पोसोको/रा. भा. प्रे. कें./2022/ 157 **दिनांक: 11 November 2022**

सेवा में,

सचिव
केंद्रीय विद्युत विनियामक आयोग, तृतीय एवं चतुर्थ तल,
चंद्रलोक भवन, 36 जनपथ, नई दिल्ली-110001

विषय: CERC Staff Paper on "Power Market Pricing"- reg.

संदर्भ: CERC Public Notice No. Eco-4/2022-CERC dated 12th October, 2022

महोदय,

POSOCO inputs/suggestions, on behalf of RLDCs/NLDC, on the CERC Staff Paper on "Power Market Pricing" are enclosed herewith for kind perusal of the Hon'ble Commission.

सधन्यवाद,

भवदीय,

(समीर चंद्र सक्सेना)
मुख्य महाप्रबंधक

संलग्न – As above

CERC Staff Paper on Power Market Pricing –

POSOCO Inputs, on behalf of RLDCs/NLDC

Price formation in organized electricity markets establishes market clearing prices for energy and ancillary services. How prices are set during tight system conditions is critical to appropriate price formation. Scarcity prices are important to attract supply and reduce demand during tight system conditions, and incentivize resources to be available and perform.

POSOCO supports the Central Commission endeavour to trigger the larger electricity market design debate for the efforts and resources to improve resource siting, promote demand side initiatives, encourage (and determine) appropriate forward contracting, and refine resource adequacy design, in which Power Market Pricing is one of the important aspects.

POSOCO inputs, on behalf of RLDCs/NLDC, on the points for discussion raised in the Central Commission 'Staff Paper on Power Market Pricing' are as follows:

1. ***"…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?…"

POSOCO Inputs

As mentioned in the Staff Paper itself, all leading Power Exchanges across the world have adopted the Uniform Market Clearing Price (UMCP) mechanism in the Day Ahead Market for past few decades. As per the international literature review and experience **(Annexure – 1)**, there are significant implications of auction design for the efficiency of electricity markets such as:

- Impacts on generation technology choice
- Price Volatility
- Exercise of Market Power
- Competitiveness of Electricity Markets
- Limiting the Exercise of Market Power
- Entry of New Capacity

- Implications for Market Monitoring

The debate of uniform pricing versus discriminatory pricing has already been well settled by the Central Commission, about 16 years back, through the staff paper on "Developing Common Platform for Electricity Trading" floated on July 20, 2006. The relevant extracts are quoted as below:

"...4.2.5 Uniform pricing Vs discriminatory pricing

4.2.5.1 Most of the power exchanges across the world work on the principle of uniform pricing. In this method, the clearing price and clearing volume of electricity corresponds to the point of intersection of the Aggregate Demand curve and Aggregate Supply curve. All the suppliers are paid based on the clearing price, irrespective of their offer. This means that price is set by the last accepted offer of supply. In the alternative approach, referred as discriminatory pricing or "pay-as-bid" method, each supplier is paid as per its bid. Each buyer pays a price, which is the weighted average of the price for all suppliers cleared by the PX.

4.2.5.2 At first glance, discriminatory pricing appears attractive as it gives the impression that prices for buyers will be lower in this option. However, a more careful analysis reveals that this may not be the case, as the philosophy of submitting offers by the suppliers may be entirely different in the two alternatives. In uniform pricing, suppliers are likely to submit their offers based on marginal cost. This is so because most of the suppliers are aware that the clearing price will be higher than the offer submitted by them and the difference between clearing price and offer price will set off their fixed charges. On the other hand, in case of discriminatory pricing, the suppliers are likely to submit bids based on the average cost, covering fixed expenses as well. It is more likely that in case of "pay-as-bid" pricing, each supplier quotes prices which are not based on its own costs but based on anticipated clearing price of marginal supplier. It is also argued that market manipulation by collusion is more likely in case of uniform pricing. However, critics of "pay-as-bid" pricing, point out that even if market manipulation takes place, it would be hard to monitor and detect in case of "pay-as-bid" pricing because suppliers will not quote consistently around a price (which will be marginal cost) but will quote higher than marginal price to a varying extent depending on their anticipation about clearing price. Though not much practical experience is available on discriminatory pricing so as to compare with uniform pricing, theoretical work done in this regard suggests that discriminatory pricing may lead to higher price level but less volatility as compared to uniform pricing.

4.2.5.3 Overall, it appears that in view of the limited practical experience worldwide on "pay-as-bid" pricing, there is no evidence to suggest that perceived advantages of this method will turn into reality. Therefore, uniform pricing appears to be a better option...."

Further, a sample illustration on change in generator bidding strategy and cost saving opportunity after implementation of Pay as Bid mechanism is depicted below in Fig. 1:

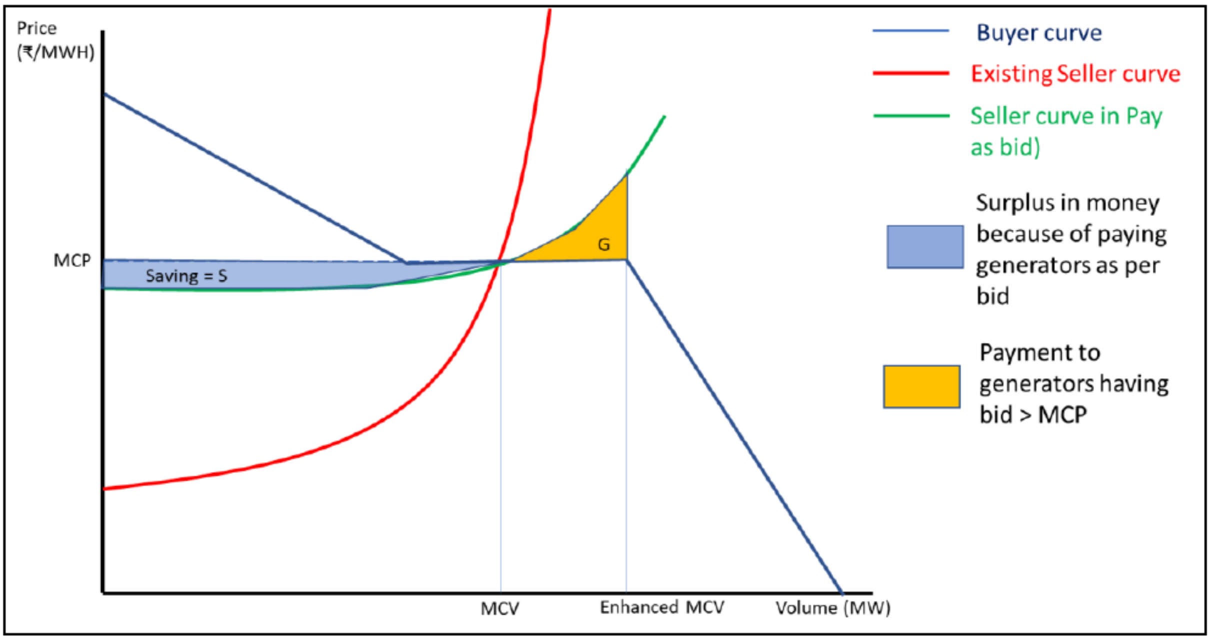

Figure 1: Typical Demand Supply Curve

In the above Fig. 1, a typical demand supply curve for a time-block is depicted. In existing scenario (red curve), sellers will bid as per their marginal cost and will get paid as per uniform MCP. However, in pay as bid mechanism (green curve), sellers will try to bid close to expected MCP resulting in reduction of supplier surplus significantly. In the process, the generators/suppliers gain individually.

It has been broadly observed, both from a theoretical and practical point of view, that a switch to a pay-as-bid auction does little to address concerns about either the affordability of electricity rates or the reliability of power supplies.

POSOCO agrees that there is a need to focus the efforts and resources to facilitate and improve facility siting, promote demand side initiatives, encourage (and determine) appropriate forward contracting, and refine resource adequacy design (to address the "missing money" problem).

Re-opening the price discovery mechanism would undermine the efforts towards improved, efficient and competitive market.

- **Need for a reference price**

One of the pros of Pay-As-Bid-Pricing (PAB), as mentioned in the Staff Paper, is it 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). In fact, there is no reference price existing in the present Indian electricity market which is declared by any statutory body for any legacy/technology.

Reference/benchmark prices first need to be established for each resource type and first these reference prices may be used for market monitoring & surveillance in the existing uniform clearing price model to gain further insights.

In fact, CERC Market Monitoring Cell (MMC) till December, 2019 published a forward curve (sample at Fig. 1) which reflected the present day's expectation of prices for a future period. The forward curve of electricity prices were based on sale prices of bilateral contracts executed by traders. The discontinuation of publishing of the forward curve has diminished the ability of market participants to forecast their portfolio planning well in advance. This practice of providing forward prices by the CERC MMC needs to be reinstated.

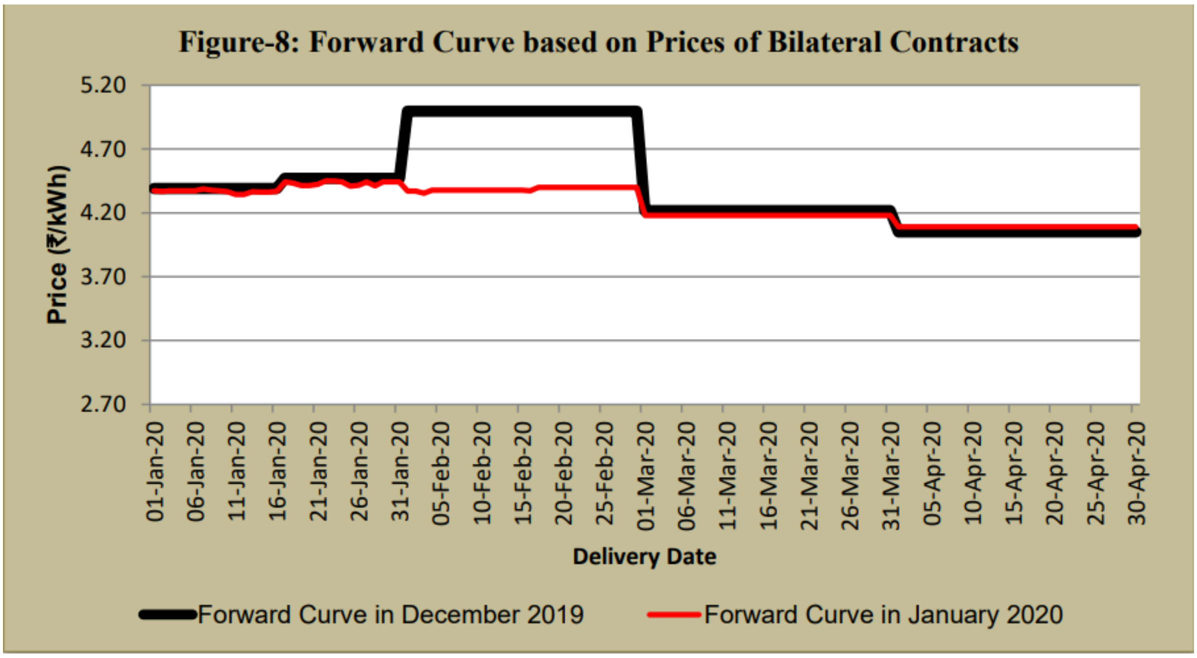

Figure 2: Forward Curve (Source: CERC MMC Report December, 2019)

- **Need for Stringent Market Monitoring and Surveillance**

Central Commission, in its monthly Market Monitoring Cell report publishes the Herfindahl-Hirschman Index (HHI), a commonly accepted index to calculate market concentration, has for measuring the competition among the trading licensees. Increase in the HHI generally indicates decrease in competition and increase of market concentration, and vice versa. The HHI below 0.15 indicates non-concentration, HHI between 0.15 and 0.25 indicates moderate concentration and HHI above 0.25 indicates high concentration. The data analysis of Day Ahead Market and Real Time Market for the past two years, illustrated in fig. 2 to 4, has revealed the following:

HHI	Day Ahead Market			Real Time Market		
	Max	**Min**	**Avg.**	**Max**	**Min**	**Avg.**
Buyers	0.29	0.06	0.12	0.52	0.07	0.16
Sellers	0.81	0.03	0.09	0.52	0.04	0.10

It is inferred from the above that, even though the electricity market has been introduced in India for around 2 decades, still there is limited depth with limited number of players. Uniform clearing prices motivates the suppliers to bid based on the marginal costs thereby facilitating competition and reducing the likelihood of collusive behaviour.

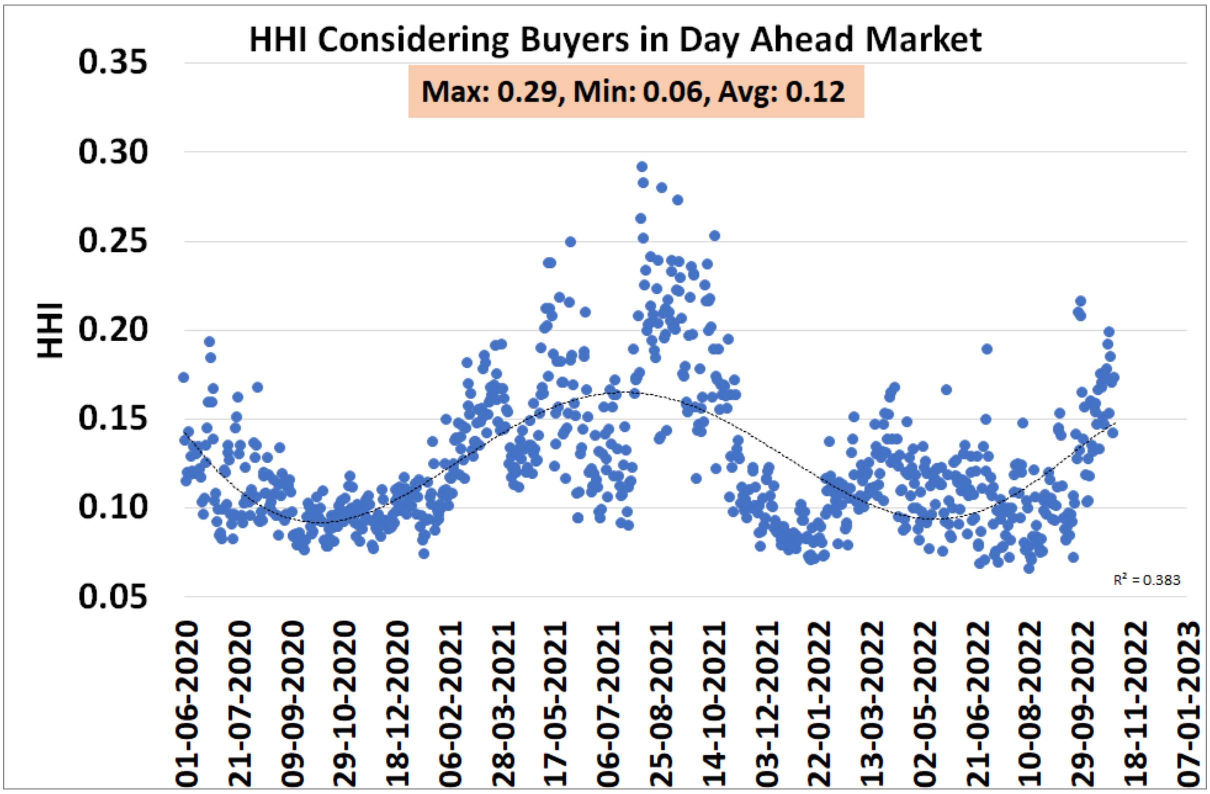

Figure 3: HHI considering Buyers in DAM

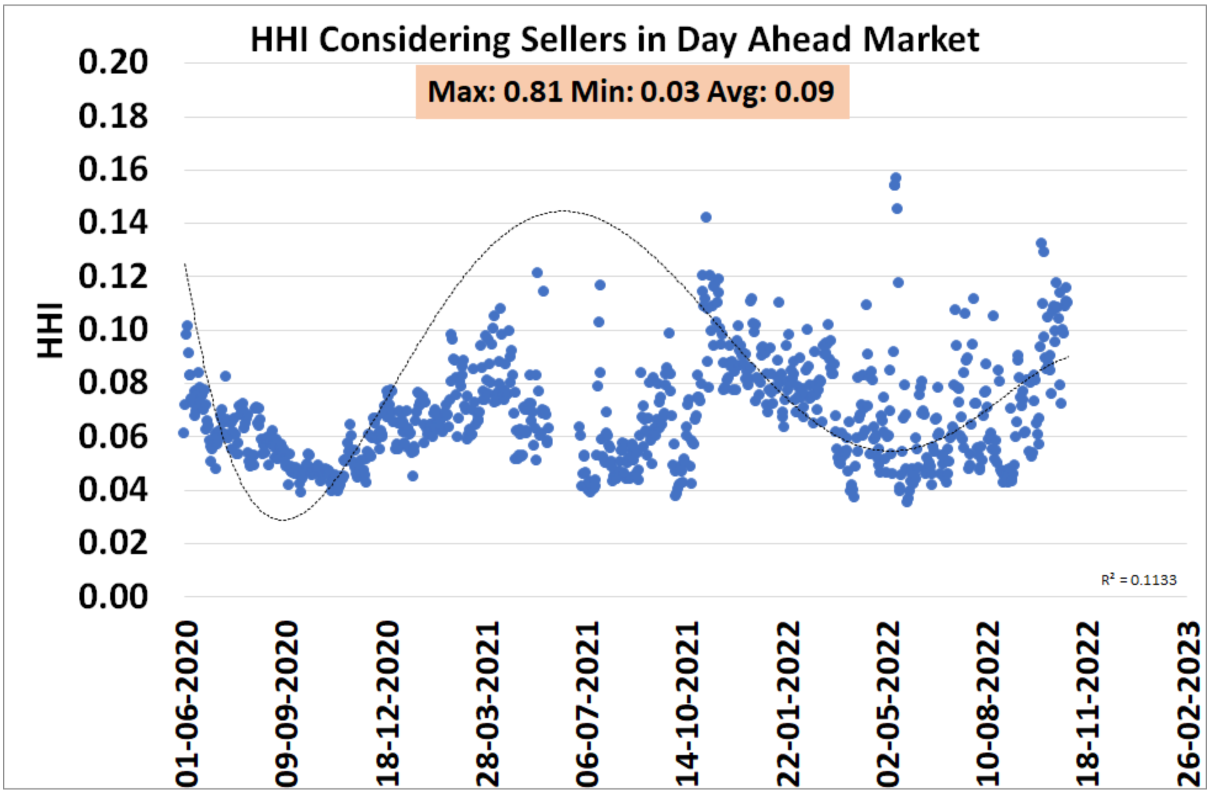

Figure 4: HHI considering Sellers in DAM

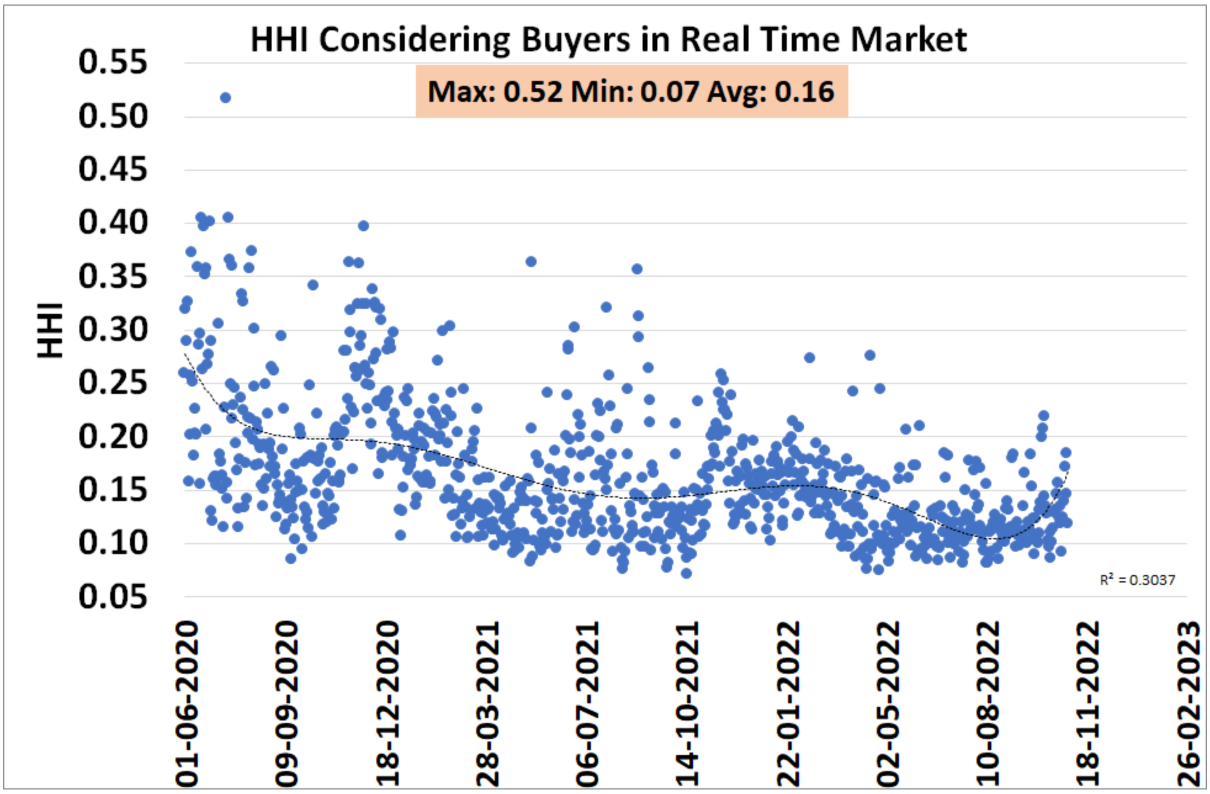

Figure 5: HHI considering Buyers in RTM

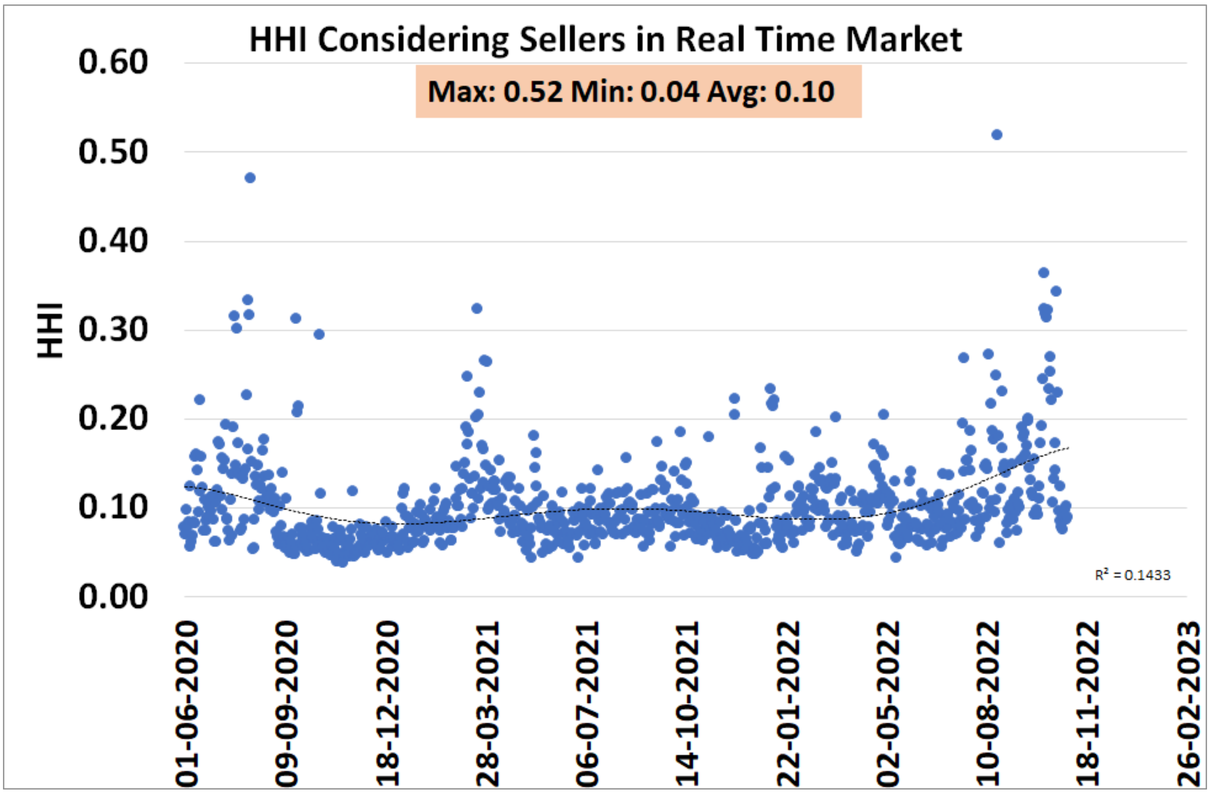

Figure 6: HHI considering Sellers in DAM

Another pro of Pay-As-Bid-Pricing (PAB), as mentioned in the Staff Paper, is it promotes market competition. 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. Therefore, pay-as-bid may inadvertently increase conditions amendable to strategic withholding in the long-run. Consequently, to the extent that market-power is a significant concern, a switch to pay-as-bid may exacerbate, rather than improve, market competitiveness.

- **Information Asymmetry**

Typically, pay-as-bid favours larger market players that can spend more on 'price' forecasting with more information, and are more likely to set the clearing price as a result of their size. In sharp contrast, uniform pricing favours bidding based on marginal costs whereby all players can participate. With uniform pricing, the big suppliers make room for the smaller rivals.

With pay-as-bid pricing, the bidder's incentive is to bid as close to the clearing price as possible. The pay-as-bid auction rewards those that can best guess the clearing price. Not only will the uncertainties introduced by pay-as-bid through information asymmetry tend to discourage the investment in additional generating facilities, it will have an especially discouraging effect on investment by small firms, the economic feasibility of which was an essential premise of deregulation itself.

2. ***"…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…"

POSOCO Inputs

Relative to the international peers with 100 % capacity through electricity market, Indian electricity market withstood the stress conditions in a better manner due to major portion of long term contracts. Long term contracts/bilateral segments, comprising over 90 % in Indian electricity market, is not part of the price discovery through a collective market mechanism. This introduces undue bias on the short term market of only around 5 - 7% when price discovery is happening through uniform clearing price mechanism.

Firstly, it is to be recognized that the respective State Governments and State utilities are responsible for ensuring resource adequacy at all times. There is a need for concrete steps for optimal capacity addition at the state level. It must be appreciated that the high price periods are a part of the much larger problem of the persisting resource inadequacy and poor portfolio planning.

Capacity markets have an important role to ensure resource adequacy (RA). There is a need to institutionalize and implement a mechanism to ensure adequacy in resources to provide the basis for capacity contracting. Still deterministic/rudimentary load forecasting tools are being utilized in many states.

There is need for extensive capacity building and engagement with states. The procurement of RA tools need to be facilitated at state level.

Energy market and capacity markets get settled separately internationally. The generators in capacity market are forced to participate in the energy market. The Load Serving Entities (LSEs)/Discoms make the capacity payments. The capacity market payment is around 10 % of overall costs and the rest 90 % of overall costs is recovered from energy market. The capacity contract ensures that the adequate capacity is available for despatch.

Price volatility/high prices in short-term market is natural due to various factors including varying load-generation balance, weather, forced outages, non-storability of electricity and increase in fuel prices. Even in developed electricity markets worldwide having adequate generating capability to operate with spinning reserves, short term prices tend to go up during stress periods when costly generation has to be bought in to bridge the gap.

Central Commission has been empowered, in case of shortages of supply of electricity, under the proviso to clause (a) of sub-section (1) of section 62 of the Electricity Act, 2003 to fix minimum and maximum ceiling of tariff for sale and purchase of electricity in pursuance of agreements entered between the generating companies and the licensees or between licensees for a period not exceeding one year to ensure reasonable prices of electricity. The Commission has been further mandated under section 66 of the Act to promote the development of market in power. In addition, SERCs have powers, under Section 86(1)(b) of the Act to regulate the purchase price at which electricity is procured by the distribution licensees.

The statutory mandate to develop and regulate market (including trading) in power is not constrained by the pre-requisite of establishing abusive behaviour by a market player. The Central Commission has the statutory mandate to take appropriate actions for addressing the imperfections of the market.

3. ***"…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?…"***

POSOCO Inputs

As per the price duration analysis as illustrated in Fig. 6 - 9 , it is observed that prices are remaining below ₹5/kWh in the day ahead market for more than 80 % of the time in the last five years. Similar is the case with Real time market for over two years.

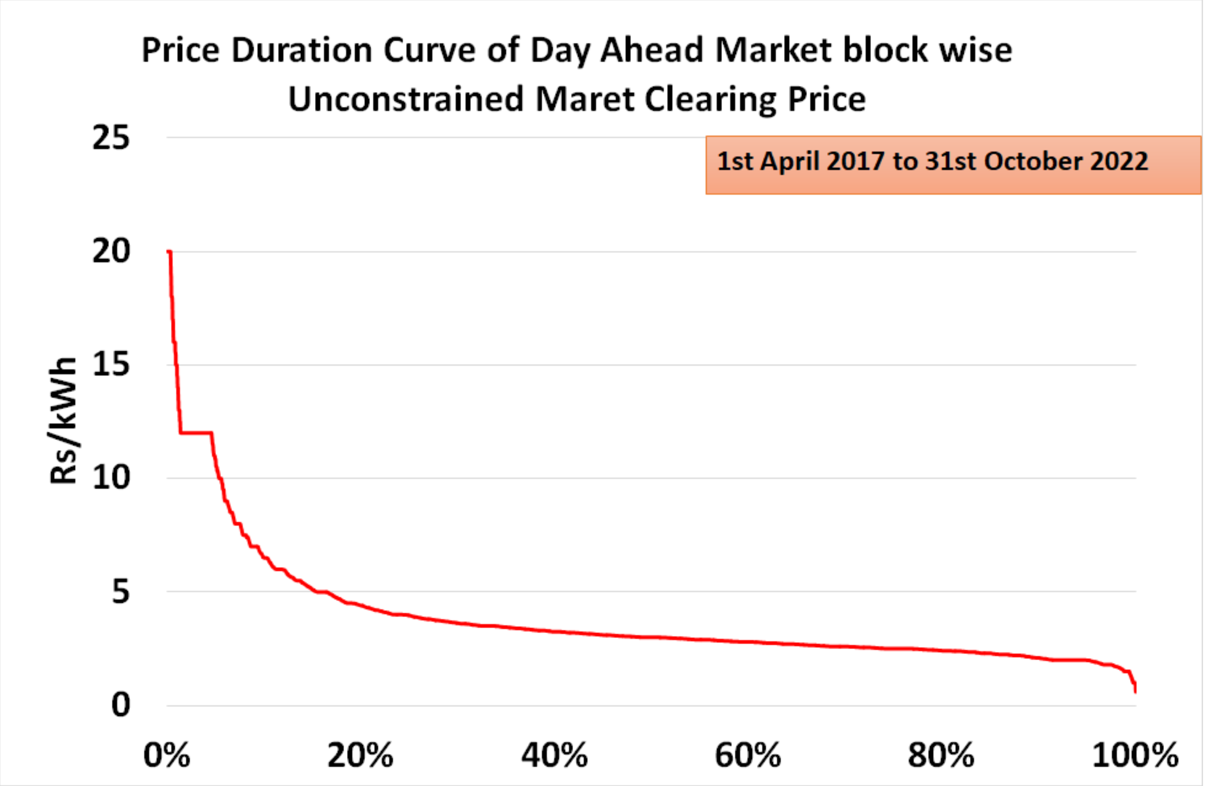

Figure 7: Price Duration Curve of DAM Prices

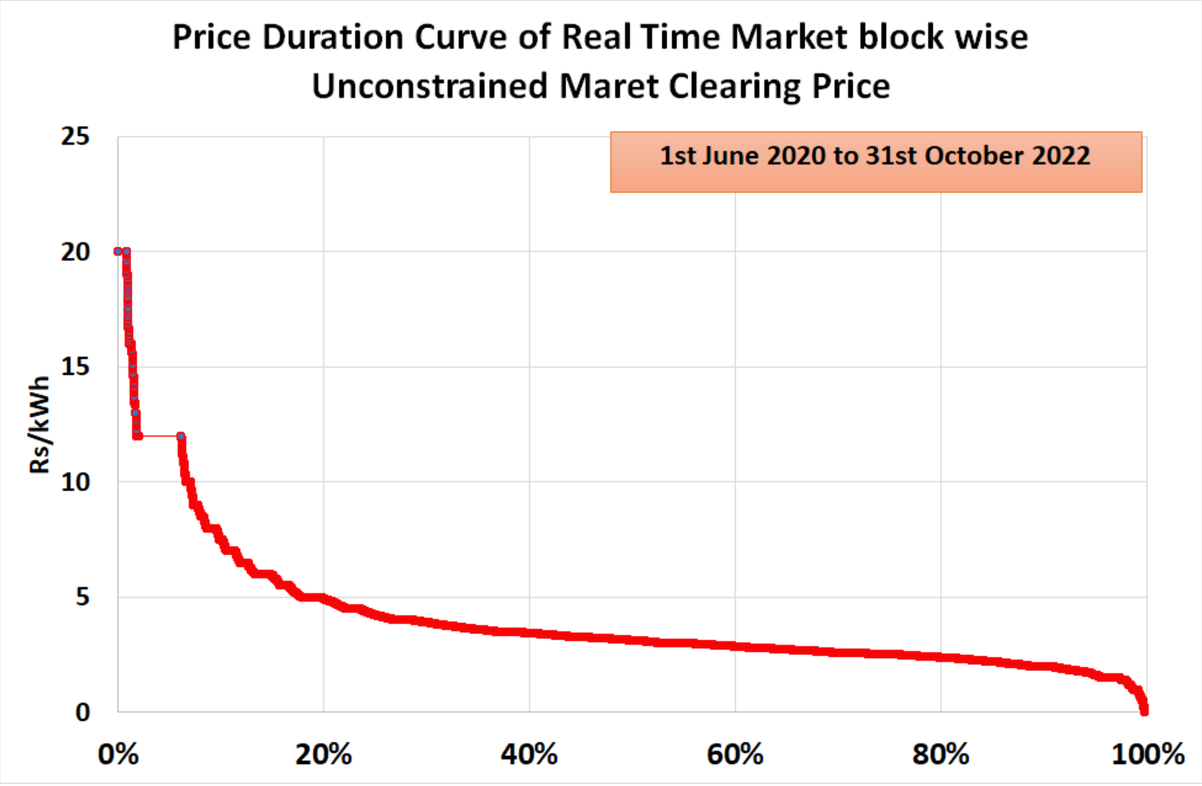

Figure 7: Price Duration Curve of RTM Prices

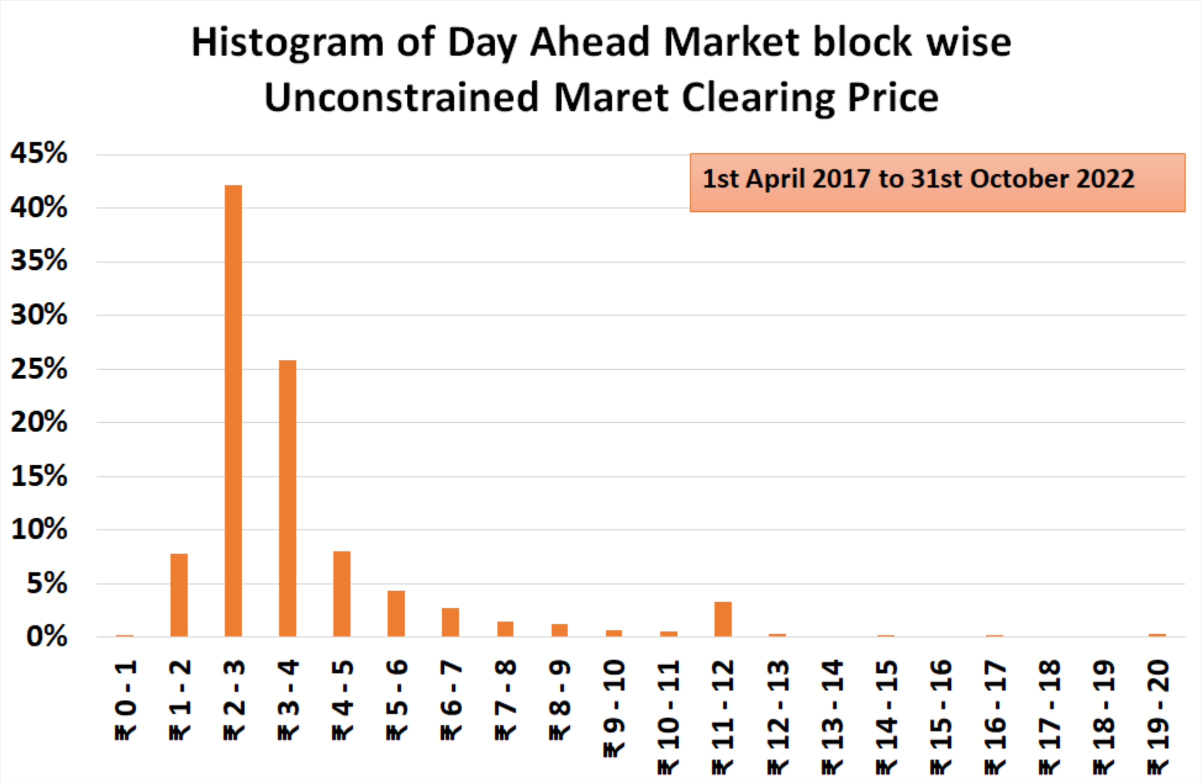

Figure 8: Histogram of DAM Prices

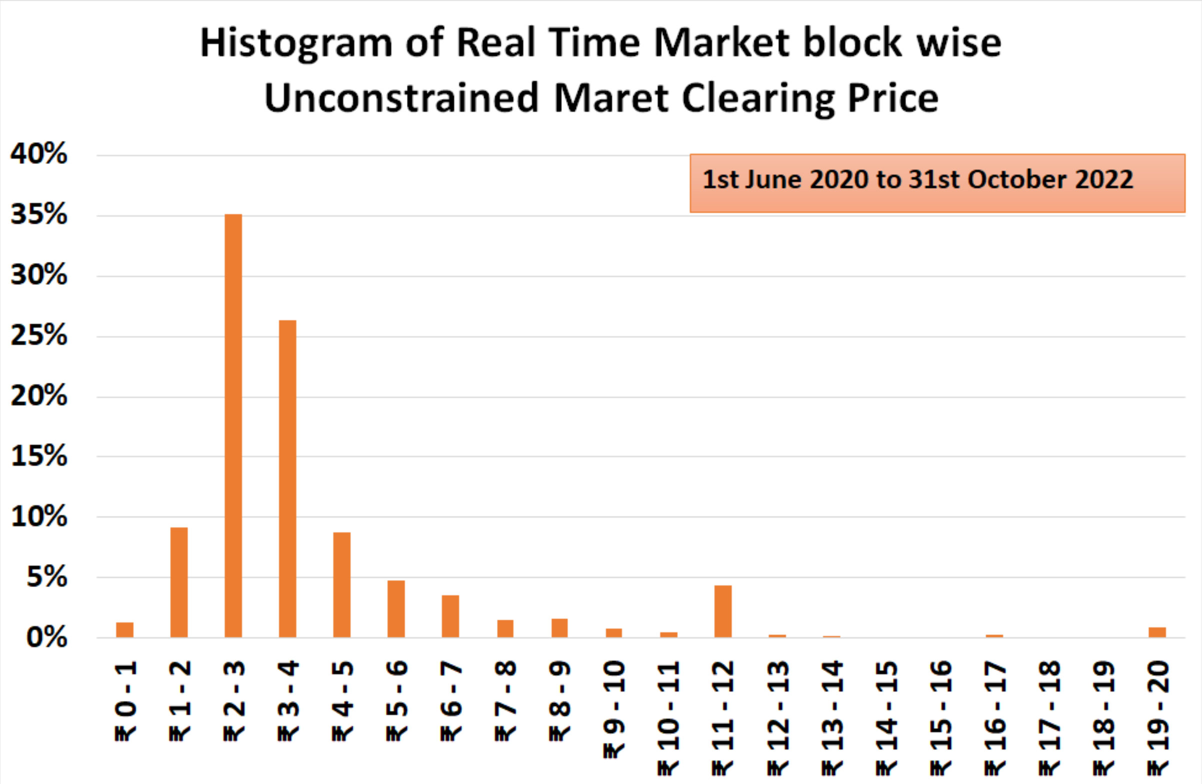

Figure 9: Histogram of RTM Prices

Hence, it is advisable to define a tolerance level for the regulatory intervention. The tolerance level may not adversely affect the return to the investors and at the same time, it needs to control the volatility/spikes in the price of electricity in day-ahead/real time markets being caused due to market imperfections.

4. ***"…What should be the basis for such intervention and tolerance level in the Indian context?…"***

POSOCO Inputs

As mentioned in the Staff Paper, there is a provision of Administered Price Cap in Australian National Electricity Market (NEM). Administered price conditions are independently assessed for each region and each market (energy and ancillary services) in the NEM. As outlined in NER 3.14.2(c), an administered price period (APP) is triggered for a given interval and market in a region when:

- the sum of the regional reference prices (spot prices) in the energy market for the previous 2,016 trading intervals (equivalent to seven days) exceeds the cumulative price threshold (CPT); or
- the sum of the ancillary service prices for a market ancillary service in the previous 2,016 trading intervals (equivalent to seven days) exceeds the CPT.

The CPT is 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 was applied to 5-minute trading prices from the commencement of 5-minute settlement on 1 October 2021 in both the energy market and ancillary service markets. The CPT for the 2022-23 financial year is $1,398,100, which is equivalent to an average spot price of $693.51/MWh over the previous seven days.

When an APP is triggered, Australian Energy Market Operator (AEMO) publishes a market notice to advise the start of an APP from the beginning of the trading interval immediately after that in which the CPT was exceeded. NEM prices and dispatch continue to be calculated normally. However, the Administered Price Cap (APC) and Administered Floor Price (AFP), defined in NER clauses 3.14.1(a)-(b), are invoked to apply upper and lower limits on the published prices as per clauses 3.14.2(d1)-(d2) of the NER.

- The value of the APC for each region is $300/MWh applied to energy and market ancillary services.
- The value of the AFP for each region is -$300/MWh applied to energy prices. The AFP does not apply to ancillary service prices as ancillary service prices are never negative.

Once invoked, an administered price period ends at 0400 hours if, at that time, the cumulative price over the previous seven days (as calculated from spot prices or market ancillary service prices without capping or flooring) does not exceed the CPT.

The relevant extracts on Cumulative Price Threshold (CPT) and Administered Price Cap (APC) from the Australian National Electricity Rules is as follows:

"…Clause 3.14.1

Cumulative Price Threshold and Administered Price Cap

(a)The administered price cap for each region is $300/MWh.

(b)The administered floor price for each region to apply to spot prices is the negative of the value of the administered price cap.

(c)The cumulative price threshold for each financial year is the dollar amount calculated by the AEMC under paragraph (d).

Note: The current value of the cumulative price threshold is set out in a schedule of reliability settings published on the AEMC's website www.aemc.gov.au

(d) By 28 February of each year (commencing 2012), the AEMC must calculate the cumulative price threshold to apply on and from 1 July of that year in accordance with paragraphs (e) and (f) and publish its calculation on its website as part of a schedule of reliability settings.

(e)Subject to paragraph (f), the AEMC must calculate the cumulative price threshold using the following formula:

$CPT^{X} = BV^{CPT} \times (Q_1^c + Q_2^c + Q_3^c + Q_4^c) / (Q_1^b + Q_2^b + Q_3^b + Q_4^b)$

Where:

CPT is the cumulative price threshold in dollars;

x is the financial year for which the cumulative price threshold is being calculated;

BV^{CPT} *is $187,500 (being the value of the cumulative price threshold prior to 1 July 2012);*

Q1 to Q4 are the values of the Reliability Settings Index for each of the four quarters of years c and b (as the case may be) as at five months before the start of year x;

Reliability Settings Index is the All groups, Australia CPI found at Index Numbers, All groups, Australia, in Tables 1 and 2 of the Consumer Price Index, Australia published by the Australian Bureau of Statistics for the relevant quarter, except where that index ceases to be published or is substantially changed, in which case the Reliability Settings Index will be such other index as is determined by the AEMC as suitable;

c is the calendar year commencing 18 months before the start of year x; and

b is calendar year 2010.

(f) If the value calculated by the AEMC under paragraph (e) is:

(1)not in whole hundreds of dollars, then the cumulative price threshold for year x will be the value calculated under paragraph (e) rounded to the nearest $100;

(2)less than the cumulative price threshold applied under this clause 3.14.1 for the preceding financial year(year x-1), then the cumulative price threshold for year x will be the value of the cumulative price threshold for year x-1…."

https://energy-rules.aemc.gov.au/ner/175/24053

Similarly, in case of Indian electricity market, one of the possibilities for triggering of regulatory intervention could be on the basis of average day-ahead market (DAM) price threshold which would be observed for previous 672 time-blocks (15-minute time-blocks for past 7 days). If the daily average DAM price (Unconstrained MCP) exceeds the threshold, then, the price cap of a pre-decided value may get kicked in the DAM segment.

The reasonable rate of return being the basis for such intervention, the tolerance level could be worked out based on the marginal cost of power based on costliest liquid fuel generation capacity. This shall ensure that costliest liquid fuel generation capacity still remains fully operational and the tolerance level does not deprive the consumers of any generation capacity. The tolerance level should also take into account the time of day value and differential between short-term and long term trade.

However, as a measure of last resort, if forced load shedding is the final resource, then this should at least be given a value. So the value or costs of forced load shedding is, by definition, unknown. This so-called "value of lost load" (VOLL) needs to be assessed. Some countries actively use VOLL assessments to calculate price caps and to determine the benefits of other initiatives to improve system security.

5. ***"…Would it be advisable to define a dynamic price cap - for example, if the prices breach the tolerance level as defined above,***
    a. ***the price cap is automatically reduced to a point where say 90% or 95% of the supply is cleared? or***
    b. ***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?…"***

<u>POSOCO Inputs</u>

Uniform price cap has traditionally been suggested as a method of mitigating the effect of market abuse. However, uniform price cap is often criticized for distorting market signal. Moreover, uniform price cap will have to be set at sufficiently higher level and may result in consistently higher prices due to opportunistic behaviour of one or more suppliers. On the other hand, bid caps put a ceiling on the maximum price that a supplier can quote.

It is logical to set bid caps based on slightly liberal estimate of marginal costs associated with the technology used for generation. In case of a competitive market, it is the competition which forces suppliers to submit bids based on marginal costs. In the absence of perfect competition, suppliers can be forced to submit bids close to their marginal costs by way of bid caps. The advantage of bid caps is that the clearing price during periods of low demand may get settled at prices lower than during peak demand periods depending on the last supplier to be dispatched in that period. The price signal for setting up peaking plants will not get lost as in case of uniform price cap.

It may be more appropriate to link the price caps/tolerance levels to an index of fuel price such as domestic coal, imported coal, domestic gas, imported gas etc. The movement in fuel prices would be captured by such index. If there is a fall in the fuel price, the ceiling would stand reduced. On the contrary, if there is a rise in the price, the ceiling would be automatically raised.

It would be similar to the prices of petrol and diesel which have been made market determined by the Government effective from 26th June, 2010 and 19th October, 2014 respectively in line with the changes in the international market prices and other market conditions. There is Indian basket of Crude and Gas as an index of the price of crude and gas imports in India. Since 2017, fuel rates are revised every day at 06:00 AM in India, and this is called dynamic fuel price method. This makes sure that variations of global oil prices throughout the day are transmitted and reflected to fuel users and dealers.

With a dynamic price cap, the administered route can be avoided with cost reflective market clearing prices of electricity.

6. ***"…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?…"

<u>POSOCO Inputs</u>

It is to be recognized that high cost of traded power, to a great extent, is the result of what some of the buyers are prepared to pay. As is well known, a large part of supply of electricity (~87%) in the country is still mainly tied in long-term Power Purchase Agreements. The price increase/volatility is limited to a volume of about 5-7 % of the total generation.

In the terms and conditions of tariff specified by the Commission, the cost of fuel (based on normative standards of efficiency) is made "pass-through". The variable charge of coal-based and lignite-based generating stations has been steady, with nominal fluctuations. However, recently, frequent and substantial increases in the cost of fuel such as coal, gas etc. has resulted in phenomenal increases in the energy charge of some of the generating stations because of which, some of the installed capacity of these generating stations at times remains un-requisitioned and idle.

The principle behind the functioning of the electricity market with renewables is that producers recover the fixed costs of renewable power plants during scarcity pricing periods. During these peak periods, renewable power is sold on the market at the price of costlier conventional energy. This infra-marginal rent makes it possible to finance the fixed costs of the entire fleet, except, of course, those of the marginal plant, which only recovers its variable costs. This is the so-called missing money problem raised in the literature by (Stoft, 2010, 2002). This requires a complementary income for this plant. If the amount of sub-marginal revenue is insufficient to cover the fixed costs of the fleet, a capacity market must be implemented. This market pays for the power to ensure that it will be available at peak times.

Few international examples of scarcity pricing are as follows:

1) US: Scarcity pricing in US refers to the price escalation that occurs when supply becomes tight in a commodity market. As demand edges close to supply limits, prices rise, reflecting the growing scarcity. High price cap is typical in an energy only market like ERCOT. To curb high prices, a price cap (the highest price a generator can charge for electricity) has been in place. This price cap has increased over the years between 2011 and 2015.

2) Iberian market: A cap is placed on the price that gas-fired plants bid into the market. Generators are then compensated for the difference between the level of the cap and the wholesale gas price. W.e.f June 2022, the cap is at €40/MWh for the first six months of the cap period, increasing by €5/MWh every month until 31 May 2023. (Graded increase of price caps)

3) Greece: The Greek government proposed to split the electricity market in two – low carbon and fossil fuel sources. Low carbon sources operate "when available" and get remunerated based on LT costs. Fossil fuel generators, flexible providers, demand response services bid into a market designed around marginal pricing. Consumers pay a weighted average across the two markets, minimizing their exposure to high prices set by gas plants

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 may have opportunity to make large windfall profits when there is a sharp rise in wholesale electricity prices. Under normal circumstances, such windfall profits also provide investment incentives.

The price caps come with problematic challenges: The demand price would be skewed downward relative to the market price, increasing electricity demand; the fact that each segment has its own electricity price creates opportunities for market gaming; electricity suppliers would attempt to evade the cap by selling outside the capped market or exchange; etc.

The public authorities are entitled to deduct the surplus if the infra-marginal rent has become excessive, which in turn, generates windfall profits. This is what the Belgian government has done since 2009 for the nuclear power plants in Belgium. They considered that these plants benefited from a scarcity income. Faced with the same situation for the French nuclear power plants, France decided to share this rent between the historical operator EDF and its competitors. This is the ARENH mechanism introduced at the same time. Recently, the French government capped the electricity-selling price (TRV) at the level of the final consumer, but not on the wholesale market, is based on the observation of windfall profits.

As outlined in the Staff Paper, on 6 October 2022, the European Union (EU) formally adopted the new Regulation introducing emergency measures to mitigate high energy prices and the risk of supply shortages in Europe. The two tax-related measures include a revenue cap on infra-marginal electricity producers and a temporary solidarity contribution over the surplus profits of companies in the crude petroleum, natural gas, coal, and refinery sectors.

However, EU Member states have been given choice to collect and redirect the surplus revenues towards supporting and protecting final electricity customers. Member states have freedom to introduce some flexibilities to reflect their national circumstances and the measures in place at national level. These include the possibility to set a higher revenue cap, use measures that further limit market revenues, differentiate between technologies, and to apply limits to market revenues of other actors including traders, among other things.

There is no mention of system operator collecting the excess revenues of inframarginal generators. Therefore, there a lot of missing links in the EU agreement which would evolve over a period of time.

Therefore, the following points may have to be considered during the design of price-caps and levy on supernormal profits:

- There are various associated actors associated with electricity market: production of electricity, extraction of fuel, or the sale of electricity and energy, production, distribution, and trade of energy products, importing electricity, energy for subsequent sale and environmental certificates
- The tax basis would have to be designed in a way that exclusively captures the windfall profits generated by the spikes in fuel prices.
- Certain players operate on a hedged basis, to protect themselves against price fluctuations, the financial benefit associated with the price fluctuations may in fact have been passed to financial counterparties, thus diluting the profit

remaining in the hands of the energy industry player. In such cases, the tax would not capture the exceptional profitability.

Whether it is better to skim windfall profits on a periodic basis, using wholesale power markets, or downstream using more standard profit taxation techniques to aggregate profit will depend on how well the economic, legal, and political complications of those interventions can be resolved in India.

7. ***"…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?…"***

<u>POSOCO Inputs</u>

In US type of Centralized Markets, the generators are generally monitored and bid within a pre-specified band of their costs. The independent marker monitor uses one such measure known as the price-cost markup, which is the average amount by which the clearing price exceeds the short-run marginal cost of the resource setting the price. (However, these data do not provide information about the earnings of infra-marginal units, which offer below the clearing price and earn the differential between the clearing price and their marginal costs.).

As per the Ministry of Power Office Memorandum, the sellers with high cost of generation will be allowed to sell in HP-DAM market based on certain technologies. To begin with, the following categories of generators would be eligible to participate in HP-DAM:

1. Gas based Power Plants using imported RLNG and Naptha

2. Imported Coal based Power Plant using imported coal.

3. Battery Energy Storage Systems (BESS)

The category of plants eligible to participate in HP DAM shall be subject to quarterly review by the Central Commission. There is a need for suitable declaration/affidavit from the potential HP-DAM sellers about their energy cost/variable cost/fuel cost which needs to be ensured at the time of bidding in the Power Exchanges. The ascertainment of the variable cost of generators whose 100% tariff are not determined by regulators would be challenging.

Independent third party audit once in a year may be prescribed to verify and validate the HP-DAM sellers' declarations regarding their energy cost/variable cost/fuel costs.

Various market options are presently available to the market participants through bilateral transactions and collective transactions through the Power Exchanges. Fragmentation of the Day ahead Market into a high price segment and a normal segment would also lead to a split in the liquidity. This may make the price discovery less robust Instead, a single DAM with a higher price ceiling is desirable so that all generation is able to participate. Buy side liquidity is also ensured in a unified (single) segment thereby, facilitating robust price discovery.

Strengthening of Market Monitoring and Surveillance

There are various strategies adopted by market participants for exercising market power. This includes physical or quantity withholding which entails deliberate reduction in the generator's output that is bid into the market to shoot up prices and financial or economic withholding which entails bidding in prices higher than the competitive bid for the particular generation unit.

Markets in US, having Financial transmission rights, also witness transmission related strategies viz. creating or aggravating transmission congestion in order to raise prices in a particular zone or node. Because of such events, pro-active market monitoring and surveillance is increasingly recognized as vital to restrict market manipulation. This would be important for India as it envisages to implement several interventions and move towards a competitive wholesale power market.

Market monitoring activities are typically undertaken by Regulators, System Operators and Power exchanges. While these entities have their in-house market monitoring functions, independent market monitors (IMM) are also appointed by ISOs in US who undertake pro-active market monitoring and surveillance. As per FERC mandate, the IMMs submit their reports to ISOs as well as FERC. Further, the IMMs can be appointed or removed by ISOs only with the approval of FERC.

FERC in US and ACER as well as National Regulatory Authorities in EU conduct extensive analysis of transactional and market data to understand market manipulation and gaming possibilities. Such IMMs have access to historical & real-time bidding data from ISOs which are shared with ISOs in order to see if pro-active measures can be taken before market clearing. To undertake such monitoring and surveillance, several indices and data-intensive simulations are carried out. There is a need for institution building of market monitoring in India.

8. ***"…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 proposed 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?…"

<u>POSOCO Inputs</u>

The demand response and storage participation has already been facilitated in Ancillary Services Regulations, 2022 at the ISTS level. Globally, demand response programs are being handled in different ways by different utilities. There is concept of passive 'implicit' control which gives residential and commercial consumers a discount on regular electricity rates in exchange for higher prices during stress periods.

On the other hand, there is concept of active 'explicit' control which allows distribution utility to directly control select loads of consumers by sending signals to the loads which are equipped with smart devices. These smart devices can automatically curtail the load based on such signals.

There are also third-party demand response companies that aggregate residential and non-residential customers. Aggregators act as “virtual power plants” and receive payments from utilities in exchange for reducing load on peak usage days.

Going forward detailed mechanisms for demand response may be worked out through a regulatory framework at the inter-state and intra-state levels.

Annexure – 1

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