Power traders, and Open Access Consumers (both Industrial & Commercial).

- PXI

  Power Exchange India Limited (PXIL), India's first institutionally promoted power exchange, has been providing innovative and credible solutions since 2008, and has revolutionized the way Indian power markets operate. PXIL's unique combination of local insights and global perspectives has helped its members make better informed business and

investment decisions, and has improved the overall efficiency of power markets in India by accurately and seamlessly connecting buyers and sellers.

- HPX

  Hindustan Power Exchange (HPX) (formerly known as Pranurja Solutions Limited) is the new age power exchange in the Indian Electricity Market. It provides a comprehensive market platform for different electricity products providing a transparent, seamless and robust exchange platform for the market participants. HPX provides opportunity to market participants to transact in the most equitable and transparent manner giving its customers unmatched user experience through advanced technology and customized value added services. Through continuous innovation and creativity in the services as well as its technology, HPX brings in a fresh perspective in the power market. HPX is promoted by three leading institutions of their respective fields; PTC India Limited, BSE Investments Limited, ICICI Bank Limited

How does a power exchange work?

The power exchanges primarily offer a trading platform to their exchange members. These members can then connect to this platform and submit their orders for buying and/or selling power, which are registered in an order book. These orders reflect the demand and supply for a specific electricity market area at a given moment in time. Based on this order book, the power exchanges calculate a market price for the trading to take place at, which are legally binding agreements to sell or purchase a specific quantity of electricity to a defined delivery area for the matched (or "cleared") price. For every delivery period, a single price known as the market clearing price (MCP) is established that is applicable to both buyers and sellers. This MCP never goes below the seller's proposed sale price or above the buyer's agreed-upon buying price.

The transaction is cleared and settled once trading on a power exchange platform is finished. Through clearing, every deal that has been finalized or registered on the exchange is guaranteed to be fulfilled correctly. After a deal is completed, the clearing house assumes the role of central counterparty and becomes the buyer and seller's contractual partner. By doing this, the clearing house reduces the counterparty risk and guarantees the fulfilment of each trade (payment and delivery). Operational constraints and environmental variables constantly limit the flow on transmission lines. Transmission link instability can result from imbalances; thus, constant supply and demand balancing is necessary for electrical networks. In order to obtain technical approval for power transactions via the grid, the exchange in the electricity market is synchronized with the System Operator (SO). Nonetheless, the supply and demand, liquidity, economy, and other factors of the market all affect the design and operation of a power exchange or power market in general.

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