Staff Paper

on

Power Market Pricing

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October 2022

Disclaimer

The issues presented in this Discussion paper do not represent the views of the Central Electricity Regulatory Commission, its Chairman, or Members, and are not binding on the Commission. The views are essentially of the staff of CERC and are circulated with the aim of initiating discussions on various aspects of pricing in power market and soliciting inputs of the stakeholders in this regard. This is not a policy note and has not been subject to regulatory consultations or empirical studies.

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1. Background

1.1. The enactment of Electricity Act, 2003 led to the development of competitive electricity market in the country. The Act, inter-alia, provides for non-discriminatory open access to the transmission and distribution, de-licensing of generation including captive power generation, and recognizes trading as a distinct activity. These provisions seek to encourage competition in all segments of the electricity industry and also provide an enabling environment for development of bulk power market in India.

1.2. The responsibility of developing the market in electricity has been vested with the Regulatory Commissions. The open access regulations, inter-state trading regulations, trading margin regulations, power market regulations, etc. of the Central Electricity Regulatory Commission (CERC) have facilitated power trading in an organized manner. Power Exchanges have been set up to develop a common platform for conducting transparent, equitable and efficient trade mechanism. These exchanges are proven platforms that enhance competition, enable transparent price discovery, and foster technical innovations and investments.

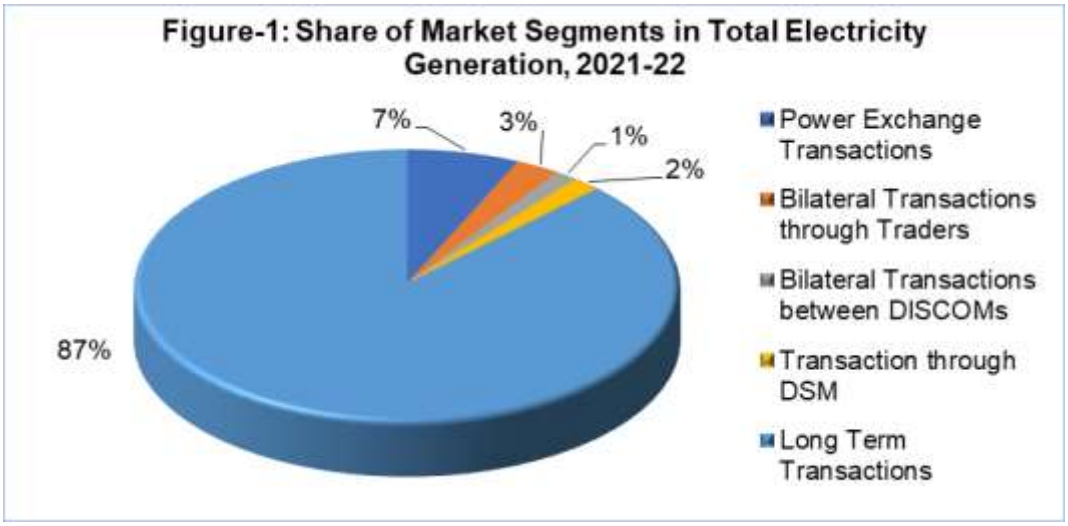
1.3. Due to these inherent features, the volume of electricity transacted through Power Exchanges has increased manifold over the years at a CAGR of about 25% from 2009-10 to 2021-22. Though the overall demand-supply situation in the power sector generally gets reflected in the prices discovered through the Power Exchanges, some spikes in the prices were witnessed in October 2021. The situation, however, was short-lived and improved with increased supplies and fall in temperature which lowered the demand pressures. During late March 2022, similar phenomenon was observed due to unprecedented high demand without commensurate increase in supply and the prices in both DAM and RTM remained significantly high for a consistent period which led to regulatory intervention in terms of imposition of price-ceiling in DAM and RTM initially, which was later extended to all other market segments. Since then, the price ceiling has been in force to curb abnormal market trend and to protect the interest of consumers. The situation in other countries is also not so different and there have been instances of

regulatory or policy interventions ranging from suspension of trading activities, imposition of price caps, and automatic price adjustments, etc.

1.4. In the wake of these events, it is imperative to review the regulatory framework, especially pricing methodology in this context and explore possible options to deal with such situations in a predictable manner. This paper has been prepared with the intention to initiate comprehensive discussion on all these and related aspects and to invite stakeholders comments on desirable regulatory and policy measures to deal with such unprecedented events.

1.5. Current Short-Term Power Market Scenario

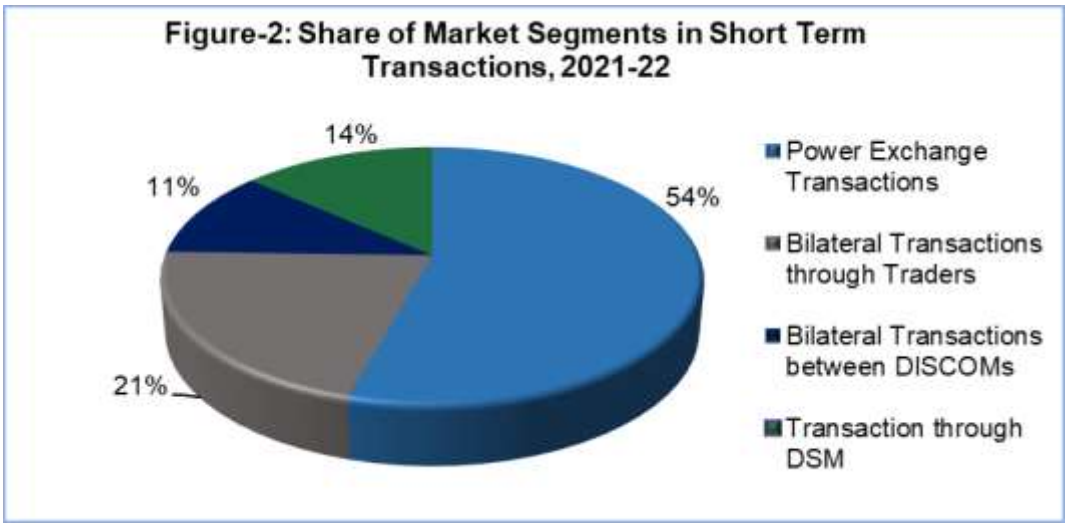
1.5.1. At present, bulk electric power supply in India is predominantly tied up in long-term contracts. For meeting their daily power needs, DISCOMs who have the obligation to provide electricity to their consumers, mainly rely on supplies from these long-term contracts and the remaining is procured through bilateral transactions with other DISCOMs, through power exchanges or traders. As depicted in Figure-1, at 87%, long-term transactions dominate the share of total electricity transactions in the country.



Source: CERC Market Monitoring reports

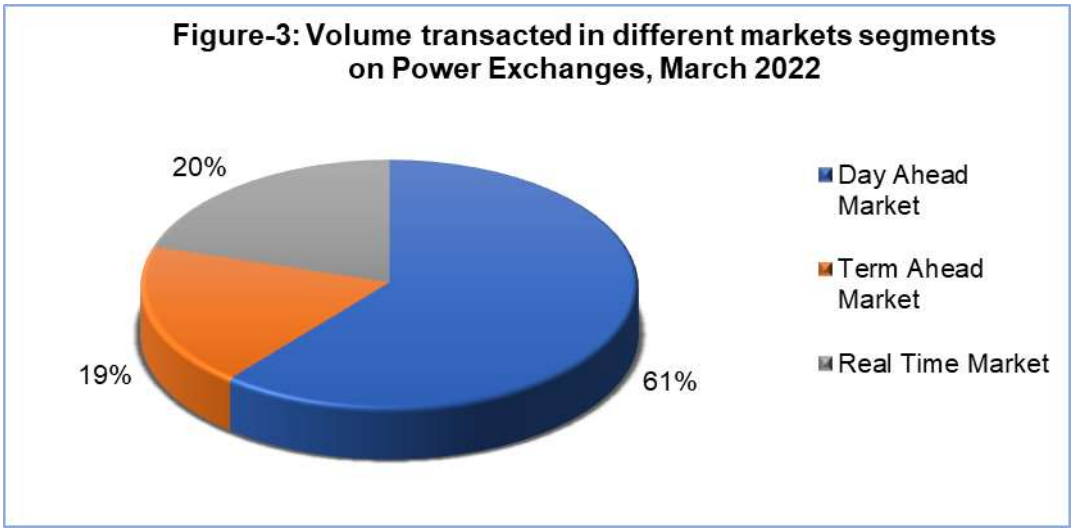
1.5.2. The Year 2021-22 saw an uptick in procurement through short-term transactions, particularly through power exchanges. The share of short-term transactions was about 13%. Of the total short-term transactions, the volume transacted through power exchanges was maximum at 54%, followed by

bilateral transactions through traders at 21%, transactions through DSM at 14% and bilateral transactions between DISCOMs at 11%.



Source: CERC Market Monitoring reports

1.5.3. Of the total volume transacted through power exchanges, majority is being transacted in Day Ahead Market (including G-DAM), followed by Real Time market and Term Ahead Market (including Intraday, DAC & G-TAM).



Source: CERC Market Monitoring reports

1.6. Institutional Arrangements for Short-term transactions

1.6.1. *Over the Counter (OTC) Market*

1.6.1.1. A key avenue for trading of electricity is the OTC market. This is a market where OTC Contracts are transacted between the sellers and buyers directly or through a Trading Licensee and such transactions are not through any electronic exchange.

1.6.1.2. The Commission made provisions for an OTC Platform in the CERC Power Market Regulations 2021 and notified the Guidelines for registration & operation of an OTC platform. The objectives of the OTC platform are to (i) provide an electronic platform with the information of potential buyer and seller of electricity; (ii) maintain a repository of data related to buyers and sellers and provide such historical data to market participants; and (iii) provide such services as advanced data analysis tools to market participants.

1.6.2. *Power Exchanges*

1.6.2.1. Power Exchanges commenced operations in India in August 2008. These are neutral electronic platforms and allow electronic bidding from across the country and undertake price discovery.

1.6.2.2. At present there are three power exchanges operating in India. While IEX and PXIL commenced operations in 2008, the Commission granted registration to the third power exchange viz., HPX, which then commenced its operations in July 2022.

1.6.2.3. Various contracts have been introduced and are available for trading on the power exchanges since the inception.

1.7. Products & Pricing Principles at Power Exchanges

1.7.1. The power exchanges commenced operation with the day ahead market (DAM) and have subsequently introduced various contracts, all approved by the Commission. These contracts are briefly illustrated below:

Figure-4: Products/Contracts at Power Exchange

1.7.2. Based on the pricing principle, the contracts are broadly categorized into two types:

i. **Collective Transactions** - the price is discovered through anonymous and simultaneous competitive bidding by the buyers and sellers. {As scope of the present paper this is elaborated in following paras}.

ii. **Continuous Transactions** – the buy and sell bids are matched on a continuous basis with price-time priority. For a specific Contract, the seller with minimum quote and buyer with the maximum quote are considered as best seller and best buyer. In case, best buy order is better than or same as best sale order, they are matched resulting into Contracts.

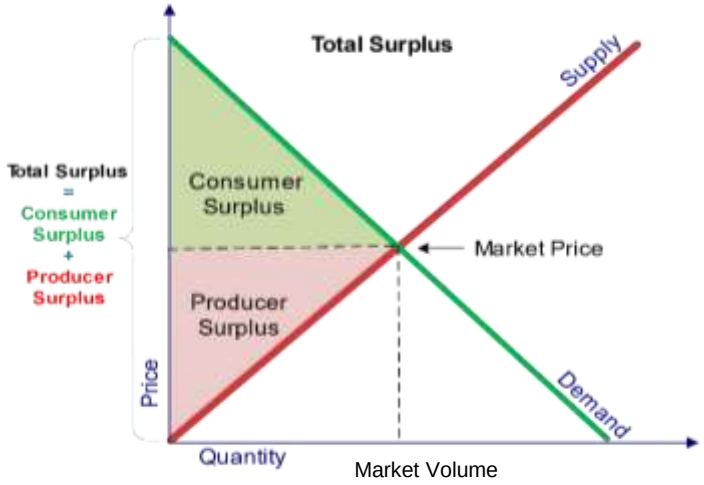
1.8. Collective Transactions at Power Exchanges

1.8.1. Day Ahead Contracts (including Green Day Ahead Contracts) and Real Time Contracts are the contracts wherein Collective transactions occur. In Day Ahead Market (DAM) the transactions occur on day (T) and delivery of electricity is on the next day (T+1). Whereas, in Real Time Market (RTM) the transactions occur on day (T) or day (T-1) and delivery of electricity is on day (T) for a specified delivery period.

1.8.2. **Price Discovery:**

1.8.2.1. The mechanism adopts the principle of maximization of economics surplus (sum of buyer surplus and seller surplus), taking into account all the bids.

Figure-5: Economic Surplus

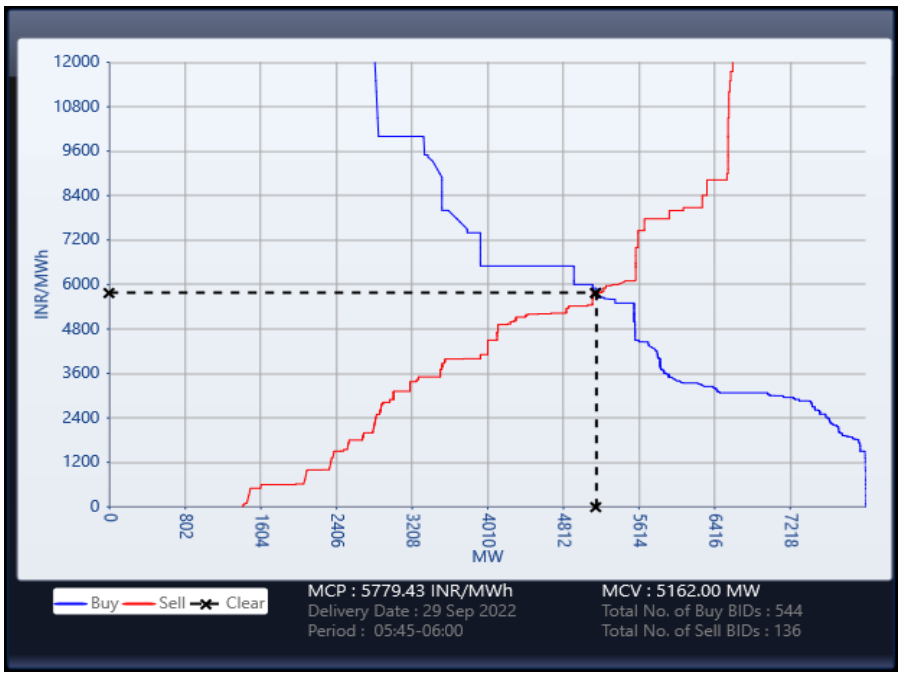


1.8.2.2. Methodology - **Double Sided Closed Auction with Uniform Market Clearing Price**

- A closed double-sided anonymous auction for each 15-min time block on day ahead or real time basis.
- Anonymous bids are offered by both buyers and sellers of electricity. These bids are different combinations of Price & Quantities.
- The offered bids are aggregated to give Aggregated Demand (AD) and Aggregated Supply (AS) Curves. These curves are drawn on Price-Quantity axes. AD curve is downward sloping and AS curve is upward sloping curve.

- Intersection of AD and AS Curves give the Market Clearing Volume (MCV) and Market Clearing Price (MCP). All the buyers and sellers on the left of the intersection point are cleared in the market. After considering transmission constraint, if any, the final MCP and Volume are determined.
- The price discovered for unconstrained market is a uniform market clearing price (UMCP) for all the buyers and sellers who are cleared

Figure-6: Aggregate Demand-Supply Curves (Day Ahead Market)



Source: IEX Website

2. Issues in Pricing Methodology

2.1. At present, the mechanism utilized in India for Collective transactions leads to discovery of a Uniform Market Clearing Price (UMCP). All leading Power Exchanges across the world have also adopted the UMCP mechanism in the Day Ahead Market as shown in the Table below:

Table-1: Price Discovery Mechanism adopted in various countries

Countries	Exchange Name	Price Discovery Mechanism
Europe	Epex spot, Nord Pool	Uniform Clearing Price
Scandinavia	Nord Pool	Uniform Clearing Price
Russia	ATS (Administrator of Trade System)	Uniform Clearing Price
North America	CAISO, PJM, ERCOT,ISO-NE, SPP, MISO, AESO, NYISO	Uniform Clearing Price
Australia	AEMO (NEM)	Uniform Clearing Price
Japan	JEPX	Uniform Clearing Price

2.2. However, due to a uniform price for all type of market participants who are cleared, all sellers who bid lower prices get an extra profit (difference of the UMCP and the bid price), which constitutes the seller's surplus. Owing to the recent events in the electricity market with prices reaching alarming levels, concerns have been raised that some sellers are making huge gains in the market due to this market auction design. This has prompted the regulators and policy makers to analyze different possible pricing methodologies .

2.3. Uniform Pricing vs Pay as Bid

2.3.1. The difference between the two lies in the final price paid to the cleared sellers.

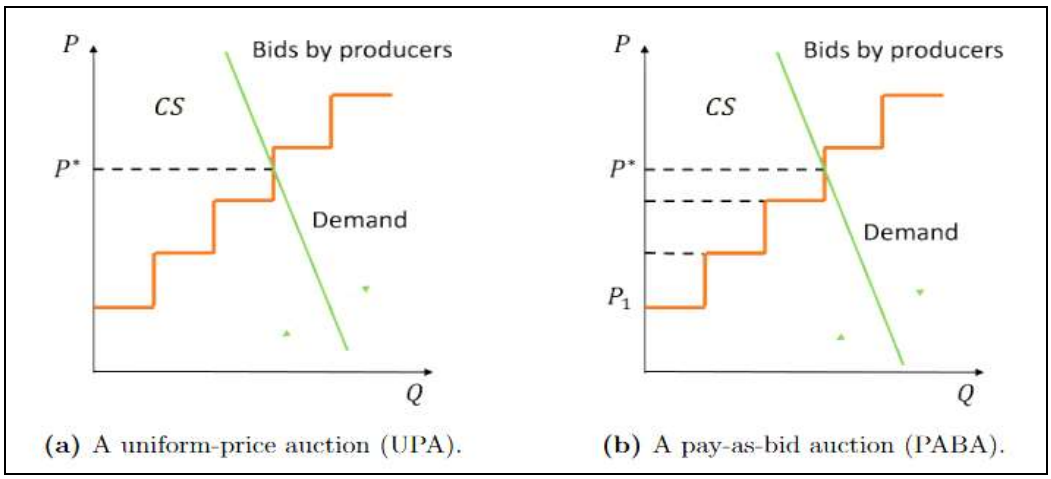
2.3.2. ***Uniform Pricing*** – All the cleared sellers receive the same price, i.e. Market Clearing Price (as explained above it is at intersection of aggregated demand and supply curves). As observed, the Market Cleared Price is the bid price of the most expensive seller cleared to meet demand.

2.3.3. ***Pay as Bid*** – Prices paid to the cleared sellers are based on the sell bid offered by the respective seller. Thus, each seller is paid a different price tied

to the bid offered by them and these prices are not dependent on the price of the most expensive seller cleared to meet demand.

2.3.4. One of the recent papers on comparison between Pay-as-Bid and Uniform-Price auction by Willems and Yu, 2022, provides[1] a detailed analysis on Bidding and Investment in Wholesale Electricity Markets. Figure-7 shows the functioning of these two auction process wherein bids by producers are represented by the increasing step function in orange. The green downward sloping curve shows the aggregate demand. The market clears at the intersection where the aggregate demand balances the supply. In a uniform-price auction, all accepted bids are paid the price of the marginal offer, while in a pay-as-bid auction, all winning producers are remunerated at their bidding prices, respectively (i.e., P1, P2 and P3). The consumer surplus as shown in the figure, is the difference between consumer's willingness to pay and the price(s) received by winning producers. However, out of these two, which one would guarantee higher consumer surplus is not certain.

Figure-7: Comparison of uniform-price auctions and pay-as-bid auctions



Source: Willems and Yu, 2022

[1] https://www.tse-fr.eu/sites/default/files/TSE/documents/conf/2022/energy/yu.pdf

2.3.5. The table below compares the pros and cons of the two methodologies:

Table-2: Pay-as-Bid vs Uniform Pricing

Methodology	Pros	Cons
Pay as Bid	1. May decrease electricity prices, as the reference price would become the average cost of production instead of the marginal one as in case of pay-as-cleared (UMCP) 2. Promotes market competition	1. May encourage sellers to offer high bid price 2. By design this method will benefit those who own more information about predicting the market-clearing price, rather than those with most efficient technologies 3. Small firms, even with efficient technologies may end up with an inefficient merit order, if they cannot afford the cost of making predictions. 4. Reduces transparency of prices
Uniform Market Clearing Price	1. Provides producers with correct short-run price signals and induces sufficient investment incentives 2. A key feature of this market design is that it is technology neutral and treats all electricity the same (whether it is from fossil fuels or renewables or 'offerings' via reduced demand). 3. Supports economic dispatch of power resources	1. Sellers with lower bid price are able to earn extra profits and sometime windfall profits 2. Market Clearing Price is Demand sensitive

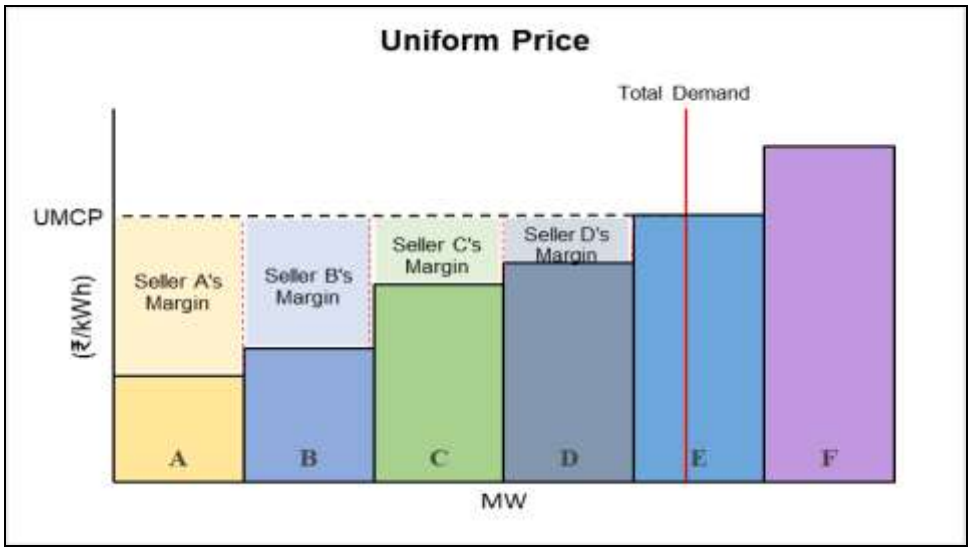
2.3.6. It is difficult to conclude, however, whether the overall cost of meeting the demand is affected by choice of pricing methodology. In a competitive market, any difference in cost, due to the two methodologies, becomes a function of the seller bidding behavior.

2.4. Supply Shortage and Uniform Pricing

2.4.1. Globally Uniform Market Clearing Pricing is the most commonly adopted pricing methodology but with the recent events in the electricity sector, concerns have been raised regarding the efficacy of this market design.

2.4.2. As evident from Figure 8, the Market Cleared Price is the bid price of the most expensive seller cleared to meet demand and received by all cleared sellers. Thus, price of the margin setting technology, generally gas-based or imported coal-based power plants, has an impact on revenue earned by sellers with lower marginal costs such as lignite-based power plants, cheaper coal-based generation, RE generators etc. These are referred as **Inframarginal** generators.

Figure-8: Market Prices and Margins under Uniform Pricing



2.4.3. In March 2022, India witnessed a period of demand surge coupled with supply shortage. The demand surged due to factors like rise in temperature causing early onset of summers and increase in economic activities with lifting of COVID-19-related restrictions. On the other hand, increase in the supply has been limited. The situation has been further aggravated due to geo-political factors affecting the fuel supply and certain domestic supply constraints. Many countries have witnessed/ are witnessing similar supply crisis like situation across the globe.

2.4.4. The increased prices of fuel, particularly imported coal led to a significant increase in marginal costs of the margin setting generators of market. This, along with surge in demand led to abnormally high market clearing price, frequently touching Rs.20/kWh, i.e., the maximum quotable price.

2.4.5. Significantly high market prices and apprehensions regarding super normal profits earned by the inframarginal generators led to various policy and regulatory interventions so as to protect the interests of consumers. Globally also, policy makers and regulators had to resort to various uncoventional measures during these challenging times.

2.5. Energy Crisis across Globe prompts Market Interventions

2.5.1. *AUSTRALIA*

2.5.1.1. Since Q1 of 2022, Australia had been witnessing a crisis like situation in energy market, which peaked in June 2022, with significantly high prices of electricity. The energy challenge has been as a result of several factors:

- A large number of generation units out of action for planned maintenance - a typical situation in the shoulder seasons
- Planned transmission outages
- Periods of low wind and solar output
- Around 3000 MW of coal fired generation out of action through unplanned events
- An early onset of winter - increasing demand for both electricity and gas
- High reliance on gas-based generation
- High international commodity prices
- Under supply of fuel

2.5.1.2. The energy challenge made market interventions inevitable. Some of the major steps[2] taken by Australian regulator and market operator were:

2.5.1.3. **Administered Price Cap** – According to the Australia's National Electricity Rules, electricity spot prices reaching a cumulative high price threshold[3] of

[2] https://www.aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/market_event_reports/2022/nem-market-suspension-and-operational-challenges-in-june-2022.pdf?la=en&hash=B2BC69EDBEBEB3A3A7A7D56B1700051B

[3] An administered price is triggered for a trading interval when the sum of the spot prices for the previous 336 trading intervals (equivalent to seven days) reaches the cumulative price threshold (CPT). The CPT is

$1,359,100 (accumulated over 7 days), automatically triggers an administered price cap of $300/MWh. On 12nd and 13th June 2022, this was triggered in major regions as prices reached the cumulative high price threshold.

2.5.1.4. **Manual directions to generators** – As a consequence of administered price cap the generation bids reduced as some generators revised their market availability. This further contributed to supply shortfall. To maintain power system security and reliability, the Australian Energy Market Operator (AEMO) directed some generators to continue meeting consumers' demand to improve reserve conditions. The Australian Energy Regulator (AER) warned generators that were withdrawing capacity from market – specially to avoid the administered price cap - to heed with market obligations.

2.5.1.5. **Suspension of Electricity Market** - The AEMO, on 15th June 2022[4], suspended spot market temporarily in all regions of its National Electricity Market (NEM) citing that critical power supply shortfalls made it impossible to continue operations. The market operator highlighted that it was forced to direct five gigawatts of generation through direct interventions on 14th June 2022, and it was no longer possible to reliably operate the spot market. The prices during suspension were determined according to the published market suspension pricing schedule by AEMO[5].

2.5.1.6. The market operator rolled out an administered price cap compensation process that allows generators, ancillary service providers and demand response service providers to claim compensation if they provided energy or service during cap period and incurred a net loss.

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calculated according to the formula defined by the National Electricity Rules (NER), and published by the Australian Energy Market Commission (AEMC) website. It is reviewed annually and applies from 1 July each year. The CPT for the period from 1 October 2021 to 30 June 2022 was $1,359,100.

[4] https://aemo.com.au/newsroom/media-release/aemo-suspends-nem-wholesale-market

[5] https://aemo.com.au/en/energy-systems/electricity/emergency-management/guide-to-market-suspension-in-the-nem

2.5.1.7. The suspension was lifted on 24th June 2022 in all regions of NEM[6]. The decision came as AEMO witnessed return of generating units from outage, improved visibility of availability, reduced shortfall and fewer manual interventions required by AEMO.

2.5.2. **EUROPEAN UNION**

2.5.2.1. The electricity prices in EU region reached alarming levels in first quarter of 2022. The European Power Benchmark averaged €201/MWh in this period – 281% higher than in Q1 of 2021. This energy crisis, which continues to reign in EU at present, is due to pressure on wholesale electricity market due to various factors like:

- Gas supply crisis
- High commodity prices (mainly gas, but also coal)
- Lower availability of some conventional plants
- Reduced Hydro based generation due to dry weather in southern & Nordic region
- Unplanned outages in France
- Scheduled closure of capacity in Germany

2.5.2.2. As per the 'European Union Agency for the Cooperation of Energy Regulators' assessment of the EU wholesale electricity market design (ACER, April 2022)[7], current energy crisis is in essence a gas price shock, which also impacts electricity prices. It states that even before the height of the current crisis, the EU's wholesale electricity market design was subject to debate (in technical, academic as well as policy circles), in particular as to whether the current market design is fit-for-purpose given the significant changes needed to deliver the clean energy transition or whether, and if so, to what extent, the market design would need further adjustment.

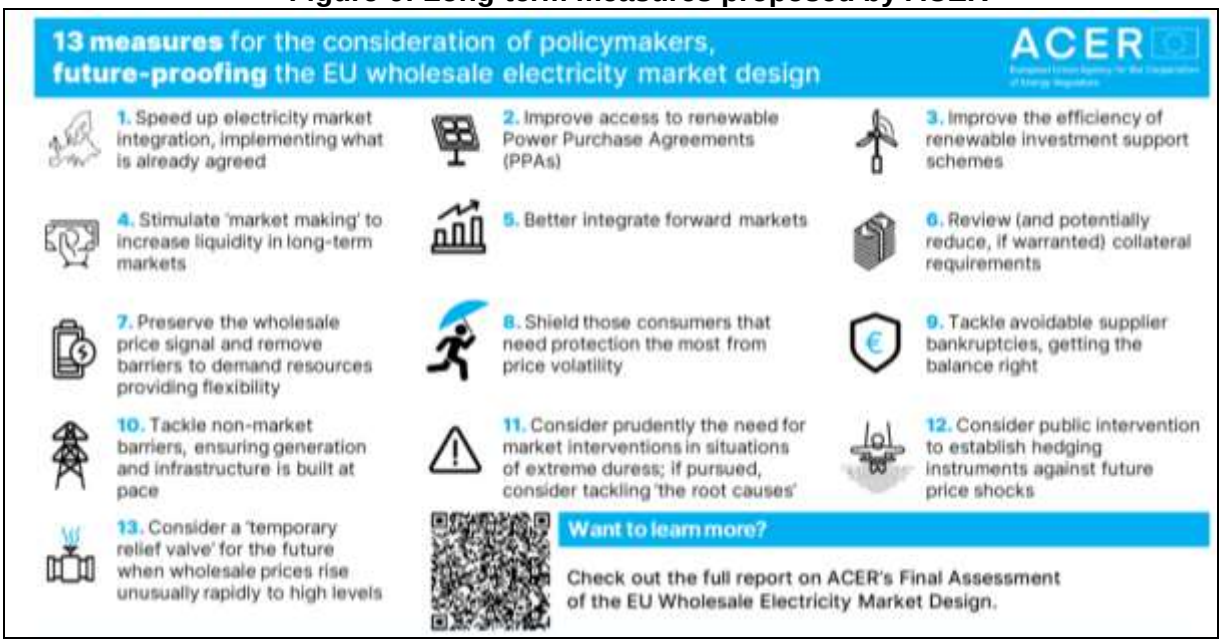
2.5.2.3. Overall, ACER finds that while the current market design is worth keeping, some longer-term improvements are likely to prove key in order for the

[6] https://aemo.com.au/newsroom/media-release/aemo-lifts-market-suspension

[7] https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER%26%23039%3Bs%20Final%20Assessment%20of%20the%20EU%20Wholesale%20Electricity%20Market%20Design.pdf

framework to deliver on this decarbonisation trajectory, and to do so at lower cost while ensuring security of supply.

Figure-9: Long-term measures proposed by ACER



Source: ACER, Final Assessment of the EU Wholesale Electricity Market Design, April 2022

2.5.2.4. As per the recent package of emergency measures to curb soaring electricity bills and coordinate member states' responses to the energy crisis published by the Council of European Union on September 30, 2022[8], the EU intends to both reduce electricity consumption during peak hours to rebalance the supply-demand mismatch and seize part of the revenues that power plants and fossil fuel companies have made due to high prices. The three measures announced by the Council are all time-limited and cover:

- An EU-wide plan to introduce **power savings**: a mandatory 5% target during peak hours, when gas plays a bigger role in price-setting, and a voluntary 10% reduction in overall electricity demand.
- A **cap on the excess revenues** made by power plants that do not use gas to produce electricity, such as solar, wind, nuclear, hydropower and lignite. The cap will be uniform and set at €180

[8] https://www.consilium.europa.eu/en/infographics/eu-measures-to-cut-down-energy-bills/

per megawatt-hour. All revenues that exceed the barrier will be collected by governments.

- **Levy on Profits**: A solidarity mechanism to partially capture the surplus profits made by fossil fuel companies (crude oil, gas, coal and refinery). Authorities will be able to impose a 33% levy on the profits made by these companies in the 2022 fiscal year – but only if the profits represent a 20% increase compared to the average since 2018.

2.5.3. **INDIA**

2.5.3.1. In March 2022, prices discovered at the power exchanges were significantly high. This was due to following factors:

- rise in temperature causing early onset of summers
- increase in economic activities with lifting of COVID-19-related restrictions
- domestic fuel supply constraints
- geo-political factors affecting the fuel supply and fuel prices
- supply not forthcoming until month of May 2022 when wind and hydro based generation are expected to come on stream

2.5.3.2. With due regard to the trend of demand and supply in the DAM and RTM leading to abnormal increase in prices, the Commission found it expedient to intervene in the market in the public interest.

2.5.3.3. On 1st April 2022, the Commission directed the power exchanges until further orders, to re-design, with immediate effect, the bidding software in such a way that members can submit their bids in the price range of Rs.0/kWh to Rs.12/kWh for DAM and RTM.

2.5.3.4. As a result of setting the ceiling price at Rs.12/kWh for DAM and RTM, the MCP in DAM and RTM was frequently hitting the ceiling price with the volume of buy bids much more than the volume of sell bids. As a result, the cleared volume was getting pro-rated amongst the buyers quoting the ceiling price in proportion to their bid volumes. Due to apprehensions of such pro-rating, it was observed that buyers increased their bid volumes at the ceiling price substantially, however they were still not able to meet their demand of electricity in the collective transaction segment of Power

Exchanges, viz., DAM and RTM. Therefore, to fulfill their supply obligations, the buyers shifted to other market segments of Power Exchanges, such as TAM. The difference in ceiling price between DAM/RTM and TAM led to shift in supply volume from DAM/RTM to TAM.

2.5.3.5. The Commission felt the need for a uniform price ceiling in all segments of the Power Exchanges so that there is no shift in supply volume from one segment of the Power Exchanges to another segment, induced by differential ceiling price between different market segments of the Power Exchanges; and so that there is no profiteering by the sellers in the backdrop of increased demand and reduced supply. So, on 6th May 2022, the Commission directed the power exchanges to revise the ceiling price of all segments to Rs.12/kWh.

2.5.3.6. Based on the assessment of demand-supply position in the power sector, it is felt that the high demand for electricity is likely to continue over the next few months due to factors like increase in economic activity, high agricultural load, increase in household demand, anticipation of peak demand (morning & evening peaks) to remain significant due to lighting and heating load in the winter month, festive season etc. Thus, the capping of ceiling price at Rs.12/kWh on all segments at power exchange, has been continued by the Commission, till 31st December, 2022.

3. Points for Discussion

3.1. Does Pricing Methodology need a change?

3.1.1. As inferred on comparison of the two pricing methodologies, in a competitive market, any difference in cost, due to the two methodologies, becomes a function of the bidding behavior of the sellers.

3.1.2. It is imperative to mitigate the concern of super normal profits which may apparently be achieved through pay-as-bid auction. While participating in the market, generators quote price to receive their marginal costs and in addition, recover part of their fixed cost. Pay-as-bid auction may encourage sellers to offer high bid price (higher than marginal cost) to earn a profit and also recover fixed costs (business rationale).

3.1.3. Given these facts, would it make sense to switch to pay-as-bid pricing methodology and would it address the concerns regarding super normal profits for inframarginal generators under Uniform Market Clearing Price?

3.2. What should be the criteria for Regulatory Interventions?

3.2.1. Market power is what should be a matter of concern. That is, as a matter of principle, is intervention in the market is justified when the price spike is a result of market power or misuse of market position by suppliers.

3.2.2. One school of thought would argue that if the price rise is caused by demand behaviour, we need to correct demand side and not further scuttle supply side. Options include demand reduction (by demand reduction we don't mean load shedding) through pre-notified demand response programme. Studies prove that compensating demand for load reduction is more cost and operation effective than procuring peak power. The signals that occasional price spikes give - in terms of the need for proper load forecasting, reserve margin, resource adequacy, demand response and other fast response reserves like ESS, should not be lost sight of.

3.2.3. However, the other school of thought believes that India cannot afford very high price caps or the standard scarcity pricing framework.

3.2.4. Given these realities,

- Would it be advisable to define a tolerance level (for instance, how many times during a day or over the week/month are we tolerant with the price touching the ceiling) beyond which intervention is justified?
- What should be the basis for such intervention and tolerance level in the Indian context?
- Would it be advisable to define a dynamic price cap - for example, if the prices breach the tolerance level as defined above,
    - the price cap is automatically reduced to a point where say 90% or 95% of the supply is cleared? or
    - generators are mandated to run and are compensated under administered route or based on some pre-specificed norms, till the situation (breaching the tolerance level) normalizes?
- Can a cap be considered on the excess revenues made by power plants that do not use gas or other high cost fuel to produce electricity, such as solar, wind, domestic coal, nuclear, hydropower and lignite? The cap could be uniform and set in advance based on the marginal generator amongst these inframarginal generators and all revenues that exceed the said cap may be collected by system operator.
- To partially capture the surplus profits made by the inframarginal generators, would it be advisable to impose a levy on supernormal profits, as was done by the Government for Petroleum?
- If price cap for inframarginal generators is levied, should the other supramarginal generators like gas based generating stations be left without a cap or a separate price of Rs 20 or so be levied for this segment as well?
- Any other suggestion?

*3.3. **How do we address the negative impact of price cap?***

3.3.1. While imposition of price cap ensures that the market prices remain reasonable and within bounds, the generators with variable cost higher than the price cap tend to go out of market. In order to attract more supply volume different countries have proposed measures of segmenting the market. While in Europe a price cap for only inframarginal technologies has been suggested, in India a proposal for introducing a separate High Price Market Segment within the existing day ahead market has been floated.

3.3.2. The following issues emerge in this context:

- What should be the basis for defining supramarginal or high cost generators? Technology or fuel source?
- Would there be enough liquidity in this small segment for collective transactions (demand and supply curve intersection) to take place?
- Would it lead to market power by these small sets of generators?
- If the high cost/marginal generator setting the market clearing price is a concern and a cause for market intervention, would Term Ahead Market (TAM) be a better option for such transactions to take place without affecting the rest of the buyers?
- Any other suggestion on mitigating the negative impact of price cap?

*3.4. **What should be the market design for incentivising demand response and energy storage system (ESS)?***

3.4.1. Record-breaking temperatures (summer/winter) and increased level of economic activities after lifting of pandemic restrictions have pushed up the energy demand across globe, putting pressure on energy prices. A reduction in demand may ease this pressure on prices.

3.4.2. In **EU**, a region wide plan to introduce **power savings** is propsed which includes

- a mandatory 5% target during peak hours, when gas plays a bigger role in price-setting, and
- a voluntary 10% reduction in overall electricity demand

3.4.3. As witnessed, prices were driven high due to high demand coupled with low supply, Demand-side response in such crisis situations would help lower prices.

3.4.4. Given these realities,

i. What should the appropriate market structure/design to encourage flexible resources like Demand Response and ESS?

ii. Apart from Time-of-Day (ToD) tariff or dynamic tariff for varied consumer categories, what are the mechanisms that can be considered for encouraging such resources?Can we think of bringing aggregators to pool together such resources and participate in the market? If yes, what should be bidding criteria or the cost recovery mechanism for such resources given that their usage is going to be limited to a very small duration during the year?

4. Comments solicited:

4.1 In view of the above discussions, comments of the stakehlders are invited on the issues and questions highlighted in section 3 of this Discussion Paper.