Staff Paper

on

Regulatory Oversight on Bidding Behaviour in Power Exchanges

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Disclaimer

The issues presented in this discussion paper do not represent the views of the Central Electricity Regulatory Commission, its Chairperson, or its individual Members and are not binding on the Commission. The views are essentially those of the CERC staff and are circulated with the aim of initiating discussions on regulatory oversight of bidding behaviour in Power Exchanges and soliciting inputs from the stakeholders in this regard.

1. Background

1.1. The Central Electricity Regulatory Commission (CERC) issued a Staff Paper on 'Power Market Pricing' in October 2022 (hereinafter 'CERC Pricing Staff Paper'). The CERC Pricing Staff Paper provided a brief review of the regulatory framework, pricing methodology in the Power Exchanges in India and other countries, and the possible options to deal with unprecedented situations like abnormal increases in prices. The key points for discussion raised in the CERC Pricing Staff Paper were as under:

i. *Does the Pricing Methodology need a change?*
ii. *What should be the criteria for Regulatory Interventions?*
iii. *How do we address the negative impact of price cap?*
iv. *What should be the market design for incentivising demand response and energy storage systems (ESS)?*

1.2. A total of 39 stakeholders have submitted comments on various issues raised in the CERC Pricing Staff Paper. The list of stakeholders and their comments are available on the CERC website http://www.cercind.gov.in/.

1.3. Many of the stakeholders have recommended continuing with the Uniform Market Clearing Price (UMCP) mechanism. Some have suggested using UMCP for the normal Day-ahead Market (DAM) and then transferring the residual uncleared bids to High Price Day-ahead Market (HP-DAM), which may utilise the Pay-as-Bid (PAB) mechanism. Some of the suggestions were related to benchmarking costs and defining varying price bands based on fuel/ source/ technology, while others have suggested defining categories based on historical bidding costs.

1.4. It has been observed that in the time blocks with inadequate supply or over demand, the aggregate demand and supply curves are made to intersect at the maximum price for price formation. This leads to a situation with buyers paying high prices, even when the cost of generation of infra-marginal producers is not that high.

1.5. In their comments on the CERC Pricing Staff Paper, some of the stakeholders submitted that such spikes in Power Exchange prices are very few in a longer time horizon, and the situation does not require regulatory intervention. However, in the interest of market participants, it is imperative to examine such situations and deliberate on possible measures to repose the participants' faith in the market outcome.

1.6. The Commission, in its Order dated 31st March 2023, in Petition No. 04/SM/2023, observed as under:

> *"8. While parting, we would like to underscore that the Commission is sensitive to the possible impact of frequent intervention in the operation of the power market, and accordingly, in the interest of ensuring regulatory certainty in the matter, direct the staff of the Commission to examine and propose measures to bring predictability on market intervention for consideration of the Commission."*

1.7. In view of the above, this staff paper has been prepared to present the possible measures to deal with such a situation and to bring predictability to market intervention. The paper, in the following sections, discusses the current price discovery mechanism in collective transactions, the issues involved in Uniform Market Clearing Price (UMCP) and Pay-as-bid (PAB), the proposed mechanism for screening of buy and sell bids, and the points for discussion with the stakeholders.

2. Price Discovery in Collective Transactions

2.1. Regulation 5(1) of the Central Electricity Regulatory Commission (Power Market) Regulations, 2021 (PMR 2021) provides as under:

"5. Contracts transacted on Power Exchanges

(1) Day Ahead Contracts and Real-time Contracts

(a) Price discovery:

(i) Price Discovery shall be done by Power Exchanges or by Market Coupling Operator as and when notified by the Commission.

(ii) Price discovery mechanism shall adopt the principle of maximisation of economic surplus (sum of buyer surplus and seller surplus), taking into account all bid types.

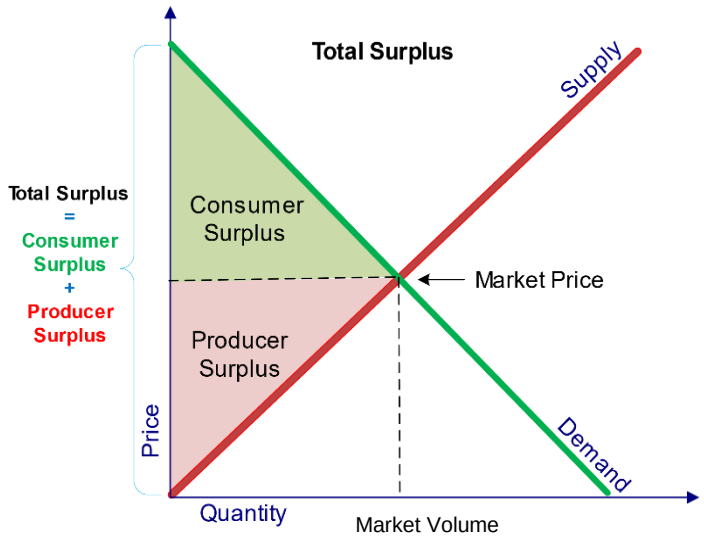
(iii) The bidding mechanism shall be double sided closed bid auction on day ahead basis or on real time basis, as the case may be.

(iv) <u>The price discovered for the unconstrained market shall be a uniform market clearing price for all buyers and sellers who are cleared.</u>

..”

2.2. The price discovery in collective transactions, i.e., Integrated Day Ahead Contracts (including Green Day Ahead Contracts and High Price Day Ahead Contracts) and the Real Time Contracts is based on a closed, double-sided anonymous auction with uniform price discovery for each 15-minute time block, on a day ahead or real-time basis. The UMCP mechanism adopts the principle of maximization of economic surplus (sum of buyer surplus and seller surplus), as stipulated in PMR 2021. Chart-1 below depicts the generation of total surplus, as a combination of consumer and producer surplus, in a typical demand-supply construct.

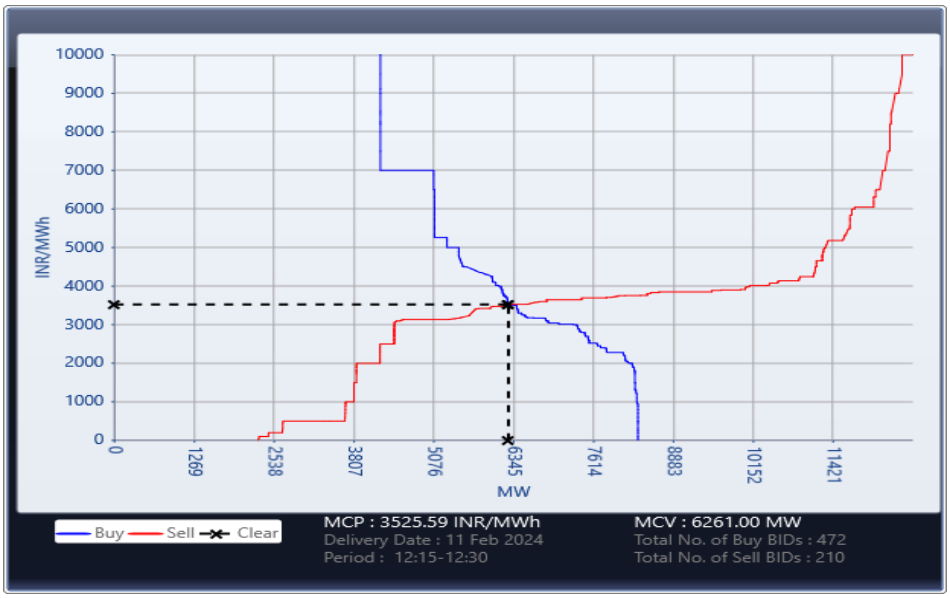
Chart-1: Uniform Market Clearing and Market Surplus



2.3. Under the collective transactions, anonymous bids in different combinations of Prices & Quantities are offered by both buyers and sellers of electricity, which are aggregated to form Aggregated Demand (AD) and Aggregated Supply (AS) Curves. The intersection of AD and AS Curves gives 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

constraints, if any, the final MCP and MCV are determined. The price discovered for an unconstrained market is uniform for all the buyers and sellers who get cleared. A typical AD-AS curve intersection is depicted in Chart-2.

Chart-2: Aggregate Demand-Supply Curves (Day-Ahead Market)



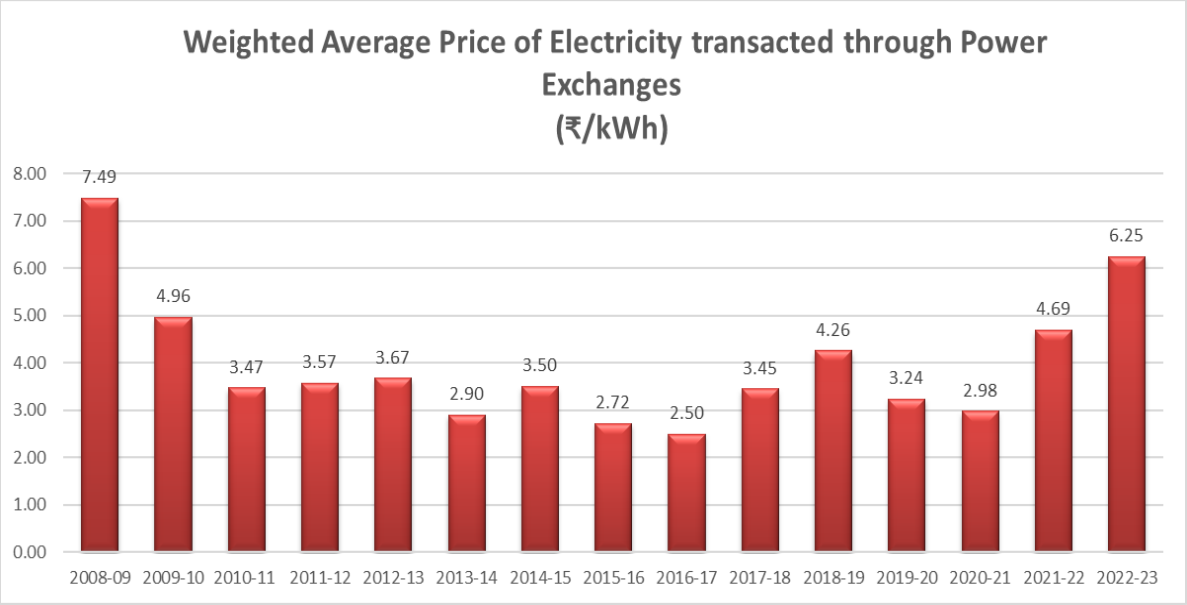
Source: IEX Website

3. Issues involved in UMCP and PAB

3.1. Prices on the Power Exchange not only signal efficient consumption and production in the short run but also signal opportunities for long-term investment. Therefore, high prices in the market indicate the need for new investments to come. In the past, high prices in the Southern region (SR) and low prices in the Northern, North Eastern, Eastern, and Western (NEW) grids indicated the need for investment in transmission capacity between the NEW grid and SR.

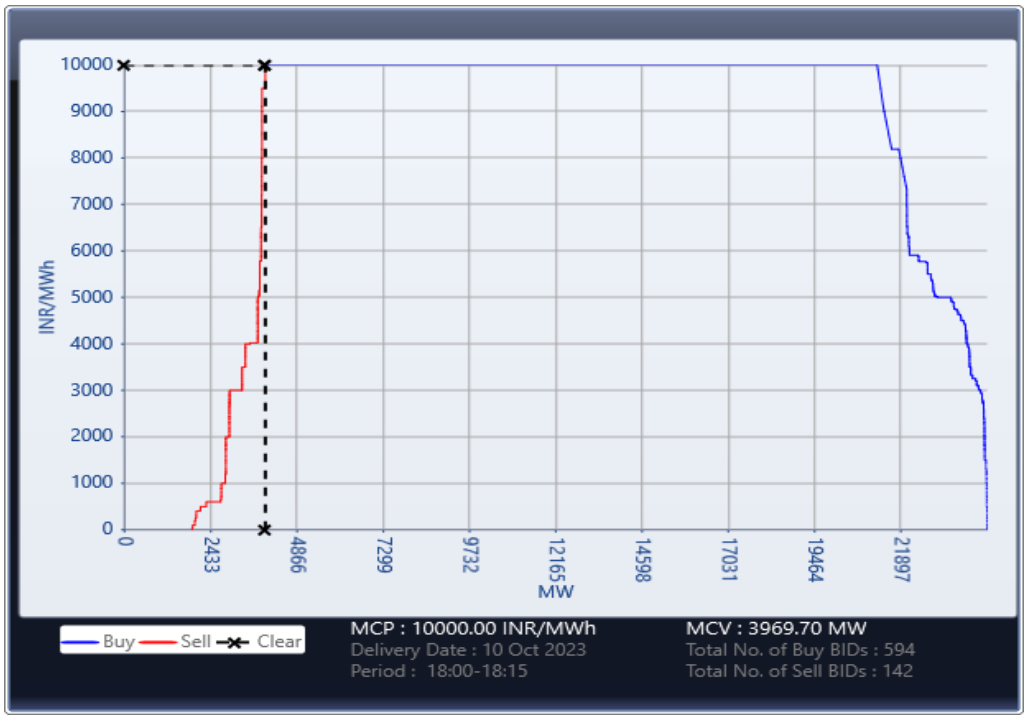
3.2. Chart 3 below shows the variation in the Power Exchange prices (weighted average of all market segments) since 2008-09. As may be observed, prices witnessed a sustained increase in the last few years.

Chart 3: Weighted Average Prices in Power Exchanges (Rs./kWh)



3.3. During Jan-Dec 2023, the Market Clearing Price (MCP) in the Day-Ahead Market (DAM) hit the price cap in approximately 21% of the time blocks, and the MCP in the Real-time Market (RTM) hit the price cap in approximately 17% of the time blocks. The recent phenomenon, particularly since 2022-23, reflects that there was inadequate supply in comparison to demand during peak hours. On several occasions, the aggregate demand and supply curves were made to intersect at the ceiling price for price formation. As may be observed in Chart-4, in a particular time block, the buyers were willing to buy more than 20000 MW at Rs. 10/kWh against the available total sell bids of about 3969 MW. In this case, about 97% of the sell bids were offered in the price range of Rs. 0-8/kWh. In order to arrive at an equilibrium price while fulfilling the basic demand and supply conditions, the supply and demand are made to intersect at the ceiling price of Rs. 10/kWh. Therefore, there are possibilities of buyers paying abnormally high prices, even when the cost of generation by infra-marginal producers is not that high.

Chart-4: Aggregate Demand-Supply Curves (DAM) in Shortage scenario



3.4. The Commission had to intervene in March 2022 and later in March 2023 to regulate such a situation through the imposition of a price ceiling, which is currently fixed at Rs. 10/kWh, applicable to all market segments in the Power Exchanges, except HP-DAM with a ceiling of Rs. 20/kWh. However, the issue of keeping a check on infra-marginal sellers and lowering the volatility in MCP persists, as is evident from the number of times the MCP touches the price ceiling during the high-demand season.

3.5. All regulations seek to regulate the conduct of agents by designing mechanisms that minimize information asymmetry. Power Exchange, with auctions based on double-sided closed bidding, is one such mechanism that intends to incentivise the sellers to reveal their true marginal costs and the buyers to reveal their marginal utilities from the consumption of electricity in a truthful manner[1].

3.6. However, under UMCP, in time blocks with supply shortages or high demand, all sellers who bid lower prices get extra profit (the difference between the MCP and the bid price), constituting the seller's surplus. There have also been

[1] This is based on the assumption that the markets are effectively competitive, and all buyers and sellers are price takers in the market.

suggestions that pay-as-bid mechanisms or, for that matter, revenue caps be considered by the Commission to determine the market clearing prices.

3.7. The extant literature and experience in other markets suggest that uniform clearing price leads to economic efficiency in the case of homogenous commodities. Further, since markets offer repeated opportunities to the same set of players, pay-as-bid mechanisms end up with outcomes very similar to uniform clearing price mechanisms. This is explained by the bidding behaviour in the two mechanisms. In the market with uniform market clearing, the sellers would generally bid based on their variable cost, and as the market clears based on the marginal generator's variable cost, such sellers would recover part or full fixed cost of generation by way of the difference between their variable cost and the market clearing price. On the other hand, under the pay-as-bid mechanism, the sellers tend to factor in part or full fixed cost while placing their bids, thereby raising the overall price in the market. Further, the infra-marginal sellers in such markets (with pay-as-bid mechanisms) have reduced incentives for enhancing the efficiency of their operations, as pay-as-bid creates a perverse incentive to bid at a higher price (at least for low-cost generators, which are likely to be dispatched anyway). Therefore, the extant mechanism of uniform clearing prices is economically efficient and this is borne by the experiences in other electricity markets as well.

4. Proposed Framework

4.1. The discussion in the preceding sections highlights that while the UMCP mechanism may be the suitable price discovery mechanism, there is certainly a need to broaden the scope of regulatory oversight to keep a check on the bidding/ participation in these markets. The Commission has been carrying out rigorous market performance monitoring and implementing various corrective measures at the overall market level. For instance, vide Order dated 21st February 2024 in Petition No. 2/SM/2024, the Commission has taken a slew of measures to ensure probity and transparency in market operation. A step forward shall be to conduct individual market participant behaviour monitoring and stipulate corrective and punitive measures at the individual participant level. In power markets, it is critical that the conduct of market players be regularly monitored against any abuse through bid price manipulation and/or quantity withholding. This essentially requires

screening of both the sell and the buy bids. Many of the stakeholders, including the Grid Controller of India, in their comments on the CERC Pricing Staff paper, have also emphasized the need for stringent monitoring to elicit disciplined behaviour from market participants and to ensure fairness and transparency in the market outcome.

Screening of Sell bids

4.2. There are several types of sellers on the Power Exchange, including IPPs, state distribution utilities (DISCOMs), private distribution licensees, ISGS, etc. A review of the sell bid data of the past year, i.e., from Jan 2023 to Dec 2023, was conducted to assess the bidding behaviour of these sellers. Some of the observations are discussed below:

IPPs/MPPs

i. It has been observed that some of the IPPs/MPPs and Open access consumers put their same sell quantum at vastly varying prices in the same block, as is evident from Table 1.

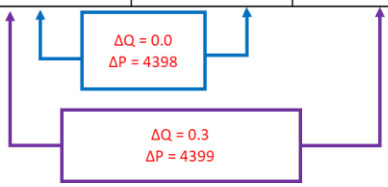
Table 1: Bidding behavior (Sell Bids)

Period	Delivery Date	Q@P 1	Q@P 2	Q@P 3	Q@P 4	Q@P 5	Q@P 6
23:00 - 23:15	07-01-2023	0.0 @ 0	0.0 @ 998	-247.8 @ 999	-247.8 @ 8387	-297.8 @ 8388	-297.8 @ 12000
23:15 - 23:30	07-01-2023	0.0 @ 0	0.0 @ 998	-247.8 @ 999	-247.8 @ 8387	-297.8 @ 8388	-297.8 @ 12000
23:30 - 23:45	07-01-2023	0.0 @ 0	0.0 @ 998	-247.8 @ 999	-247.8 @ 8387	-297.8 @ 8388	-297.8 @ 12000
23:45 - 24:00	07-01-2023	0.0 @ 0	0.0 @ 998	-247.8 @ 999	-247.8 @ 8387	-297.8 @ 8388	-297.8 @ 12000

ii. In another instance, some sellers submitted sell bids offering a high quantum at a low price and a low volume at a higher price within the same block (for e.g. 120 MW offered at Rs. 999/MWh and an additional 0.3 MW is offered at Rs. 5398/MWh), as can be seen in Table 2.

Table 2: Bidding behaviour (Sell Bids)

Date	Time Block	Q@P 1	Q@P 2	Q@P 3	Q@P 4	Q@P 5
08-08-2023	16	0.00@998	-120.8 @ 999	-120.8 @ 5397	-121.1 @ 5398	-121.1 @ 10000
08-08-2023	17	0.00@998	-120.8 @ 999	-120.8 @ 5397	-121.1 @ 5398	-121.1 @ 10000



iii. For the same time block, the supplier offered block bids (referred to as BBB) with high quantum and single bids (referred to as SBB) with very small quantum. The bidders offered both the block and the single bids at the same price (Table 3).

Table 3: Bidding behavior (Block Bid vs Single Bid)

Date	Time block	Q@P	Q@P
24-05-2023	6	-574.0@4437.0@BBB	-0.5@4437.0@SBB
24-05-2023	7	-487.0@4437.0@BBB	-0.5@4437.0@SBB
24-05-2023	8	-487.0@4437.0@BBB	-0.5@4437.0@SBB
24-05-2023	9	-487.0@4437.0@BBB	-0.5@4437.0@SBB
24-05-2023	10	-387.0@4437.0@BBB	-0.5@4437.0@SBB
09-06-2023	79	-341.0@3914.0@BBB	-0.1@3914.0@SBB
09-06-2023	80	-341.0@3914.0@BBB	-0.1@3914.0@SBB
09-06-2023	81	-341.0@3914.0@BBB	-0.1@3914.0@SBB
09-06-2023	82	-441.0@3914.0@BBB	-0.1@3914.0@SBB
09-06-2023	83	-516.0@3914.0@BBB	-9.1@3914.0@SBB

DISCOMs

iv. Some DISCOMs have offered both sell and buy offers within the same bid in the same time block at varying prices. For instance, in the same time block (time block 44), a DISCOM offered to sell a low quantum (121 and 79 MW) at a low price (~Rs. 5/kWh) and put a high quantum buy bid (150 MW) at a higher price (Rs. 10/kWh) (refer Table 4)**.**

Table 4: Bidding behavior (DISCOMs)

Date	Time Block	Q@P 1	Q@P 2	Q@P 3	Q@P 4	Q@P 5	Q@P 6	Q@P 7	Q@P 8
31-07-2023	44	-121.0@5171.0	-79.0@5521.0	25.0@0.0	24.0@1360.0	22.0@1361.0	22.0@2180.0	407.0@2181.0	150.0@10000.0
31-07-2023	45	-171.0@5171.0	-79.0@5521.0	25.0@0.0	24.0@1360.0	22.0@1361.0	22.0@2180.0	407.0@2181.0	100.0@10000.0
23-07-2023	65	-171.0@8000.0	-79.0@9500.0	25.0@0.0	24.0@1460.0	22.0@1461.0	22.0@2280.0	20.0@2281.0	387.0@2400.0

4.3. Assessment of the bidding behaviour within any market offers valuable insights. While some of the above observations warrant further investigation, not all may necessarily indicate abuse. It is, therefore, critical to approach each observation with discernment and recognise the factors contributing to the behaviour – whether legitimate, strategic or malicious. This approach ensures effective regulatory oversight and a fairly targeted regulatory intervention in addressing any market abuse. With this in view, it is proposed to monitor the price quotes of sellers vis-à-vis the cost of such generation/ supply.

4.4. There could be several reasons why a generator may quote price bids higher than its variable cost. Some of the plausible reasons could be as under:

i. A merchant generator may wish to recover its fixed cost from these markets in addition to the variable cost;
ii. A generator may try to internalize the costs of start-up/shut-down, operation at higher heat rates in its quote; and
iii. A generator may aim to recover the variable cost on an average from the markets, as there could be times when the generator would have to bid lower than its variable cost to remain on bar and prevent backing down as compared to other times.

4.5. Based on the analysis of DAM prices at IEX from Jan-Dec 2023, it has been observed that the MCP varied between Rs 0.99/kWh to Rs 12/kWh. Of the total 35040 (15-minute) time blocks considered during this period, the distribution of price range in different time blocks is given in the table (Table 5) below:

Table-5: Price distribution in Day Ahead Market, January to December 2023

Price Range	No. of time blocks	% share
Below Rs 1/kWh P<1.0	5	0.01%
Between Rs 1/kWh and Rs 3.50/kWh 1.0≤P≤3.5	10,511	30%
Between Rs 3.50/kWh and Rs 5/kWh 3.5<P≤5.0	10294	30%
Between Rs 5/kWh and Rs 7.50/kWh 5.0<P≤7.5	5370	15%
Between Rs 7.50/kWh and Rs 9.50/kWh 7.5<P≤9.5	1464	4%
Above Rs 9.50/kWh P>9.50	7396	21%

4.6. In the case of RTM, it has been observed that MCP was in the following range during Jan-Dec 2023:

Table-6: Price distribution in Real Time Market, January to December 2023

Price Range	No. of time blocks	% share
Below Rs 1/kWh P<1.0	198	~0.56%
Between Rs 1/kWh and Rs 3.50/kWh 1.0≤P≤3.5	9494	27%
Between Rs 3.50/kWh and Rs 5/kWh 3.5<P≤5.0	11606	33%
Between Rs 5/kWh and Rs 7.50/kWh 5.0<P≤7.5	6284	18%
Between Rs 7.50/kWh and Rs 9.50/kWh 7.5<P≤9.5	1427	4%
Above Rs 9.50/kWh P>9.50	6017	17%

4.7. It appears from the duration of each price band (as reflected in Table-5 and Table-6) that the existing market mechanism allows enough headroom for the generators to recover their costs. An ex-ante screening mechanism within the existing framework would provide a check on the behaviour of market players and stakeholders by signalling that the bid-price behaviour is being regularly monitored and effectively acted upon to prevent any market abuse and loss of consumer surplus.

4.8. In view of the above and in line with the suggestions received from various stakeholders, the following mechanism for ex-ante screening of sell bids is proposed:

I. ***Benchmark Supply Offer (BSO) –*** It is proposed that a benchmark supply offer, equivalent to the variable cost of the suppliers, shall be utilized as a reference for screening the sell bids. The following process is proposed for this:

(i) <u>Declaration by Suppliers and Benchmarking</u>

1. All categories of suppliers participating in the Power Exchanges shall be required to declare their variable costs to a designated agency on a monthly basis. This information will be kept confidential with the designated agency and used only for screening and surveillance purposes.
2. **For ISGS/ IPPs** – The generators covered under Section 62 and 63 of the Electricity Act, 2003 shall intimate the energy charges as determined or adopted by the Appropriate Commission, which will be treated as the BSO.
3. **For other Generators** – All Merchant Power Plants, Captive Power Plants, and other generators not covered under point (2) above shall intimate the BSO at their will but will also be required to submit the details of generation, viz., technology, ramping rate, fuel source, fuel price, and start-up and shut-down costs of the generating stations based on which the designated agency shall estimate and verify the BSO.
4. **For DISCOMs as sellers** - All DISCOMs willing to sell on Power Exchange shall submit the details of the contract price of power procurement. The marginal energy charge rate in the contracts shall be used as BSO.

5. **For Traders as sellers**: Traders shall intimate the purchase prices of all their contracts before sale in the Power Exchange. The marginal purchase price shall be used as BSO.

(ii) <u>Verification of BSO</u>

1. For generators whose tariff is determined or adopted by the appropriate Commission, and for the DISCOMs and the Traders, the BSO declared by the sellers shall be considered as it is.
2. For others, the BSO shall be verified by the designated agency on a regular basis, with the cost estimated based on their respective technical parameters specified above as per the following procedure.
    i. For verification purposes, software shall be developed and hosted by the designated agency. This software shall compute the difference between the declared and computed variable costs.
    ii. In case the BSO (based on declared VC by the seller) deviates by more than five per cent (5%) from the cost computed by the designated agency, the software will generate automatic alerts, which will be communicated to the respective sellers.
    iii. All such sellers will be required to submit an explanation for the deviation beyond the prescribed threshold within 24 hours of the alert, which shall be reviewed by the designated agency. In case the explanation submitted is not found satisfactory by the designated agency, the same shall be reported to the Commission for further corrective action.

II. Screening Measures:

(i) ***<u>Ex-ante Screening</u>***

Allowable Bid Offer (ABO)[2] – The designated agency shall intimate the BSO for each category of suppliers to the Power Exchanges on a monthly basis. The Power Exchanges shall ensure that the bid price offer

[2] This is akin to Bid Cap.

submitted by a supplier in any time block does not exceed 1.6 times[3] the respective BSO and the average bid price offer submitted by the supplier during the day (i.e., across 96 time-blocks) does not exceed 120% or 1.2 times[4] the respective BSO, as discussed above, subject to a ceiling of Rs. 10/kWh. The average bid price shall be calculated on the basis of the number of time blocks where the seller has submitted bids.

For example, in case the estimated BSO of a supplier is Rs. 4/kWh, the average bid price of such a seller across all the 96 time-blocks shall not exceed Rs. 4.8/kWh. In other words, the seller shall have the flexibility to quote different prices across the 96 time-blocks within the existing price bands (Rs. 0-10/kWh), but the average bid price of the seller during the day would not exceed Rs. 4.8/kWh. Similarly, in any time block, the seller shall not bid more than Rs. 6.4/kWh (i.e., 1.6 times of Rs. 4/kWh).

(ii) ***Ex-post Screening***

All the sell bids shall be evaluated by CERC for any possibility of market manipulation. The Power Exchanges shall be required to submit their bid order books to CERC for each month by the last day of every month.

For the evaluation of supply offers, first the supplier with dominant position/ significant position shall be identified. For this, the Pivotal Supplier Index shall be utilized. The index is briefly explained below:

Pivotal Supplier Index – It is performed by testing if the supply is insufficient to meet demand with the supply of an individual supplier removed for the particular time block. In other words, a supplier shall be flagged if the total market demand cannot be met without the offer of such supplier, in the relevant time block. Such a supplier is termed as Pivotal supplier.

[3] Based on the various scenario-based simulations carried out by the Commission's staff, it was observed that in the worst-case scenario, where a generator operating at technical minimum for 12 hours (quoting sell bids Rs. 0/kWh) was able to recover its cost if he bids 1.6 times of its variable cost while operating at full capacity for remaining 12 hours.
[4] To factor in fixed cost recovery.

The formula used for the computation of Three Pivotal Supplier Index (PSI) for each time block is:

$$PSI_j = \frac{\sum_{i=1}^{n}(S_i) - \sum_{i=1}^{2}(S_i) - S_j}{D}$$

Where,

D = Total Demand of Electricity in each Time block (this could be further enhanced by considering demand for Ancillary services also)

$\sum_{i=1}^{n}(S_i)$ is the total supply in the market in each time block, n is the total number of suppliers in the markets

$\sum_{i=1}^{2}(S_i)$ is the supply of the two largest suppliers in any time block. The choice of two can be changed (if collusion is suspected between certain market players).

S_j is the supply from the supplier being tested

If PSI is greater than 1, this means that even without the top three suppliers, there is sufficient supply in the "***relevant market***" to meet the demand. If this ratio is less than 1, it means that the total supply in the "***relevant market***" without the three suppliers will not be sufficient to meet the demand.

While the above index can help identify the suppliers with market power, it does not indicate that the market power is being abused. Also, in cases where a generator or seller has a smaller supply compared to the overall market size but can still significantly impact market prices, this formula may not be effective in detecting such conduct. Therefore, after identifying such suppliers, based on PSI results, their sell bids shall be further tested for potential abuse of market power. In such cases, alternative models are necessary to assess the pivotal suppliers influencing market prices. A Pivotal Supplier Test (PST) shall be used to identify such cases of market power. The steps involved in PST are explained in **Annexure I**. In the event a seller is found to be indulging in uncompetitive behaviour, suitable action shall be initiated by the Commission against it, in terms of the PMR 2021.

4.8. **International experience:** Markets in the US, such as Pennsylvania-New Jersey-Maryland Interconnection (PJM) and New York Independent System

Operator (NYISO), also have energy offer price caps. The NYISO and PJM have an energy offer cap, limiting the maximum and minimum price per MWh that energy suppliers can offer in the market. Location-based Marginal Prices can and do exceed the offer cap under various circumstances, particularly under reserve, regulation, or transmission shortages where applicable demand curves are used to set constraint shadow prices. The offer price cap in these markets is in the range of $1000 - $2000/MWh[5]. There is also a minimum offer price restriction in these markets.

4.9. A report by the Staff of the Federal Energy Regulatory Commission titled "Staff Analysis of Energy Offer Mitigation in RTO and ISO Markets" (2014) evaluates matters affecting price formation in the energy and ancillary services markets operated by Regional Transmission Operators (RTOs) and Independent System Operators (ISOs) subject to the jurisdiction of the Federal Energy Regulatory Commission (FERC). The report states that all six Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs) have some common elements in their systems. These include the use of reference levels, a $1,000/MWh offer cap, the utilization of transmission constraints to identify system conditions where resources may require mitigation, and the consideration of resource ownership and affiliation. If a resource is found to have market power under the mitigation procedures, the resource's offer will be mitigated to that resource's reference level. Reference levels are created either by the market monitors or by the resources themselves (in the case of PJM) and are based on short-run marginal cost estimates for each resource. These estimates are updated regularly (daily in most markets) based on information from resources and fuel price indices. The marginal cost estimates are referred to as "reference levels" in ISO-NE, MISO, and NYISO, "cost-based offers" in PJM, and "default energy bids" in California ISO (CAISO).

4.10. CAISO implements Market Power Mitigation[6] measures to ensure fair competition in the energy market. These measures go beyond simply preventing economic withholding, physical withholding, and uneconomic bids that cause

[5] https://www.nyiso.com/o/training-resources/material/ferc-order-831-increased-offer-caps/presentation_html5.html

[6] https://www.caiso.com/Documents/Section39-MarketPowerMitigationProcedures-asof-Jul1-2023.pdf

congestion. CAISO also monitors bidding practices that distort prices or uplift charges away from what is expected in a competitive market. This includes scrutinizing Start-Up Cost and Minimum Load Cost data, ensuring that Bid Costs submitted on behalf of an Electric Facility are reasonable and not unjustifiably high, and verifying the physical operating capabilities of an Electric Facility to prevent any misrepresentation resulting in uplift payments or prices significantly higher than the actual costs.

4.11. Hence, the cap on energy offers and the associated market power mitigation measures are a standard practice in other electricity markets as well.

Ex-ante screening of Buy Bids

4.12. On the buy side, the price bids should ideally reflect the marginal utility of consumption. Depending on the marginal utility, the buy bid price could vary across state DISCOMs/open access consumers.

4.13. Based on the analysis of bid data for Jan-Dec 2023, it is observed:

I. The buyers have built a tendency to quote consistently at ceiling prices in order to secure clearance, irrespective of the MCP discovered.

II. The states/DISCOMs put in very high quantity demand bids under stressed/high-demand situations and often at the price ceiling. For instance, bids as large as 15000 MW at INR 10000/MWh have been submitted. It appears that the states probably do this in view of the aggregated supply getting pro-rated between all the buyers whose buy-bid prices are equal.

4.14. A comparative analysis was also carried out to assess the buy-bid offers with respect to the residual Available Transmission Capacity (ATC) of many State DISCOMs. Here, the residual ATC quantum is the balance after considering the ATC utilized for scheduling under all bilateral contracts. For this, the schedule just before the opening of the bidding window for DAM was considered, and the bids submitted for blocks with MCP equal to the price ceiling, i.e., Rs. 10/kWh, were examined. It was observed that during this period (Oct-Dec 2023), some of the

State DISCOMs quoted bid quantum substantially higher than their residual ATC at the ceiling price.

4.15. This conduct of the buyers of consistently bidding high quantum at ceiling price needs to be regulated because this is not a truthful revelation of the requirements and marginal utility of consumption. Therefore, ex-ante screening as a check on buy bids could be as follows:

> The Power Exchanges shall ensure that the buyer's total quantum bid, at the start of the bidding session of the DAM or the RTM as the case may be, does not exceed the residual ATC of the state. In case of intra-state buyers, the total quantum bid shall be restricted to the drawl limit of the buyer or the intra-state entity-wise ATC as stipulated by SLDC, as the case may be.
>
> Here, residual ATC indicates the balance after utilizing the ATC under bilateral contracts. In other words, the total quantum of the bid by the buyer plus the quantum scheduled from the inter-state power system by the buyer shall not exceed the ATC of the state.

4.16. The proposed screening is expected to contain the tendency of the buyers to quote abnormally high bids. One possible argument against the proposed screening is that it may impact the portfolio optimization by state DISCOMs. However, with the availability of the Real-Time Market, the state DISCOMs already have an avenue for cost optimization available.

Summary:

4.17. A brief summary of the framework proposed in the instant Staff Paper for screening of bids is provided below. A flowchart depicting the operative part of the proposed framework is at **Annexure II**.

Screening of Sell Bids:

i. All sellers shall be required to declare their variable costs to the designated agency on a monthly basis. Additionally, the merchant sellers shall be required to declare their technical parameters to support the cost declared.

This will be kept confidential with the designated agency and used only for screening and surveillance purposes.

ii. The variable cost provided by each seller shall serve as the Benchmark Supply Offer (BSO) for its supply offer. For the generators covered under Section 62 or 63 of the Act, the energy charge as determined or adopted by the Appropriate Commission shall be treated as BSO. For the DISCOMs as sellers, the marginal energy charge rate out of their power purchases shall be treated as BSO. For the traders, their marginal purchase price shall be treated as BSO. For the merchant power plants, the variable costs as declared by them or the variable cost as estimated by the designated agency, whichever is lower, shall be treated as the BSO.

iii. The designated agency shall intimate the BSO for each category of suppliers to the Power Exchanges on a monthly basis.

iv. Power Exchanges shall ensure that the bid price offer submitted by a seller in a time-block does not exceed 1.6 times the respective BSO and the average bid price offer submitted by a seller during the day (96 time-blocks) does not exceed 1.2 times the respective BSO.

v. All sell bids shall be evaluated ex-post, for any possibility of market manipulation. For evaluation of supply offers, Pivot Supplier Index and Pivotal Supplier Test shall be utilized to identify the seller with a dominant position and abuse of market power.

vi. Based on the evaluation of the supply offers, if a seller is found to be indulging in uncompetitive behaviour, such cases shall be reported to the Commission for further investigation and suitable action.

Screening of Buy Bids:

vii. The Power Exchanges shall ensure that the buyer's total quantum bid, at the start of the bidding session of the DAM or the RTM, as the case may be, does not exceed the residual ATC of the state.

viii. In the case of intra-state buyers, the total quantum bid shall be restricted to the drawl limit or the intra-state entity-wise ATC limit as stipulated by the SLDC, as the case may be.

ix. The residual ATC indicates the balance after utilizing the ATC under bilateral contracts. In other words, the total quantum of the bid by the buyer plus the quantum scheduled from the inter-state power system by the buyer shall not exceed the ATC of the state.

4.18. The above-discussed mechanism of market screening would broadly involve the following:

i. All suppliers shall be required to declare their variable costs to the designated agency on a monthly basis.
ii. The designated agency shall develop and host software to verify the declared variable costs against the estimated variable costs of the merchant suppliers.
iii. The introduction of software by Power Exchanges for evaluating sell bids and buy bids before feeding them into the market clearing engine.
iv. Power Exchanges shall be required to submit their order books to CERC for each month by the last day of each month.
v. Development of APIs by Power Exchanges, through which the results of the market monitoring screen can be shared with CERC.

5. Comments solicited:

5.1. In view of the above discussions, comments and suggestions of stakeholders are invited on the changes proposed in terms of the monitoring and surveillance of buy and sell bids, as detailed in section 4 of this Discussion Paper.

***

Annexure-I

Pivotal Supplier Test broadly involves the following steps:

Pivotal Supplier Index (PSI) plays a role in assessing market power through a concept called the Pivotal Supplier Test (PST). The steps involved in the PST are as under:

1. **Identify Relevant Market:**
    - Define the geographic area and product (energy (DAM, GDAM, RTM, reserves, etc.) being analysed.
    - In case of market splitting (because of network congestion), the market may be reduced to a bidding area
2. **Select Load Levels:**
    - Choose critical periods with high demand, or time-blocks when prices are high
    - This can include periods with high system outages, low availability of solar and wind generation, etc.
3. **Identify Potential Suppliers:**
    - Consider all generators/sellers that could feasibly deliver electricity at a competitive price (based on the Benchmark Rates).
4. **Transmission Availability:**
    - Account for existing transmission limitations that might restrict how much a supplier can deliver.
5. **Economic Capacity Calculation:**
    - Subtract the supplier's native load obligation from its total generation capacity.
    - Adjust for transmission limitations to determine the remaining economic capacity available for the market.
6. **Pivotal Supplier Identification:**
    - Simulate the market scenario without a specific supplier's contribution.
    - If the remaining available capacity (excluding the specific supplier) is insufficient to meet demand, that supplier is considered pivotal.
    - Being a pivotal supplier may not always be an issue unless such supplier influence the market prices. It is, therefore, proposed to use Benchmark Analysis Models and Simulation Models (Oligopoly Models) for this purpose.

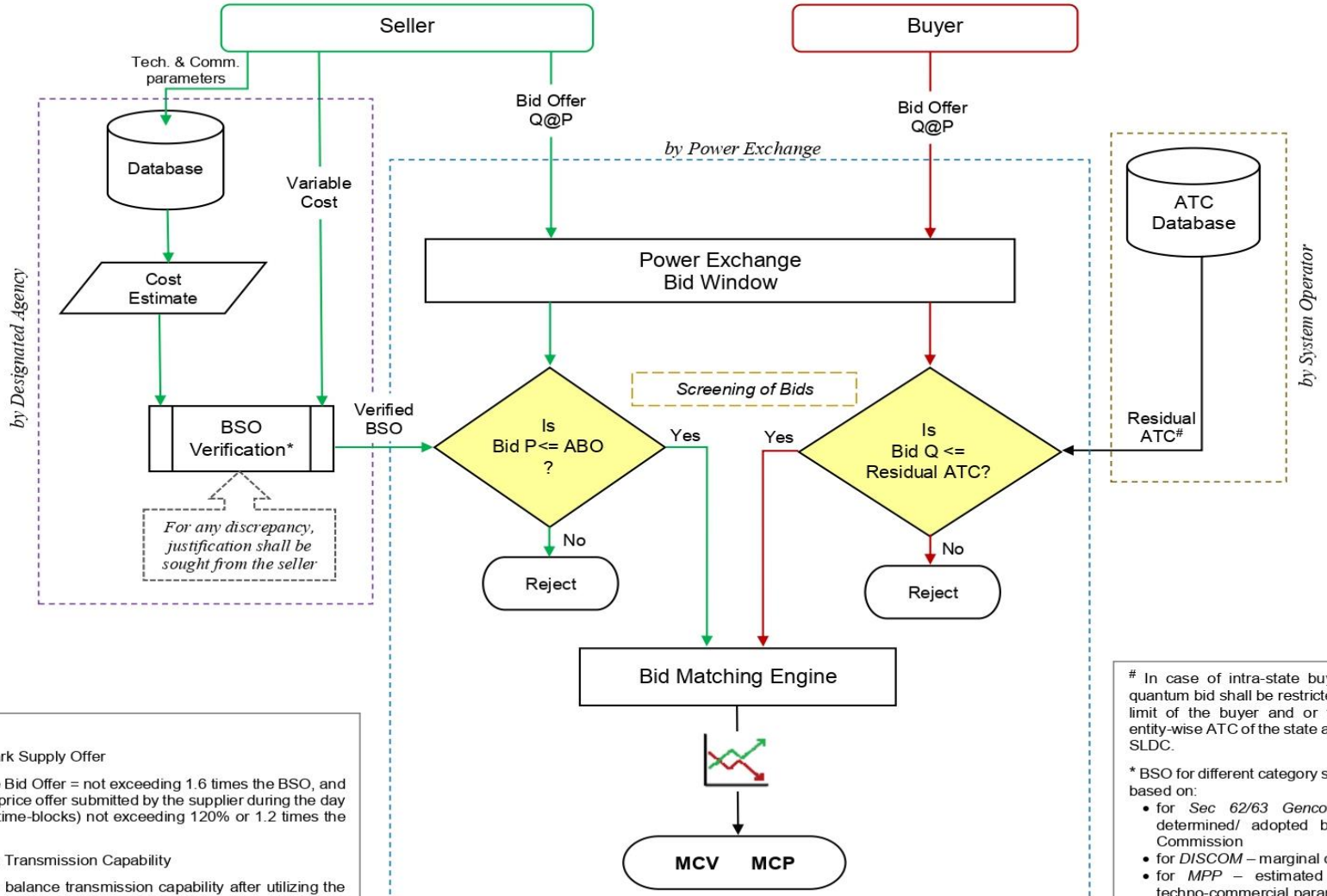
- Did any supplier (or a combination of them) become pivotal in terms of offering price/quantum bids in the market above their benchmark price, or by staggering their quantum at widely different prices, or withholding quantum, thereby influence the market price? Further, large suppliers with power plants in different bidding areas can strategically bid (bid low in one region and at close to their benchmark rates in other region) to impact transmission congestion, and hence influence market prices. Further, such strategic bidding across markets (scheduling in the long term, in TAM, and DAM and RTM) can influence prices in DAM/RTM.

    1. This can be assessed by running market simulations models to assess whether a generator/seller/supplier with multiple assets in different parts of the grid is Pivotal or not.

    2. Competitive Benchmark Models/Simulation models[7] may be used for this purpose.

[7] https://eepublicdownloads.entsoe.eu/cleandocuments/pre2015/publications/etso/Congestion_Management/ETSO%20Market%20Power%20final.pdf

Annexure II


Seller
Buyer
Tech. & Comm. parameters
Bid Offer Q@P
Bid Offer Q@P
by Power Exchange
Database
Variable Cost
ATC Database
by System Operator
by Designated Agency
Cost Estimate
Power Exchange Bid Window
Screening of Bids
BSO Verification*
Verified BSO
Is Bid P<= ABO ?
Yes
Yes
Is Bid Q <= Residual ATC?
Residual ATC#
No
No
For any discrepancy, justification shall be sought from the seller
Reject
Reject
Bid Matching Engine
MCV MCP
Here,
BSO - Benchmark Supply Offer
ABO - Allowable Bid Offer = not exceeding 1.6 times the BSO, and the average bid price offer submitted by the supplier during the day (i.e., across 96 time-blocks) not exceeding 120% or 1.2 times the BSO
ATC – Available Transmission Capability
Residual ATC = balance transmission capability after utilizing the ATC under bilateral contracts
In case of intra-state buyers, the total quantum bid shall be restricted to the drawl limit of the buyer and or the intra-state entity-wise ATC of the state as stipulated by SLDC.
* BSO for different category shall be verified based on:
for Sec 62/63 Genco – Tariff as determined/ adopted by appropriate Commission
for DISCOM – marginal contract cost
for MPP – estimated cost as per techno-commercial parameters
for Traders – contracted price