

## **ENERGY ANALYTICS LAB**

Department of Industrial and Management Engineering Indian Institute of Technology Kanpur

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# Power Chronicle

## Power System Overview & Analysis

*	All India Demand Met Profile	2	
*	Region-wise Demand Met Profile	2	
$\div$	All India Renewable Energy (RE) Generation		
	Profile	3	
$\div$	Region-wise Unscheduled URS (Excluding Gas		
	Power Plants)	3	
$\div$	Short-term Energy Transactions	4	
$\div$	Monthly Short-term (ST) Purchase and Sale		
	Quantum across States	4	
wer Market Overview & Analysis			
*	DAM-Market Clearing Price (MCP) & Market		
	Clearing Volume (MCV)	5	
*	Term-Ahead Market (TAM)	5	
*	RTM - Market Clearing Volume (MCV) and		
	Market Clearing Price (MCP)	5	
$\dot{\cdot}$	RTM Vs DAM on Market Clearing Price (MCP)	6	

## **Regulatory & Policy Perspective**

*	CERC (Power Market) – Regulations, 2020	
	(Draft)	7
*	EAL Opinion on CERC (Power Market)	
	Regulations, 2020	8
*	EALNews	11

# Editorial

Post COVID-19 lockdown, electricity demand has been witnessing a gradual recovery, with the western region contributing most of this recovery, followed by the northern region. Given the growing generation from renewable energy sources and subdued electricity demand, the plant load factor (PLF) of thermal generation plants witnessed a downward trend. The northern region, followed by the southern region, continues to witness electricity shortages during peak hours amidst un-requisitioned surplus in the respective regions.

The implementation of Real Time Market (RTM) effectively delivers on its promise by encouraging re-balancing of the portfolio near to the time of delivery. EAL's analysis of the relationship between market clearing prices in the DAM and the RTM reveals interesting initial insights into the bidding behaviour of buyers and sellers. RTM prices are, in general, found to be lower than the DAM prices. The late-night and evening peak hours witness a proportionately higher RTM to DAM price ratio. While the latter may suggest relative shortages during the peak hours, the former seems to suggest dormant proactiveness of the bidders for the late-night hours.

EAL has been contributing towards the development of a competitive and robust regulatory framework for the Indian power market. EAL has also provided inputs to the Draft CERC (Power Market)Regulations, 2020. While attempting to bring regulatory clarity to various aspects of the Indian power market, some proposals need to be tested with caution. EAL has also identified some gaps that need to be addressed. The existing market monitoring framework enables the regulator to analyse the market behaviour in general. A detailed analysis of the role of the market participants, across all the market platforms and the market segments would provide greater insights into the market power and its impact on the market outcome. A report on the identified events and those investigated should be part of the periodical market monitoring reports. The suggestions provided by EAL for designing a market for ancillary services and the role of derivatives would help improve market efficiency, and also help the stakeholders hedge their risk under various contractual arrangements.

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Register at eal.iitk.ac.in to access data and resources

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## **Power System Overview & Analysis**



During July to September quarter, all India peak demand reached 176.77GW (19:30 - 19:45) on 18<sup>th</sup> September, 2020, about 0.64 percent lower than the previous year's peak demand recorded at 177.9 GW (19:30 - 19:45) on 29<sup>th</sup> August, 2019 during the same quarter. Post COVID-19 lockdown, demand for electricity witnessed partial recovery across the regions.

## **Region-wise Demand Met Profile**



 $\frac{1}{2}$  Demand and generation profiles at India and state-level can be accessed on EAL's web portal.

2

## All India Renewable Energy (RE) Generation Profile



All India peak RE generation reached 32.14 GW (13:15 - 13:30) on  $8^{\text{th}}$  August, 2020, about 20.24 percent lower than the previous year's high of 40.30 GW (19:15 - 19:30) on  $11^{\text{th}}$  September, 2019 during same quarter.

## **Region-wise Unscheduled URS (Excluding Gas Power Plants)**

All India highest peak-hour demand shortage during July to September, 2020 was recorded to be 1537 MW, on 13<sup>th</sup> July, 2020 for NR. Persistence of shortage amidst availability of unscheduled URS highlights a need to explore the economics of furthering the exchange of unscheduled URS. Presence of URS even after SCED highlights scope for further improvement in cost effective power procurement.







## **Short-term Energy Transactions**

## Monthly Short-term (ST) Purchase and Sale Quantum across States





ST Energy Sale, ST Energy Purchase and Share of ST Purchase in Total Energy Supplied (August, 2020)



## **Power Market Overview & Analysis**

## DAM – Market Clearing Price (MCP) & Market Clearing Volume (MCV)



## **Term-Ahead Market (TAM)**

**Daily Day-Ahead Contingency Transactions** 



Daily Intra-Day Transactions



The weighted average clearing price observed in Intra-day market during July to September quarter is higher in comparison to the Day-ahead contingency market. Also, the proportion of sale bids in Term-Ahead Market is much higher when compared to purchase bids placed in the Term-Ahead Market.





5









- The price difference between RTM and DAM is calculated only in cases where the latter exceeds the former. ٠ The block-wise RTM price exceeds the DAM price for about 61.60%, 43.38% and 43.21% of the days for the month of July, August and September respectively.
- During 19:00-19:15 block, 84% of the days in the month of July, RTM prices surpass DAM prices. •
- Maximum difference between RTM and DAM price was observed to be Rs. 1792.2/MWh (04:30-04:45), Rs. 1959.4/MWh (22:45-23:00) and Rs. 2300.52/MWh (19:45-20:00) in July, August and September, respectively.





## **Regulatory & Policy Perspective**

## CERC (Power Market) – Regulations, 2020 (Draft)

CERC notified draft Power Market Regulations, 2020 on 18 July, 2020. This will be applicable to the Power Exchanges other market participants relating to delivery of electricity, RECs, Energy Saving Certificates and any other contracts approved by the Commission, as well as the contracts in the OTC market.

## Summary of the key points of the draft regulation

Price discovery, scheduling, delivery procedures and settlement conditions of the Day Ahead & Real Time, Intraday & Contingency and Term Ahead contracts transacted on the PXs as well as in the OTC market along with procedure for transaction of RECs and Energy Savings Certificates (Part 3):

## A. Day Ahead Contracts & Real-Time Contracts:

1. <u>Price discovery & its mechanism:</u> The price discovery shall be done by the PXs, or the Market Coupling Operator (MCO), as and when notified by the Commission. The mechanism shall be double-sided closed bid auction on a day ahead basis or on a real time basis, as the case may be, and shall adopt the principle of maximisation of economic surplus while taking into account all bid types.

The price discovered for the unconstrained market shall be a uniform market clearing price for all buyers and sellers who are cleared, provided that in the case of congestion in the transmission corridor, market splitting shall be adopted.

 Scheduling and delivery mechanism: The scheduling of such transactions shall be in coordination with the NLDC and, in accordance with relevant provisions of the Open Access Regulations and the Grid Code. Inter-State transmission charges and losses shall be applicable as per the Open Access Regulations & Sharing Regulations.

## B. Intraday Contracts & Contingency Contracts:

- 1. <u>Bidding and price discovery mechanism</u>: Bidding and price discovery mechanism, based on the proposal of the Power Exchange, shall be approved by the Commission.
- 2. <u>Scheduling and delivery mechanism</u>: The scheduling of such transactions shall be in coordination with the system operator and in accordance with relevant provisions of the Grid Code and the Open Access Regulations and the Procedure issued thereunder. Inter-State transmission charges and losses shall be as per the Open Access Regulations and the Sharing Regulations.

#### C. Term-Ahead Contracts:

- 1. <u>Bidding and price discovery mechanism:</u> Bidding and price discovery mechanism shall be approved by the Commission based on the proposal of the Power Exchange.
- 2. <u>Scheduling and delivery mechanism</u>: The scheduling of such transactions shall be in coordination with the system operator and in accordance with relevant provisions of the Grid Code and the Open Access Regulations and the Procedure issued thereunder. Inter-State transmission charges and losses shall be as per the Open Access Regulations and the Sharing Regulations. The contracts shall be settled only by physical delivery of electricity without netting, and shall be binding on the participants executing the transactions. No circular trading shall be allowed, and the rights and liabilities of the parties shall not be transferred or rolled over by any other means whatsoever.

## D. Contracts relating to Renewable Energy & Energy Saving Certificates:

The transactions shall be in accordance with the procedure issued by the Central Agency in pursuance to the REC Regulations and the Administrator in pursuance to the Energy Savings Certificates Regulations.

## E. OTC Market Contracts:

1. The price and other terms of contract shall be determined either through mutual agreement between the



buyer and the seller or through competitive bidding process or as determined by the Appropriate Commission.

2. The application for scheduling shall be made in accordance with the:

(i) Open Access Regulations for: (a) Advance scheduling; (b) First-Come-First-Served; (c) Day-Ahead bilateral transaction; (d) Bilateral transactions in a contingency.

(ii) Grant of Connectivity Regulations for: (a) Long-term access; (b) Medium-term open access. 3. The settlement of contracts shall be only by physical delivery of electricity without netting.

3. The settlement of contracts shall be only by physical delivery of electricity without netting.

Objectives of establishment and operation of Power Exchanges (Part 4):

1. Design and facilitate transactions of electricity contracts.

2. Facilitate and disseminate price discovery that is extensive, quick and efficient.

*Objectives of market coupling, designation & functions of market coupling operator (Part 5):* 

1. Uniform market clearing price discovery for the Day Ahead Market or Real-time Market or any other market as notified by the Commission.

2. Optimum use of transmission infrastructure.

3. Economic surplus maximisation, taking into account all bid types and thereby creating simultaneous buyer-seller surplus.

*Objectives behind the establishment and operation of OTC Platform (Part 6):* 

1. Providing information about potential buyers and sellers of electricity on an electronic platform.

2. Maintaining a repository of data related to buyers and sellers, and providing the historical data to Market Participants.

3. Providing advanced data analysis tools to Market Participants.

Objectives behind procedural aspects related to Market Oversight (Part 7):

1. Detecting and preventing market manipulation, insider trading, cartelization, and abuse of dominant position by any Market Participant.

2. Ensuring that Market Participants have confidence in the integrity and fairness of power markets.

3. Discovery of prices in a transparent and competitive manner.

## EAL Opinion on CERC (Power Market) Regulations, 2020

"Market Coupling" (2 (af) & 37): The process of market coupling can bring economic efficiency gains for the market as a whole particularly for the market products with low liquidity. The country has adopted 'market coupling' through the SCED mechanism thereby bringing significant cost efficiencies in the sector. Internationally, such market coupling has been adopted for integrating a number of hitherto uncoupled markets.

European electricity market provides a practical example of such a coupling that links a number of control/market areas thus reducing price differentials. In 2010, European countries adopted Price Coupling of Regions (PCR) that evolved into Multi Regional Coupling (MRC) that now includes 19 European countries.

Coupling Across Market Areas' vs 'Market Platform Coupling': SCED is an example of coupling across market areas. This has improved/optimized cost of power procurement by utilities leading to cost savings. A Power Exchange (PX) itself presents an example of coupling across 'market areas'. This is



violated only in the case of market splitting. So far, we did not have a provision for coupling across market platforms. Let us also consider some of the analogous contexts in capital and commodity markets.

The two leading stock exchanges of the country, the BSE and the NSE, which have continuous market trading remain decoupled as significant liquidity and competition has thinned possibility of arbitrage across these markets. Similarly, multiple commodity exchanges/market continue to flourish, some in the regional, and other in the national context.

In the context of PXs, the principles of 'for delivery' should negate the opportunity for arbitrage even if there are differences in prices discovered across PXs for the same time block and market area. The difference in discovered prices across the PXs arises not only on account of differences in bids, market participation and liquidity, but also the price discovery algorithms adopted by the PXs.

- Three Propositions for Market Coupling: Considering that it is going to be a significant step with distributional impact across the market platforms and may also influence future investment, the following three steps may be adopted in the interim.
  - (i) Adopt market coupling for the market products with low liquidity. For example, the TAM, which need this more than the more liquid market products.
  - (ii) Provide for a uniform algorithm across PXs, as adopted in the European context.
  - (iii) Increase the depth of the market as it currently covers around 4.3% of the total electricity generated in the country (2018-19) and had only marginally inched up this year. This would increase liquidity and competition across PXs. Higher liquidity and introduction of MBED may obviate the need for the market coupling in future.
- **A** Phased Implementation Begin with Low Liquidity Products: Given the significantly skewed market volume across the two power exchanges, there would be distributional impact of the market participants on the PXs. It would be useful to present a summary of the overall efficiency gains and the distributional impact, if any. This may help in evaluating overall impact for the sector. One would also expect likely redistribution of cleared market volume across the PXs. Given that such market coupling would significantly erode the value of one of the leading PX, which has been built its clientele due to its business practices, such an assessment would be desirable for long-term market development in the country.

Further, the market coupling would be significantly beneficial for those market products which have considerable low liquidity. For high liquidity market segments, one would expect higher levels of market efficiency.

- A Market Coupling and Payment Risk: How would payment risk associated with the market clearing and payment would be managed across the multiple PXs? Would that mean 'coupling' of the same as well?
- Solution Description Contracts (2) To facilitate extensive, quick....(2) To facilitate extensive, quick....(2) To facilitate extensive, facilitate fair, transparent, quick, efficient, and extensive dissemination of the market outcome".
- Prevention of Cartelization in Market Oversight (49): Cartelization may be either explicit or otherwise demonstrated in the action of the participant. The provisions for market oversight should include both cases.
- 3 Capacity Market and Ancillary Services (4): The regulations should provide greater detailing of market design and, price discovery for ancillary services and capacity market. It is not currently included in the draft. Provisions for the introduction of such market, design of contracts and the role of the PXs over such contracts is ambiguous.



J Design of Market for Ancillary Services: Given that ancillary services (the RRAS) is currently being managed and needs to be managed by a system operator, the present design has limited participation and does not foresee participation by broader set of system constituents including provider of storage services as well as aggregators for demand response schemes.

Considering that SCED has been expanded to include intra-state entities, a similar approach can be adopted for RRAS. Further, improvement in the market design may be brought about by introducing single side bid-based price discovery allowing participation of generators on a competitive basis. This would also provide for participation of merchant generators as well as aggregators for demand response.

- Source: A research undertaken at Energy Analytics Lab (EAL) demonstrated benefits of co-optimization of energy and RRAS market in the Indian context. Adoption of a similar approach can be considered to enhance overall cost efficiency.
- 3 Roadmap for Power Market Derivatives: As the power market matures, there may be a case for introducing derivatives for legitimate market participants with direct exposure to the buy/sell positions. The Commission may float a discussion paper for further deliberating a roadmap for introduction of derivatives for electricity contracts in the country.
- Prevention of Circular Trading (2 (k)): Legitimate needs for taking buy to sell or sell to buy position across different market segments may arise due to the availability of more reliable information about generation/demand near to the time of delivery. For example, a decrease/increase in demand or generation from RES may necessitate the need to offload a buy/sell contract cleared in the DAM, in the RTM later. However, circular trading that aims to enhance the market volume with no intention of taking the delivery should be checked. The regulation should further elaborate on circular trading (primarily meant for squaring off the positions) and differentiate with the rebalancing of the portfolio (for delivery services)
- **A** Insider (2 (z)): An insider should also include a person who has acquired unpublished price sensitive information through unfair/unethical means in addition to those through criminal activity.
- J Unpublished Price Sensitive Information (2 (bf)): This should also include information relating to contracts to be transacted or those that were supposed to be transacted on a PX. The price sensitive information should also include quantum along with price of the contract.
- **J** Price Discovery (5.1 (a)): "Price Discovery shall be done by Power Exchanges or by......" should be replaced by "Price Discovery shall be done by Power Exchanges, or by Market Coupling Operator, as and when notified by the Commission.
- Scheduling and Delivery of Term-Ahead Market (3 (b) (iii))): Physical delivery mechanism is considered only in the case of Term Ahead Contracts. "Term Ahead Contracts shall be settled only by physical delivery of electricity without netting and shall be binding on the participants executing the transactions".
- Sources Transacted on the OTC Market (7.1): The regulations identify the role of the SERCs to regulate the OTC market, seemingly for intra-state transactions. There is discrepancy regarding OTC market as approved by the SERCs, they would not be able to carry out inter-state transactions.
- J Delivery Procedure for OTC Market (7.2 (i)): The delivery procedure of Open Access Regulations should be determined by the Appropriate Commission. Moreover, the preference order for 'delivery' is not clearly stated.
- 3 Bye-laws, Rules and Business Rules of Power Exchange (19): "Trading margin for a Trader Member and service charge for a Facilitator Member" is defined as a part of bye-laws, rules and business rules in accordance to which the PX should function. But it is not clear, how a PX will monitor the buying and



selling price for a trader/facilitator member to ensure that appropriate trading margin/service charges are being levied.

- A Management of Power Exchange (20): The qualification of one of the three full- time professionals is mentioned as "Degree in Computer Science/Computer Application/Information Technology with...", which should be made generic as nomenclature for such degree differs across institutions.
- 3 Objectives of the OTC Platform (42.2): This should include "To ensure transparency and an efficient participation and price discovery, the information regarding availability of various contracts and the contracts executed on OTC platform should be made available in the public domain".
- Trading Margin and Service Charge (24): "Provided that the service charge shall not include any charges......" should be replaced by "Provided that the trading margin and service charge shall not include any charges....".
- 3 Market Surveillance by Power Exchange (32.5): The quarterly surveillance report submitted by Market Surveillance Committee should be made publicly available along with market monitoring report of CERC.

In addition to the market surveillance undertaken at the level of the PXs, an overall market surveillance would be required for effective market coupling. This will also help to monitor the circular trading involving more than one PX.

- **A** Designation of Market Coupling Operator (38): The criterion for selection of Market Coupling Operator is not included in the draft regulation. Certain key aspects for the same should be identified.
- **A** Procedure for Market Oversight (50.2 (b)): "Involvement of Market Participants in any of the ....." should be written as "Involvement of Market Participant(s) in any of the .....".
- 3 Regional Participation on the Indian Power Exchanges: The Indian PXs may provide for trading of cross-border as well as country-specific contracts in future. An enabling provision, taking into account developments under regional cooperation treaties, may be included.
- A Market Manipulation: Definition of "Market Manipulation" should include the case of 'secures or attempts to secure, by any member of the PX or client, relatively lower buy price while curtailing supply to other beneficiaries entitled to receive the same power'. It should include disseminating any information not only through the media but by any means.

## EAL NEWS

EAL has launched new dashboards on Load Duration Curve (All India & State-wise), Power Map of generating stations, and Coal Availability, providing users relevant information.



## Load Duration Curve (1<sup>st</sup> Jul, 2020 - 30<sup>th</sup> Sept, 2020)



# Power Map Dashboard Image: Display Di



## Coal Availability Dashboard



## **EAL's Android App**



EAL has developed an Android App, which is available on the Google Play store, to provide seamless access to EAL's registered users.

It can be downloaded using the link

https://play.google.com/store/apps/details?id=e.admin.eal\_app

We want to take this opportunity to thank you for being an active member of EAL's web portal. We hope that you find this as a meaningful and insightful initiative.







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