



No. IEX/RA/069/22-23

Date: 11.11.2022

To,

The Secretary
Central Electricity Regulatory Commission
3rd & 4th Floor, Chanderlok Building
36, Janpath, New Delhi - 100001
Fax: 011-23753923

Sub: IEX Comments on Staff Paper on Power Market Pricing issued on 04.11.2022

Dear Sir,

This has reference to the Public Notice dated 12.10.2022, inviting suggestions and comments from stakeholders on the Staff Paper on Power Market Pricing.

The comments/suggestions on behalf of IEX on the aforesaid Staff Paper are hereby attached for kind consideration of the Hon'ble Commission.

Thanking You
Yours Sincerely,

A handwritten signature in blue ink, appearing to be 'Jogendra Behera', written over a light blue horizontal line.

(Jogendra Behera)

CRO & VP (Regulatory & Market Economics)

Enclosures: As above

IEX Comments on Staff Paper on Power Market Pricing

The staff paper has discussed about two broad approaches for pricing methodologies namely the Uniform Clearing Pricing (UCP) and Pay-As-Bid (PAB) in the wake of recent high prices in DAM and supernormal profits earned by the inframarginal generators. The paper has succinctly explained the difference between UCP & PAB along with the pros and cons of both the pricing methodologies and sought comments/suggestions on whether there is a need to change the existing pricing methodology, what regulatory intervention can be designed to alleviate such situation etc. We have made our submissions in two parts i.e., Part A and Part B. In Part A we have provided an overview of the two pricing methodologies highlighting some of the findings from the past studies and experiences. In Part B we have submitted our comments to the specific queries raised in the staff paper.

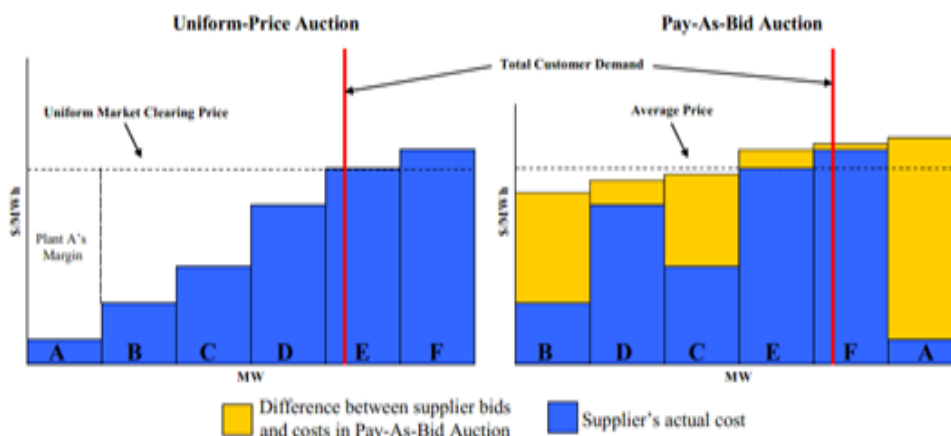
Part A: Background to the discussion

1. Uniform Clearing Price (UCP) vis-à-vis Pay-As-Bid (PAB)

- 1.1. The fundamental difference between the UCP and PAB is that in case of UCP all the sellers who will be cleared in the market will get the uniform market clearing price whereas in PAB the sellers will get the price quoted in their respective sell bids.
- 1.2. In UCP mechanism, a generator will not have any incentives to bid other than its marginal cost. Bidding above marginal cost will reduce its likelihood of getting selected to supply electricity while bidding below marginal costs would result in financial loss. A generator will invariably bid at the marginal cost and whenever the market clearing price is higher than its marginal cost it will get cleared and the margins earned over & above the marginal cost will go towards meeting its fixed cost & profits. Whereas in PAB, the generator is incentivized to forecast the market clearing price and bid as close as possible to maximize its revenue as bidding anything lower than the market clearing price is a revenue loss for the generator.
- 1.3. The different approach to bidding under UCP and PAB pricing methodologies will have different implications for the market. As in UCP the generators will be quoting their marginal cost regardless of the demand situation it will lead to efficient price discovery and merit order dispatch of generating stations. Whereas in case of PAB due to the constant endeavour of the generator to bid as per their forecasted price, following inefficiencies may creep into the market:
 - 1.3.1. **Deviations from MoD and increased MCP:** Every generator will have different estimate of the market clearing price and will accordingly bid to come as close as possible to the estimated price. In the process there are possibilities that some of the generators with lower marginal cost may err in forecasting and quote a higher price than the market clearing price and remain undispached in the market. This will not only distort the merit order dispatch of the generating stations and but

also may increase the market clearing price. This is illustrated through the following example:

Supplier Bids and Market Prices Under Uniform-Price and Pay-as-Bid Auctions



In the UCP auction Plant A, B, C, D, E, and F will bid at their marginal cost while in PAB auction each of the Generator will bid as per their best estimate of the market clearing price. As a result, there is a possibility that the Generator A which is of lower marginal cost may bid at a higher price than the market clearing price and not get dispatched in the market distorting the merit order dispatch of the generators. Further, in the endeavour to bid as close to the estimated market clearing price, not only the savings expected in the PAB will fade away but also there are possibilities that the price discovered in PAB may become higher than the UCP pricing methodology.

- 1.3.2. Cost of forecasting the market clearing price:** Under UCP, generators prosper or fail on the basis of their relative generating efficiencies alone. Whereas under PAB, their profitability depends heavily also on successful forecasting of the market clearing price. The generators will incur additional costs in developing systems & processes to forecast the market clearing price as accurately as possible.
- 1.3.3. Smaller bidders are disadvantaged under PAB:** Smaller generators may find it challenging to develop the required systems & processes for accurately forecasting the market clearing price which may also discourage investments. Whereas, under UCP, no such forecasting is necessary. The uniform market clearing price automatically goes to all competitors alike.
- 1.3.4. Transparency in the Market:** UCP involves greater transparency of bidding behaviour. In a marginal cost-based bidding it should be feasible to ascertain whether bid prices had exceeded those levels. Whereas, under PAB, every seller would be forced to bid above its marginal cost even if the market were perfectly

competitive, so there would be no direct way for observers to identify exercises of market power from the bid data.

2. Learnings from the Past Experiences/Studies: In the past several studies have been conducted to assess the merits/demerits of the two pricing methodologies i.e., UCP and PAB methodologies some of the significant ones are highlighted below:

2.1. “Uniform Pricing or Pay-as-Bid Pricing: A Dilemma for California and Beyond”, Alfred E. Kahn et al. (2001): This study was conducted by a panel appointed by California Power Exchange to examine the two pricing methodologies i.e., uniform and as-bid pricing in the wake of extreme price spikes in the DAM and suggest whether it is appropriate to switch to pay as bid pricing. The panel chaired by renowned economist Alfred E. Kahn opined against shift from uniform to as-bid pricing citing that the behavioural change in bidding behaviour in pay as bid pricing will worsen the situation. Some of the relevant excerpts of the study are reproduced below:

*“...The shift would provide purchasers of electric power substantial relief from the soaring prices of electric power such as they have recently experienced—is simply mistaken. The immediate consequence of the introduction of pay as-bid pricing **would be a radical change in bidding behavior that would-***

- *Forestall any anticipated savings;*
- *Introduce **unmeasurable inefficiencies in the dispatch of power and impose new costs on generating companies**, which would inevitably tend to increase rather than decrease average prices*
- *Tend to **weaken the competition in a generation** that is the best safeguard against exertions of monopoly power, such as may have contributed to the sharp price increases at times of peak demand; and*
- *Impede—again to an unmeasurable extent—the expansion of capacity that, along with the intensified demand-side response, is the only fundamental remedy for the recent poor performance of these markets...”*

2.2. “Uniform Pricing Versus Pay-as-Bid in Wholesale Electricity Markets: Does it Make a Difference?”, Tierney et al. (2008) – This is a paper published by the Analysis Group in association with New York ISO examining the uniform and pay as bid auction mechanism as the prices increased in some of the North American Power Exchanges. The paper has concluded that switching to a pay as bid approach may worsen the situation due to strategic bidding behaviour. Some of the relevant excerpts of the paper are reproduced below:

“...This paper has assessed the advantages and disadvantages of a switch from uniform-price to pay-as-bid auctions and reached a number of different conclusions:

- *Pay-as-bid is unlikely to result in any immediate decrease in wholesale prices for generation through eliminating supplier margins or reducing opportunities to strategically withhold. **The prospect that pay-as-bid auctions might offer immediate relief to consumers facing rising electricity prices is in fact illusory.** Price increases are largely a consequence of market forces well beyond the control of those charged with regulating electricity markets.*
- *The margins that suppliers earn between their marginal generation costs and the market-clearing prices provides a means for plant owners to recover plant fixed and capital costs and provides them with an incentive to improve plant performance.*
- ***Pay-as-bid auctions may have adverse consequences for market efficiency, including inefficient plant dispatch, disincentives for demand response, and disincentives for investment in baseload and other low-variable-cost technologies that would lead to inefficient shifts in the mix of generation technologies.***
- ***Pay-as-bid may have adverse consequences for efforts to reduce the exercise of market power by reducing incentives for small suppliers to participate in wholesale markets, by reducing reliance on forward contracting, by reducing incentives for demand response, and by potentially decreasing the effectiveness of market monitoring.***

*Interest in the redesign of wholesale electricity markets has arisen largely as a response to increases in electricity prices following the restructuring of electricity markets in many states. Although the cause of these price increases is largely the result of prices on global markets for fossil fuel used for power generation, which are well outside of the control of electricity regulators, the unfortunate coincidence of timing has tended to direct attention upon these recent restructuring efforts. While these markets still require continued development, particularly to ensure sufficient and appropriate investment in generation and transmission resources, **changes to the auction format for wholesale markets appear unlikely to either lower price or address other resource adequacy concerns. In fact, such a switch would likely make conditions worse. Indeed, there is a risk that needed efforts and resources to improve facility siting, promote demand response, encourage (and determine) appropriate forward contracting, and refine capacity market design (to address the “missing money” problem) become diverted by an effort to a switch auction format that does not address any of these needs....”***

2.3. “Recent energy price dynamics and market enhancements for the future energy transition”, Florence School of Regulation Policy Brief, January 2022 – Keeping in view the calls that were made to switch to pay as bid pricing approach due to high electricity prices during October 2021, FSR has published this policy brief in January 2022. As per the brief, the pay as bid pricing would not lead to reduction in payment rather it may

have a negative impact on the efficiency of generation mix used to serve demand. Some of the relevant excerpts of the policy brief are reproduced below:

“...this is not the first time that ‘pay-as-bid’ is proposed to replace ‘pay as-cleared’ as the pricing method in electricity markets. Every time the conclusion is the same: ‘pay-as-cleared’ is a superior pricing method for electricity markets and it is not true that ‘pay as-bid’ pricing would necessarily result in lower overall payments to resources selling electricity on the market. Increasing prices is the exact signal that the market should convey when scarcity emerges in order to attract additional resources – e.g., demand-side response and additional generation investment – into the market. However, it seems that the debate regains its appeal every time prices in the electricity market increase”

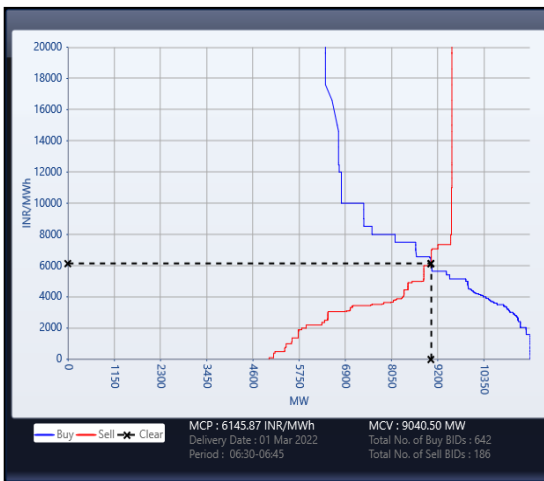
2.4. “High Energy Prices”, ACER, October 2021 and “Assessment of Wholesale Market Design”, ACER, April 2022 – In view of unprecedented electricity prices in EU during last year ACER has been publishing reports analyzing the underlying reasons and possible ways to mitigate the situation. ACER has concurred that pay as clear (uniform pricing) is more efficient than a pay as bid approach. Some of the relevant excerpts from the above two reports are provided below:

“...These factors combined would seem to imply that any future market design needs to be able to (a) remunerate technologies above their marginal costs, sometimes quite significantly so, and (b) incentivise the alleviation or smoothing of volatility in the market. The ‘pay-as-clear’ model allows for both of these elements....” (October 2021)

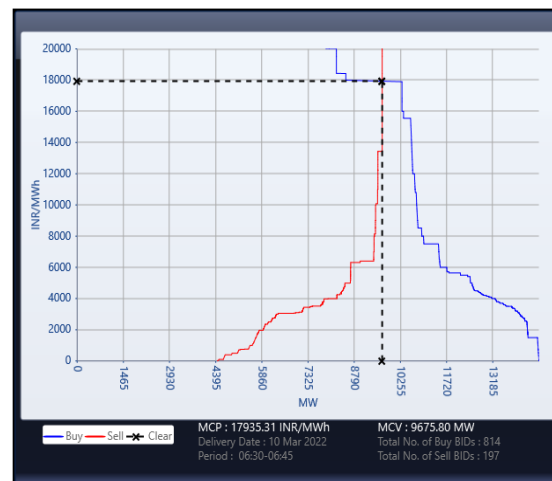
“...Whenever electricity prices rise considerably, one sees the debate over the prevalent market model and pricing system. Past analyses tend to reach a similar conclusion, namely that in day-ahead markets, a pay-as-clear approach is more efficient than a ‘pay-as-bid’ approach...” (April 2022)

3. Leading Power Exchanges have adopted UCP Pricing Methodology: Due to the inherent merit of UMCP methodology viz. marginal cost-based bidding, efficient price discovery, merit order dispatch, fairness & transparency in the market etc. all the leading power exchanges in world viz. Epex Spot, Nord Pool, AEMO, JEPX, Power Exchanges from North America-CAISO, PJAM, ERCOT, ISO-NE, MISO etc. have adopted the UCP pricing methodology. Further, due to recent increase in electricity prices, several initiatives were taken by their respective regulator or govt. viz. increasing price cap, imposing revenue cap on the inframarginal generators, levying windfall tax etc. to alleviate the situation; however, none of them have considered changing their pricing methodology, rather conscious efforts have been made to avoid any interference with the price formation in the market.

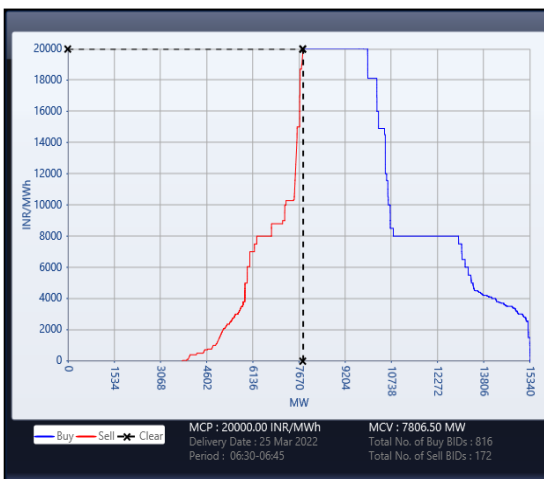
4. Evidence from the IEX Day Ahead Market: Based on the approval of the Hon'ble Commission the Exchanges are using the UCP for both DAM and RTM and this has yielded efficient price discovery in the market purely driven by underlying demand and supply forces. The prices discovered in DAM and RTM consistently remaining lower than other available mode of transactions in the short-term market is a testimony to the efficacy of the pricing methodology. The recent price increase is due to shortage scenarios and aggressive bidding by the buyers to fulfil their demand. However, in the context of this discussion, the important point to note here is that the aggressive bidding by the buyers is seen to have no significant bearing on the seller's bidding behaviour. It is observed that the sellers continue to bid mostly at their marginal price regardless of the higher demand prevailing in the market. This is captured in the demand supply curves provided below during the month of March when the MCP increased significantly.



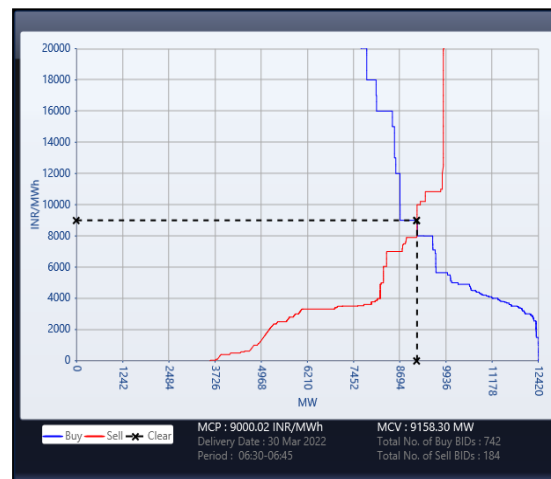
1st March 2022, 06:30-06:45



10th March 2022, 06:30-06:45



25th March 2022, 06:30-06:45



30th March 2022, 06:30-06:45

The above figure has captured the demand supply curve on different dates during the month March 2022. As the demand increased during the month the demand curve shifted towards the right indicating higher quantum bidded during the period. Along with the quantum, the buyers have also quoted a higher price during this period. However, as can be observed from the above figures, the increased demand has not influenced the seller bidding behaviour. The seller curve continues to show more or less a similar shape with most of the offered sell quantum getting over by Rs. 12/unit. Due to this when the situation improves with improvement in demand supply situation the MCP also reduced in the market. The average MCP reduced to Rs. 3.96/unit during October 2022. Previously also higher prices have been observed in DAM for e.g., in October 2021 but after few days the market used to correct itself on its own. However, this time due to other macroeconomic factors viz. shortage of coal, high imported coal and gas price, high e-auction coal prices etc. the price remained high for a sustained period.

Part B: Comments/Suggestions on Queries

In light of the above discussion the comments/suggestions to the specific queries raised in the staff paper are provided as under.

3.1 Does Pricing Methodology need a change?

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? (Para 3.1.3)

IEX Comments/Suggestions: As discussed above the UCP pricing methodology has inherent benefits viz. marginal cost bidding, efficient price discovery & appropriate signal to the market participants, merit order dispatch of generators, fair & transparent market etc. based on which all the leading power exchanges in the world have adopted this methodology for their price discovery. Many studies conducted in the past on the aftermath of increased prices have established the superiority of UCP over PAB pricing methodology. It was time and again ascertained that the PAB mechanism will not be able to address the super normal profits for the inframarginal generators as the generators would forecast the market clearing price and bid as close as possible to their forecasted price to maximize their revenue. This strategic bidding behaviour of the generators will take away the savings expected in the PAB pricing methodology. On the contrary the error involved in forecasting the market clearing price may distort the merit order dispatch of the generating stations and increase the market clearing price itself. **In view of the above, it is submitted that we should not consider switching to pay as bid pricing methodology.**

3.2 What should be the criteria for regulatory interventions?

- *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, or the price cap is automatically reduced to a point where say 90% or 95% of the supply is cleared? Or or generators are mandated to run and are compensated under administered route or based on some pre-specified 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? (Para 3.2.4)*

IEX Comments/Suggestions: Previously also higher prices have been observed in DAM for e.g., in October 2021 but after few days the market used to correct itself on its own with the interplay of demand and supply forces. However, this time due to acute shortage scenario, there was an unprecedented increase in price, and it also sustained for a longer period. Some of the buyers were quoting at the ceiling price in the range of Rs. 18-20/unit that increased the price. In an efficient market scenario, the price rise is expected to provide signal to bring new supply into the system that eventually pushes the prices down. However, during March & April, due to acute shortages in the country, the market failed to attract any new supply into the market while the inframarginal generators were benefiting from the situation and earning supernormal profits. **In this background, the Hon'ble Commission prudently implemented the price cap of Rs. 12/unit below which around 99% of the supply was getting exhausted. Going forward also the regulator should intervene whenever the market forces become ineffective due to other structural issues in the sector. As the market is still in evolution stage and constitutes only 6-7% of the overall transactions unlike the developed economies the Hon'ble Commission may intervene after carrying out the due diligence on a case-to-case basis. The Hon'ble Commission may intervene whenever there is sustained increase of price let's say the price is at the ceiling or twice of the highest marginal cost generators for 50% of the time block for 15 continuous days. As the market will mature dynamic price cap may be considered. The other suggestions to cap the**

excess revenue or levying tax on supernormal profit is not required if the price cap is implemented in the market. This may be difficult to implement and affect the investor's confidence.

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

- *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? – dispatch high cost through ancillary*

IEX Comments/Suggestions: The implementation of price cap has disabled the high variable cost generating station to participate in the market even if there are buyers willing to buy. In such a scenario the H.P DAM proposed by Ministry of Power is expected to address the situation. The supramarginal generators should be classified based on their variable cost of generation which in turn may be dependent on fuel viz. imported coal, gas etc. or technology viz BESS etc. It is difficult for the sellers to exert any market power as the buyers have the choice to buy or not. The demand for such supply will only be required only during high scarcity situation. The shortage during few hours in a day let's say the evening hours may not lead to viability of the imported coal or gas-based stations. However, this may promote the BESS who can supply during few hours of high demand scenario at a premium. **Allowing the high price transactions through the TAM should not be considered as in the past we have witnessed how the partial implementation of price cap across DAM and RTM has created the distortion with volume getting shifted to the TAM segment during pro-rata allocation of the volume. An integrated DAM with automatic carry forward option for unselected bids will lead to efficient price discovery across the time blocks during the day.**

3.3 What should be the market design for incentivizing demand response and energy storage system (ESS)?

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

IEX Comments/Suggestions: In order to accommodate flexible resources like demand response/ESS, **the market needs to enable the aggregators who can pool the demand/supply of individual entities and work in tandem with the market to reduce demand or increase supply as desired.** This would be similar to the functioning of Balance Responsible Parties (BRP) and Balancing Service Provider (BSP) in the EU market.
