



Deepening India's Short-Term Power Market With Derivatives

New Financial Products Will Boost National Trading of Renewable Energy

Introduction

Long-term power contracts dominate the Indian electricity sector. Power purchase agreements (PPAs), with tenures of 25 years, comprise 88% of the overall traded volumes. While providing investors with certainty over a long duration and de-risking from price volatility, the growing implications of these PPAs need to be addressed to aid the financial viability of state distribution companies (discoms).

In the wholesale market, liquidity in the short-term market has increased over the years, although the overall volume is still low. Short-term bilateral contracts traded up to 3 months in advance of delivery comprise 3-4% of the volume; the day-ahead market comprises another 5-6%; and the balance of 1-2% is Unscheduled Interchange (UI).

June 2020 saw the introduction of the real-time market with price discovery through double-sided closed auctions which happen every half hour for two 15-minute time blocks, one-hour ahead on the power exchange. Further, in August 2020 the Green Term Ahead Market (GTAM) for trading renewable energy was launched. The introduction of green markets on the national exchange platform is a significant milestone that will enable consumers to make a sustainable choice, help the government to achieve its renewable energy goals and enable integration of renewable energy in the most flexible and efficient way.

The introduction of green markets on the national exchange platform is a significant milestone.

In April 2021, the Indian Energy Exchange (IEX) commenced the Cross Border Electricity Trade (CBET) on its platform, with the aim of building an integrated South Asian regional power market in support of the One World One Sun One Grid ambition of the Government of India, developing a green electricity export market.

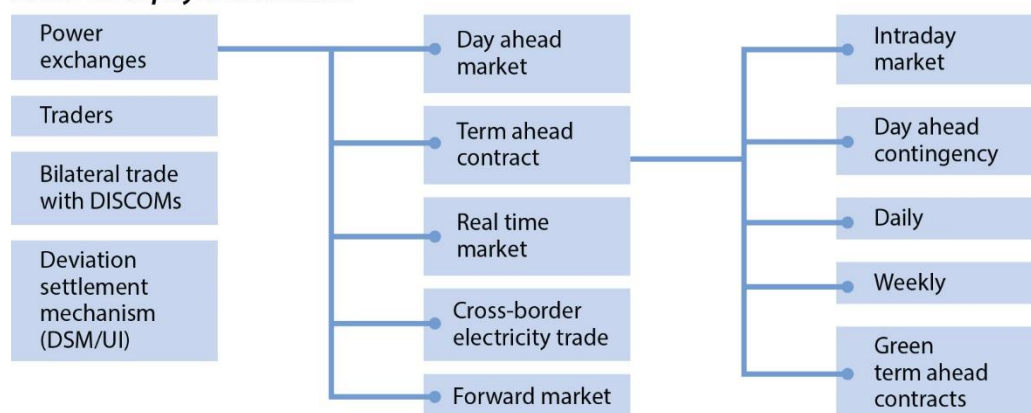
With the massive deflationary effect of renewable energy, discoms are becoming increasingly wary of signing long-term PPAs, thereby impacting development of new renewable projects in the absence of off-taker certainty. Long dated two-part PPAs for many coal power plants also undermine India's ability to retire expensive,

polluting end-of-life coal-fired power plants. Discoms are struggling with huge financial losses, with total debt projected to hit an all-time high of Rs4.5 lakh crore (US\$61bn) in FY2020/21.¹

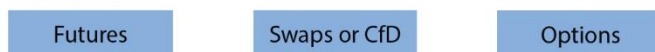
In order to ease their financial burden, the discoms need to be unshackled from expensive long-term PPAs with old, inefficient plants. The long-term PPAs are rigid contracts that underwrite the capital cost (financing and depreciation) of the old plants without providing value for customers. India now needs to transition towards development of financial products in the derivative (or financial) electricity market that developers could utilise to hedge risk without requiring the signing of long-term PPAs for the financial closure of projects.

An Overview of the Indian Physical and Financial Electricity Markets

Short-term physical market:



Short-term financial market:



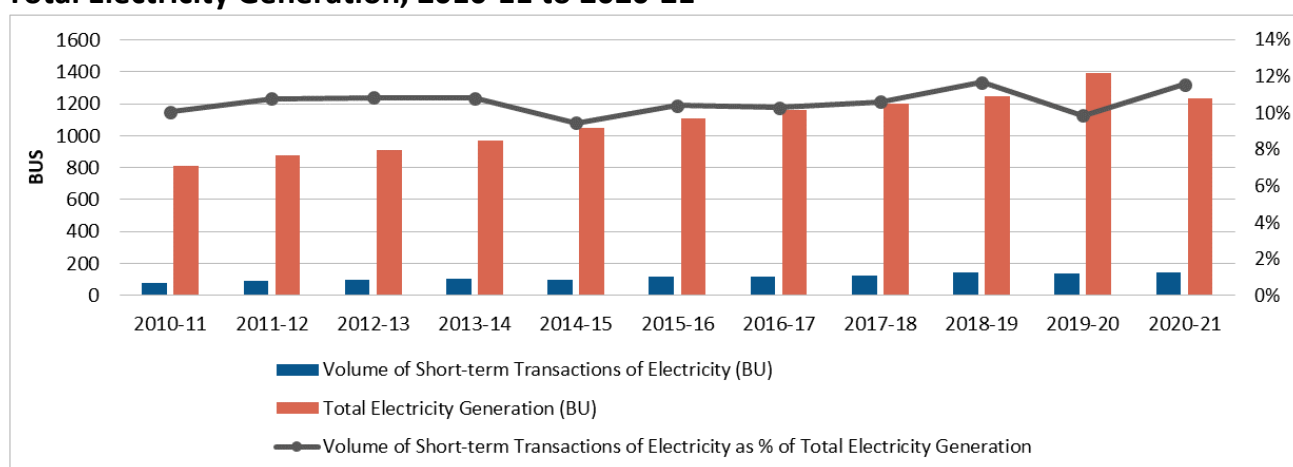
Source: IEEFA.

¹ ET Energy World. [Discom debt to hit all-time high of Rs 4.5 lakh crore in 2020-21](#): CRISIL. June 2020.

Stagnating Short-Term Market Needs Innovative Products

The short-term market has evolved over the years with the introduction of a variety of products which have led to an increase in liquidity and can provide efficient discovery of prices. The figure below shows the volume of electricity transacted in the short-term market, which has stagnated at 10-12% of total electricity generation. Growth is consistent with the underlying market volume of electricity transacted which has increased at a Compound Annual Growth Rate (CAGR) of 6% from fiscal year (FY) 2010/11 to FY2020/21.

Figure 1: Volume of Short-Term Transactions of Electricity Relative to Total Electricity Generation, 2010-11 to 2020-21



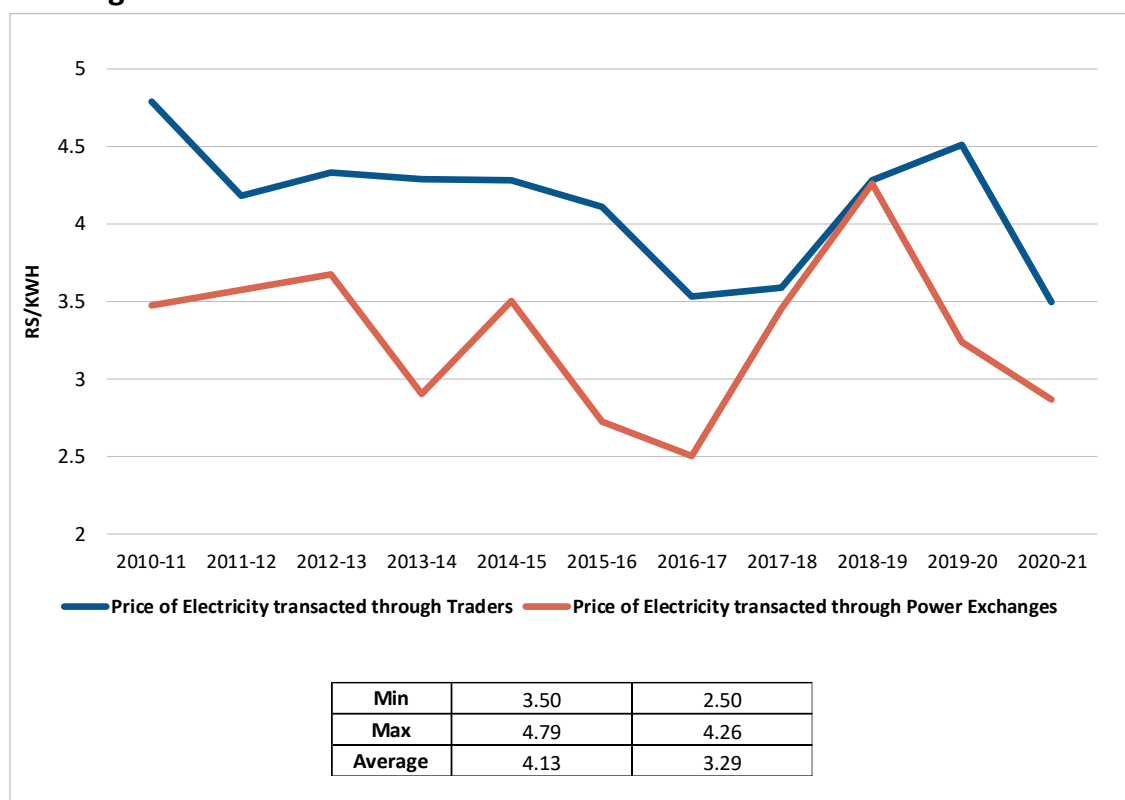
Source: CERC Annual Report on Short-term Power Market 2019-20, CERC Monthly Market Monitoring Reports 2020-21.

The volume of electricity transacted through traders and power exchanges as a percentage of the total volume of short-term transactions is ~60%. At the Indian Energy Exchange (IEX), the electricity market achieved an all-time high volume of 74BU during 2020/21 leading to 37.2% YoY growth, a significant market share gain.²

The weighted average price of electricity transacted through traders and power exchanges declined from Rs4.79/kWh and Rs3.47/kWh respectively in 2010/11 to Rs3.50/kWh and Rs2.86/kWh respectively in 2020/21. The prices were high in 2008/09 and 2009/10 when the power exchange was established and volumes were low. With huge generation capacity added, and with supply exceeding demand during most hours of the day, prices in the short-term market have gone down and stabilised over the years.

² IEX. [Power Market Update](#). April 2021.

Figure 2: Price of Electricity Transacted Through Traders and Power Exchanges



Source: CERC Annual Report on Short-term Power Market 2019-20, CERC Monthly Market Monitoring Reports 2020-21.

Analysis of electricity prices transacted by traders during round-the-clock (RTC), peak and off-peak periods shows that the price during peak periods is higher than the price during RTC and off-peak periods.

The launch in June 2020 of the real-time electricity market (RTM) on the IEX has benefited renewable energy generators. The RTM allows them to sell their unanticipated surpluses and earn additional revenues. Data reveals that volume in the RTM picked up from 515MU³ in June 2020 to as high as 1473MU in April 2021. The weighted average price is ~Rs2.9/kWh, while the maximum price during the period June 2020 to April 2021 is Rs10/kWh.

In August 2020, a new product, the Green Term-Ahead Market (GTAM), further facilitated sale of renewable energy on the power exchange. About 786MU volume was traded in this market during August 2020 to March 2021.⁴ The market has enabled distribution utilities, industrial consumers and green generators to buy and sell green power while also fulfilling their Renewable Purchase Obligation (RPO) in

³ 1MU (Million Units) = 1GWh and 1BU (Billion Units) = 1 TWh.

⁴ IEX. [Power Market Update](#). April 2021.

the most competitive way.

Another milestone was achieved when the government allowed electricity to be traded like other commodities with forward contracts and derivatives on exchanges.⁵ Delivery-based long-term contracts are likely to be traded on power exchanges under Central Electricity Regulatory Commission (CERC) jurisdiction, and the derivative contracts are likely to be traded on commodity exchanges under Securities and Exchange Board of India (SEBI). This will pave the way for the introduction of long duration, delivery-based contracts on the power exchanges and allow discoms to lower their power purchase costs and hedge their risk.

Next Step in Power Market Development

Need for Derivatives Market

Discoms are reeling under huge losses and in recent years have not been signing long-term PPAs with power developers. As a result, there is a large number of unsigned PPAs, which puts at risk future development of additional renewable energy capacity.

Delays in signing PPAs are a bottleneck in the growth of renewable energy capacity in India, jeopardising the government's renewable energy targets of 175 gigawatts (GW) by 2022 and 450GW by 2030, dampening investor confidence and threatening the viability of new projects. The introduction of financial instruments in the derivative market will help in hedging the offtaker risk and provide flexibility and certainty of supply to both discoms and developers for sale of power in the futures market, and should help develop the price signal needed to incentivise supply into peak demand periods – the key to enabling battery deployments and demand response management.

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Discoms with their power optimisation tools, can also participate in derivative markets and hedge their risk. This will help discoms to lower their power purchasing costs and also prevent them from being saddled with the inflexibility of long-term PPAs as electricity demand profiles change. Discoms will have the flexibility to buy power based on demand. This is important because demand is evolving as rising incomes lead to greater penetration of both energy-intensive and energy-efficient products, and electricity storage.

⁵ ET Energyworld. [Govt Allows Electricity Derivatives, Forward Contracts](#). 15 July, 2020.

The derivatives market will provide the vibrancy by increasing trade volumes and encourage more participants by separating the physical delivery of electricity from the financial settlement. This will allow hedgers, speculators and a host of other participants to trade in the electricity market.

The derivatives market will also provide diversified avenues for supply, higher visibility of a more reliable forward price curve and transparency in power pricing. It will enable the transfer of risk from entities that have it but may not want it to those with an appetite for it, which further enables market participants to expand their volume of activity. Moreover, prices in the derivatives market will reflect the collective perception of market participants about the future.

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Currently, the practice is to extrapolate the price trends in the day-ahead or term-ahead market. The derivatives market will provide a forward price curve that will help in making investment decisions. With an increasing share of renewable energy, the derivatives market will provide avenues for sale with price certainty, thereby attracting more investment into the sector.

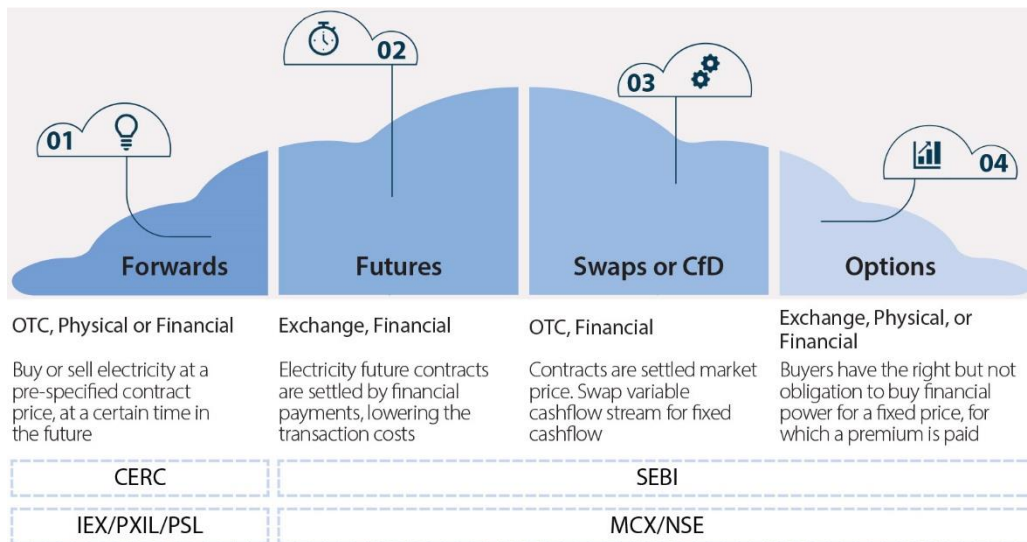
Designing the Derivatives Market

Financial Products

All financial contracts will be derivative contracts, with value derived from the price of the underlying commodity. These products will perform economic functions such as transferring risks, discovery of future prices, and increasing saving and investments in long run.

The products may involve physical delivery of electricity in the future at a specific time of day or they may be merely a financial instrument for hedgers, speculators and arbitrageurs. The physical delivery of products will happen on the power exchanges – Indian Energy Exchange (IEX), Power Exchange India Limited (PXIL) and the new third exchange Pranurja Solutions Limited (PSL). The financial contracts will be settled on commodity futures exchanges like Multi Commodity Exchange of India Limited (MCX) and National Stock Exchange of India Ltd. (NSE).

Figure 3: Products in the Derivatives Market



Source: IEEFA analysis.

Upon reaching the due date, the contract is settled at the price, which covers the difference between the final closing price of the futures contract and the Market Clearing Price (MCP) on power exchange in the delivery period. The settlement of futures contracts involves both a daily mark-to-market settlement and a final spot reference cash settlement. A mark-to-market settlement covers gains or losses from day-to-day changes in the market price of each contract.

The futures market will allow saleability of hybrid products more easily than the plain vanilla wind and solar projects. With an increasing share of renewable energy in the total generation mix, multiple products including wind, solar and biogas, along with battery storage, are likely to see more demand, and financial markets could enable the sale of hybrid products. Unlike with an inflexible 25-year long-term contract, availability of different hybrid products in the financial market could help to better manage seasonal and peak/time-of-day demand periods.

Reference Price

Electricity is a flow commodity rather than a stock. Given electricity is not a storable commodity, the general pricing model of cost of carry does not work for electricity unless there is a price signal to incentivise storage by time arbitrage of electricity delivery. However, India can learn from the U.S. and European electricity derivatives markets, where reference pricing models exist for products in the futures market. Australia is also illustrative, given the market in 2021 has moved to a five-minute

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interval of supply and demand pricing to enhance grid reliability by a stronger short time interval price signal.

For buyers and sellers to participate in the derivatives market, the right price signal needs to be established. This price should give signals to investors for new capacity, particularly of increasingly important storage infrastructure.

How to determine the right reference price? The price at power exchange is a good start to prevent market manipulation or collusion, or gaming by players. The price discovery will also take into account other factors such as demand, supply, weather, temperature, humidity, water storage levels, and events like festivals. Given the price discovery will be a collective decision by various buyers and sellers, there is little scope to influence prices.

The average of the unconstrained market clearing price (UMCP) could be used as the basis for setting up the reference price. If there is no congestion in the transmission network, there will be one price at the power exchange rather than different prices for different areas. When there are different area prices due to network congestion then UMCP will not fully hedge all participants. However, in order to create liquidity, generally UMCP for base and peak are used for settlement of futures contracts.

Whether the reference price will be derived from the short-term market or long-term contracts is a tricky question, given the power exchange volume constitutes ~5% of the total generation share. The optimal duration for determining the reference price for long-term contracts also needs to be established. How much difference should there be between the instrument, age and the price signal? These are questions that need to be answered when designing regulations for determining the reference price.

For example, a Commercial and Industrial (C&I) consumer would like to hedge its landed cost which includes open access charges. Such charges are fixed for a year and revised by the regulatory commission at least every six months. However, the open access charges cannot be accounted in the financial market. Open access charges are regulated and not market based, so designing an instrument that takes care of such charges is difficult.

Timelines for Launch of Products

When designing products in the financial market, the mantra should be to keep them simple, stable and standardised, increase the liquidity in those products and then gradually bring more products into the market. To begin with, futures and options should be considered for trading in the financial market. The products could be launched for weekly, fortnightly, monthly and then also

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quarterly contracts to reflect seasonal changes. The type of products in these markets could be RTC or peak products based on the unconstrained market clearing price. As the markets evolve and liquidity in these products goes up, more products can be added.

More innovative products like weather derivatives linked with electricity derivatives could be launched. To address the issue of congestion in the transmission network, another product for congestion management could be introduced. A variety of financial instruments could be created once the market matures, providing lot of scope for innovative products to be launched in the derivatives market going forward.

In the derivatives market, the contract should be standardised. Parameters such as type of settlement, delivery point, timelines for clearing and settlement, margins and delivery process need to be defined properly. The trading system should provide an interface for accepting bids and offers that includes price/quantity/tenure, and the ability to trade on a continuous trade basis.

Risk Management

In order to mitigate the risk of market manipulation or gaming by players, a surveillance mechanism needs to be put in place. A real-time surveillance mechanism which prevents collusion by players and influencing of price needs to be established.

Events in Australia show an independent surveillance and assessment capacity is needed to prevent gaming e.g. withholding supply at times major plants or grid links are scheduled to be offline, as happened [twice](#) in [May 2021](#).

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Further, contract sanctity and payment of charges needs to be ensured. The Clearing Corporation provides the counter-party risk and that requires counter-party risks to be borne by the exchange and/or clearing corporation. Such counter-party risk is managed through margins and collaterals specified under contract specifications.

Way Forward

The national electricity market already has a robust basic structure in place, and now the regulator and the market participants are gearing up for the successful launch and implementation of the derivatives market. This should help provide price discovery and transparency to assist in two-way power flow markets and incentivise the rollout of new storage investments.

IEEFA notes that liquidity will increase in the short-term market with the

introduction of the financial market. The financial and physical electricity market will complement each other. Further, the physical delivery market is also likely to witness increased liquidity as risk will be minimised by reducing volatility on account of extreme events.

A spot market at power exchanges and the derivatives market will feed into each other. It will be a virtuous cycle wherein the derivatives market will establish forward prices, more participants will shift from PPAs to exchanges, thereby increasing liquidity in derivatives and subsequent increasing of liquidity in spot market at power exchanges and vice versa.

The derivatives market will be lucrative for players including developers, discoms, open access buyers, traders, investors in the power sector and others who also have the ability to take on risk. It opens up the market for many more participants who don't want to own an asset, thereby increasing liquidity in the market.

While the prices in the short-term market have stabilised over the years, there is still variation on account of seasonality, weather, festivals etc. Less volatility in short-term prices does not negate the need for the financial markets. In fact, it is beneficial as the margins to reference price will not be very high.

Furthermore, electricity as a commodity cannot be stored absent large-scale battery and pumped hydro storage. Thus, the price volatility will always be there as the price is determined by demand and supply during each block of the day. The financial market enables avoidance of the vagaries of demand and supply and thereby price variation on a day-to-day basis. The contract is settled at the price prevailing at the date of the end of the contract period.

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IEEFA notes that the derivatives market will be a boon for renewable energy developers, both for existing projects with untied PPAs as well as for projects under the development phase for sale in the financial market. Also, stranded gas peaking power plants may find buyers in the financial market, if a separate derivative product for gas-powered plants were to be created linking the time of delivery price, possibly with the input price of gas to help solve the financial stranding of much of India's gas-based electricity capacity.

The electricity derivatives market in India is likely to take shape in 2021. With the resolution on the jurisdiction of power between CERC and SEBI, a joint working group by the Ministry of Power will be established. The role of the working group will be to vet the contracts for the derivatives market and determine the types of contracts that need to be introduced etc., which will be approved by SEBI for the launch of products on NSE or MCX. CERC will be required to notify the Power Market Regulation detailing the roles and responsibilities, market clearing mechanism etc. in greater detail.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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