Power Markets in India

Center for Study of Science, Technology and Policy

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CSTEP launched the Empower series of blog articles to simplify the power sector for non-technical readers. Through the series, we hope to explain how every step of the journey of electricity affects the consumers. In the first article, we introduced you to the many actors involved in this journey. The second article of the series explains the costs involved in electricity generation. The third article simplifies electricity bills while detailing the aspects relevant for consumers, to enable them to understand their bills better. Continuing this informative journey, the fourth segment discussed the various expenses associated with power distribution and explained revenue recovery assessment for distribution companies. This blog — fifth in the series — discusses the working of power markets in India.

Electricity, like any manufactured product, can be bought and sold in a market — in this case, a power market. The buying and selling transactions of electricity occurs in the units of either power (in megawatts, MW) or energy (in million-units, MU). Like all transactions, power transactions involve a buyer and a seller, which can be a distribution company (DISCOM), a generation company (GENCO), a power exchange, or a bulk consumer. At both ends of a power transaction, a balance has to be maintained in the national electricity grid — the power demand should be matched with timely power supply. Electricity is thus of tradable value when it is available *at the right time, in the right amount,* and *to the right demand*. Therefore, power trading helps maintain balance, security, and cost effectiveness of electricity in the grid.

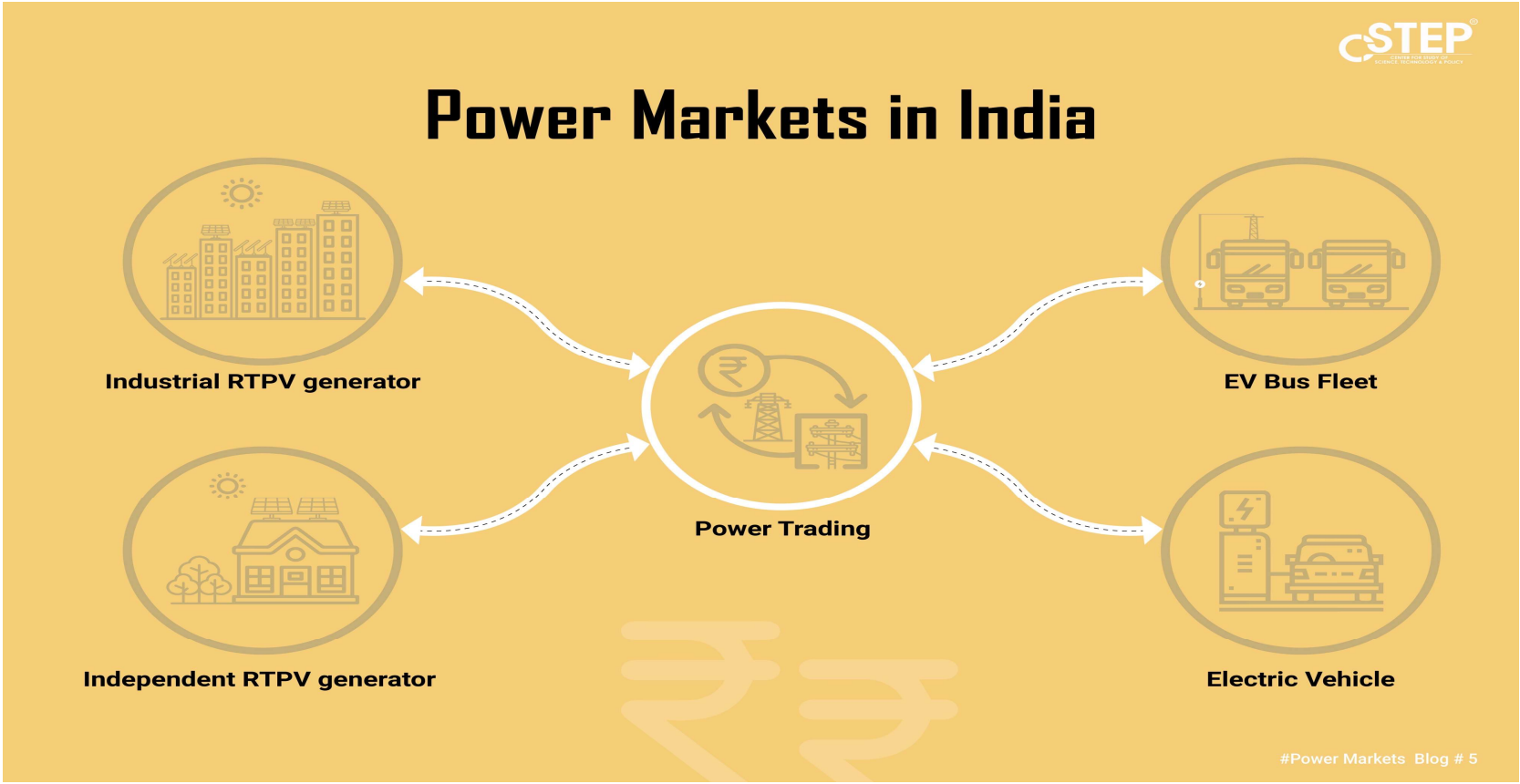

Image by CSTEP

The National Tariff Policy 2016 has enabled the creation of a market ecosystem for electricity trading among various entities and through various modes. Further, various methods are available for electricity trading in the Indian power market — broadly categorised as long-term (conventional) and short-term (modern) methods.

Long-Term Methods of Power Trading

The conventional methods of power trading are wholesale and retail. Both include bilateral trades (that is, power trade between two willing parties such as two DISCOMs trading with each other through a power exchange) and time-bound power purchase agreements with power generators. To ensure supply reliability and to optimise costs, such trades are conducted in the wholesale market over varying time periods — small (up to 1 year), medium (1–5 years), and long term (5–25 years). A power generator can sign a memorandum of understanding with a power distribution entity for any of these time periods. The tariff can be set through two methods, both conducted by the state regulatory body — either a maximum and a minimum price limit set for a period of one year, or the tariff decided through a transparent bidding process. In wholesale trading, power is purchased in bulk from power generators on the basis of a preliminary demand estimate. The actual delivery of power occurs after setting the selling rate for various consumer categories such as commercial, industrial, or household. The key market participants include GENCOs, DISCOMs, traders, power exchanges, and load dispatch centres. While DISCOMs can trade power from generators through various time-bound contracts, they can also buy power from trading companies or power exchanges.

Short-Term Methods of Power Trading

Apart from fixed purchases, there are often immediate requirements for electricity in the grid for short time periods. Such requirements arise because of high power demand during certain time blocks of the day or during a season. For example, urban power consumption peaks during the evening because of a large number of users and also during peak summers and winters because of the use of heavy electrical appliances (air conditioners, heaters, etc.). Rural consumption peaks during early morning because of the use of water pumps for irrigation. In such peak demand scenarios, the contracted power may become insufficient and more power then has to be purchased through other modes. Such purchase occurs through short-term trading. A short-term market trade usually refers to a contract with a period of less than one year. These purchases take place in power trading markets; depending on the delivery period, these markets can be categorised as instantaneous or real-time markets, day-ahead markets, and term-ahead

markets. For actual dispatch, DISCOMs plan a day in advance. Some of the key short-term markets are as follows:

1. Real-Time Market: These markets are a novel idea first implemented in June 2020. These markets bring together consumers and sellers just an hour before power delivery.

2. Day-Ahead Markets: In these markets, power delivery occurs the next day after transactions are contracted.

3. Term-Ahead Market: In these markets, the power transfer schedule can vary from 3 hours later on the same day up to 11 days in the future. The actual power delivery can range from more than one day until the term mentioned in the contract. Term-ahead markets can be further categorised into intra-day markets (a continuous trading platform for delivery within the same day (0400 to 2400 hours) and day-ahead contingency markets (providing hourly contracts to substitute day-ahead markets for next-day delivery). Term-ahead markets also include period markets such as daily markets (run from the second to the eighth day) and weekly markets (open for successive weeks).

Market players (DISCOMs and GENCOs) thus have various power trading modes available to them, for both short- and long-term delivery. However, most of these modes fall under high-volume, bulk trades that take place at a macro level and with a handful of registered players involved.

> The growing digitisation in the power sector provides an opportunity to an average power consumer or generator to enjoy inclusivity and fair participation in the power market ecosystem. With various technology breakthroughs such as decentralisation of power generation, block chain technology (enabling trust), and digital platforms (facilitating fair online auctions), it has finally become possible for an individual electricity user to access the power trading system from their desktop. In fact, power trading has the potential to support even micro trades — small time-independent generators and consumers directly interacting with each other. One such innovative mechanism is discussed here to shed more light on such models.

Peer-to-Peer Trading and Efficient Use of Renewables

With falling prices of renewable energy (RE)-based technologies (solar photovoltaic, wind, etc.) and support for RE generation in the Indian power sector, the share of renewables in India's power generation mixture is

increasing. Moreover, RE generation promotes entrepreneurial opportunities and profit sharing. This can be achieved without the participation of the conventional grid and requires only two entities to interact. For example, an independent generator such as a rooftop solar user can supply power to a buyer who requires it for their electric vehicle. Such trading of power is called peer-to-peer trading, which frees both buyers and sellers from the control of a handful of buying/selling enterprises. Both parties can be either in a residential or an industrial setup. Such a mechanism essentially opens up all power purchase options. The trade can be in a mutually profitable window, which can be slightly better than the trade prices offered by routing through the conventional grid. Another example can be of a commercial and an industrial peer-to-peer trading setup, such as an industrial RTPV generator and a private EV transporter (for example, an owner of an EV bus fleet). Such quick trades will require a basic trading support from DISCOMs at a small service cost, so that such point-to-point trades can be set up for all interested peers.

However, currently, such a mechanism is being explored only as an experiment in India, with few pilots currently under observation. To make this mechanism a reality will require policy push from state governments at the infrastructural level. Further, regulatory measures and modalities need to be charted out to provide an encouraging roadmap for power customers.