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Power Chronicle

Power System Overview & Analysis

Power Market Overview & Analysis

Regulatory & Policy Perspective

EAL News

Editorial

The era of perennial power shortages seems nearly over. However, this does not diminish the role of planning for long-term resource adequacy (RA) to meet the expected demand. CEA issued a draft that aims to provide a framework for RA planning across the country. The RA guidelines, though include the role of demand response, place greater emphasis on creation of capacity. Growing role of renewables including behind the meter generation and electric mobility and emergence of green hydrogen present new forms of generation sources and demand generation. This highlights the role of a dynamic approach to RA as with required granularity. EAL's experience reveal that such studies need extensive data and elaborate modelling exercise that needs to be tailored to the needs of the specific states. The need for capacity building of the state-level agencies in undertaking RA studies is crucial to ensure that adequate data is archived and periodic analysis is undertaken in a timely manner.

The CERC staff paper on power market initiated a discussion on the mechanism for price discovery and the impact of price cap introduced post the price spike on the PXs. An attempt to change the pricing mechanism from uniform price bidding (currently being used) to Pay-as-Bid pricing would not likely solve the gains made by cheaper generators. EAL opines that this would then change the bidding behaviour itself with cheaper generators bidding at a much higher price, thus diminishing any hope to reduce the surplus to be gained by such generators. Further, Pay-as-bid pricing, in the absence of a capacity market, would also undermine the incentive for capacity addition and would lead to inferior outcome for the sector. EAL suggested adoption of promotion of demand response, dynamic pricing cap and a hybrid approach to determine market clearing price to partly address some of the concerns highlighted above.

The EScerts market needs to derive economic signals from the other such markets providing value to carbon displacement. The lower price cap for EScerts, if required, may have been linked to the REC markets floor price. PPAs with thermal plants having completed 25 years would be viewed as a new PPA and thus be compared on a fixed as well as variable cost basis. Furthermore, pooling of all such PPAs would lead to inefficient market outcomes that would deviate decision-making from sound commercial principles. EAL analyse that the pooling mechanism would lock the beneficiaries into the 'pool' of PPAs rather than being considered on an individual basis.

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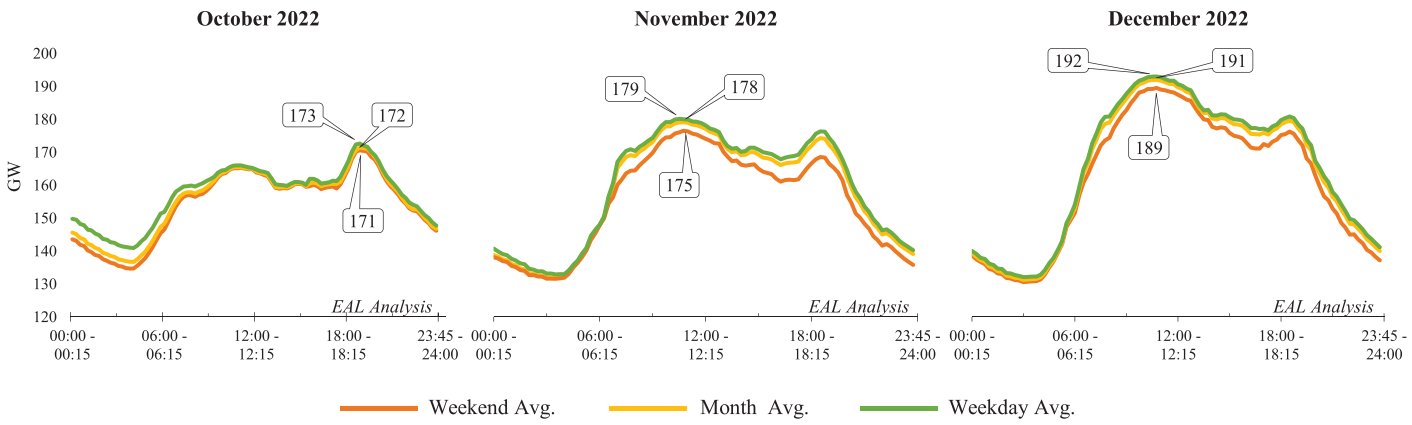
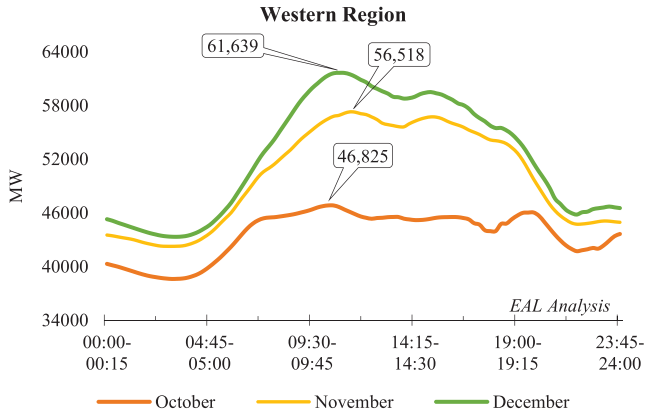
Power System Overview & Analysis

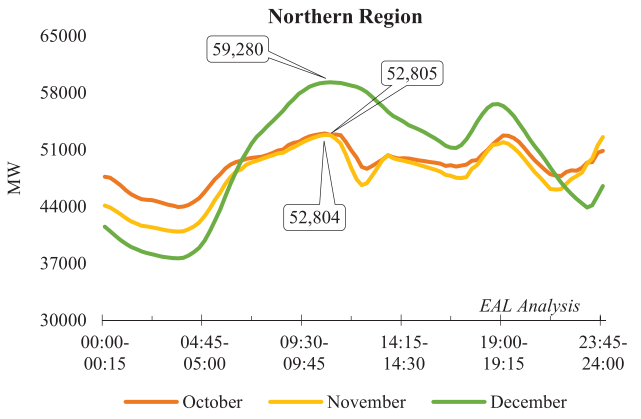
All India Demand Met Profile

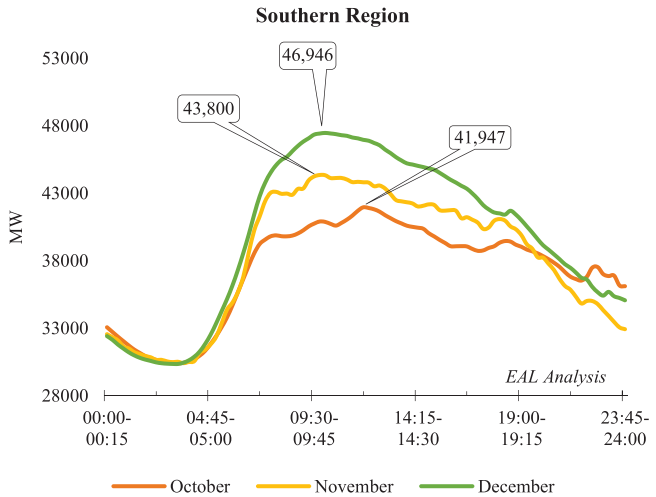


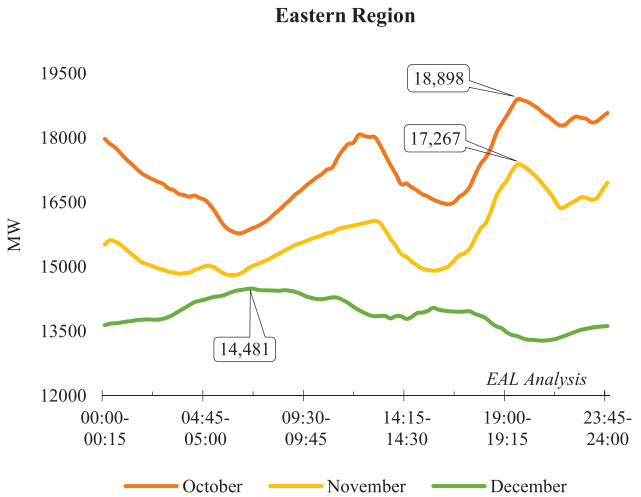
From October to December quarter, all India peak demand reached 205 GW (10:45 - 11:00) on 31st December, 2022, about 12% higher than the previous year's peak demand recorded at 183 GW (10:45 - 11:00) on 24th December, 2021, during the same quarter.

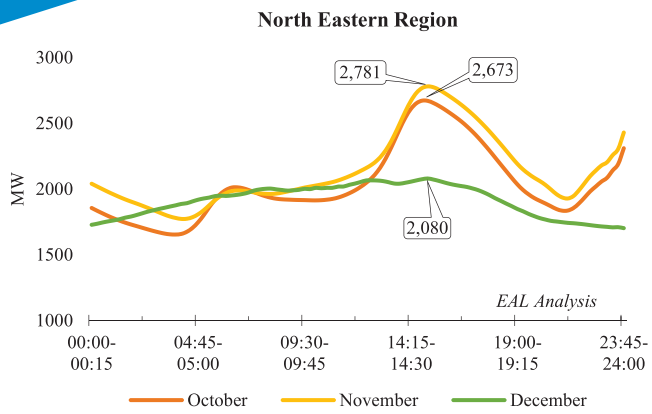
Region-wise Demand Met Profile







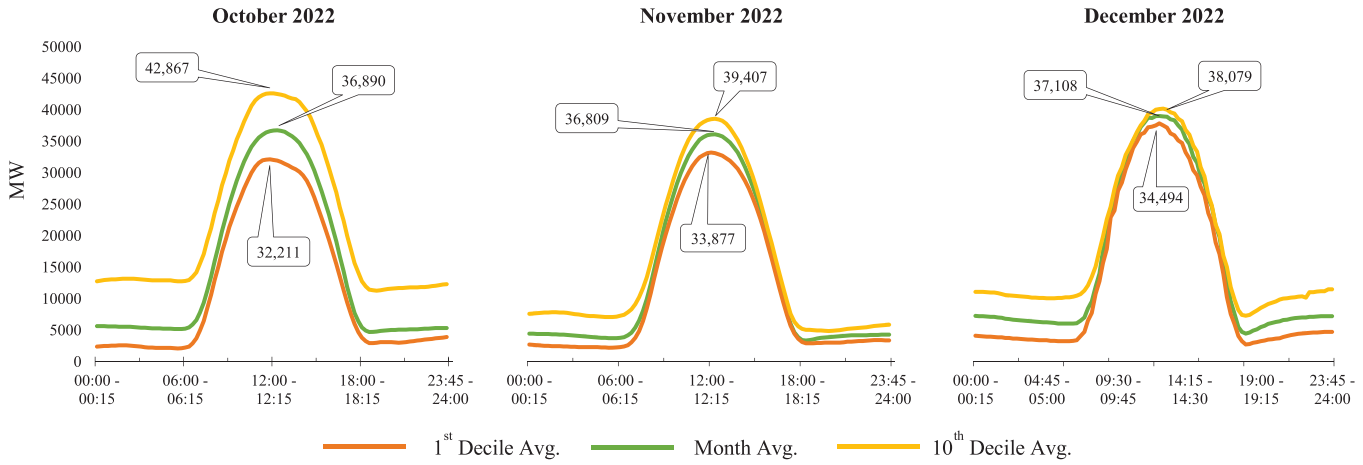




- Significant increase in demand can be observed in the month of December for Western and Southern region.
- Significant increase in demand can be observed for Eastern region in the month of October.
- Significant increase in demand can be observed from 14:15-15:00 hrs for North Eastern region in the months of October and November.

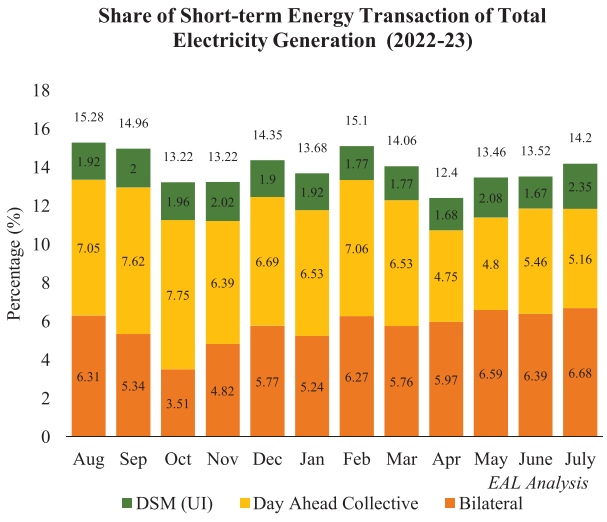
Demand and generation profiles at National, Regional and State-level can be accessed on EAL's web portal.

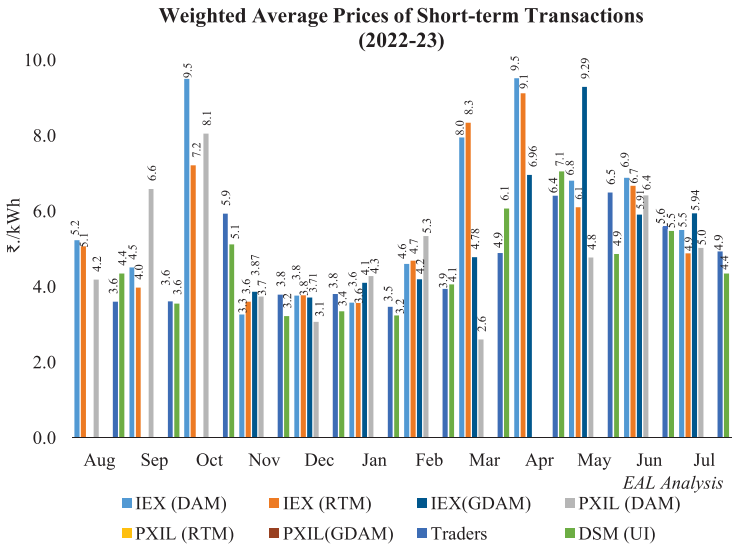
All India Renewable Energy (RE) Generation Profile



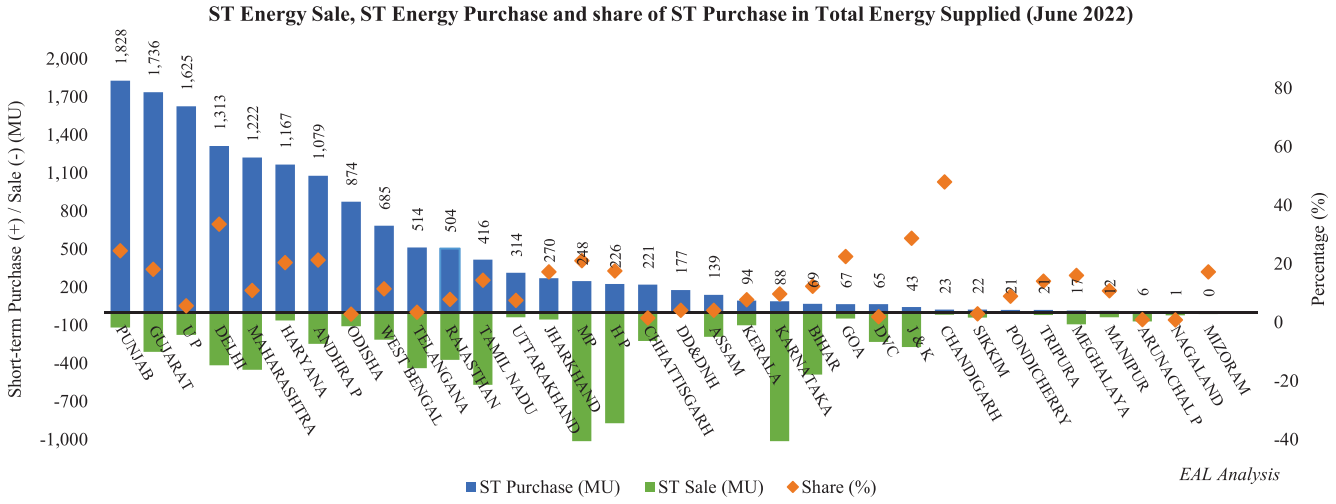
All India peak RE generation reached 43.39 GW (12:15-12:30) on 22nd December, 2022, about 22.39% higher than the previous year's peak of 35.45 GW (12:30 - 12:45) on 19th December, 2021.

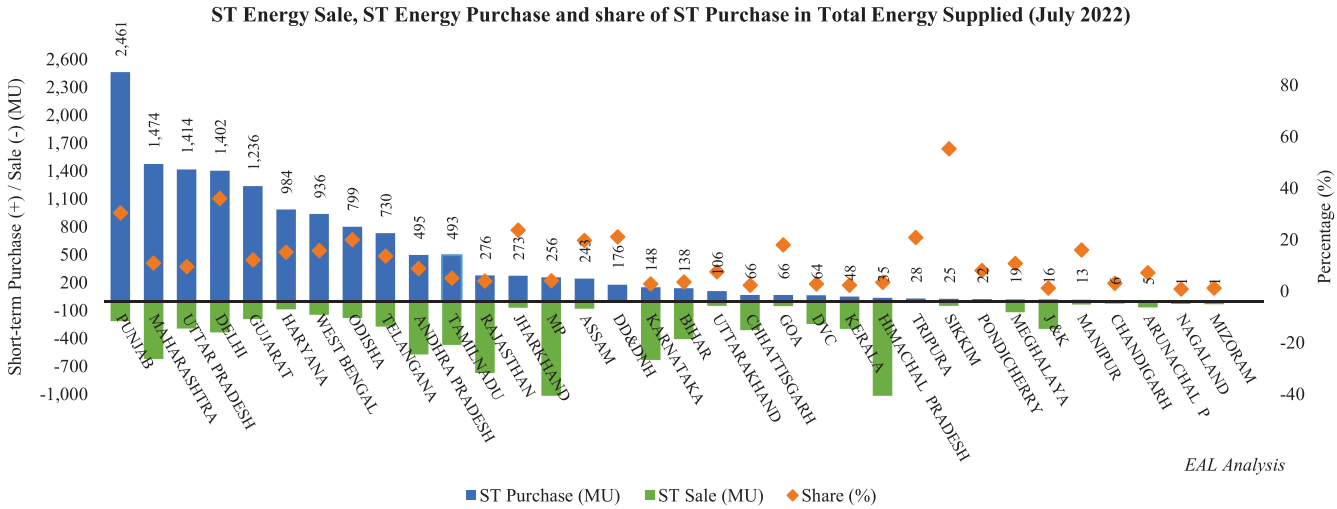
Short-term (ST) Energy Transactions





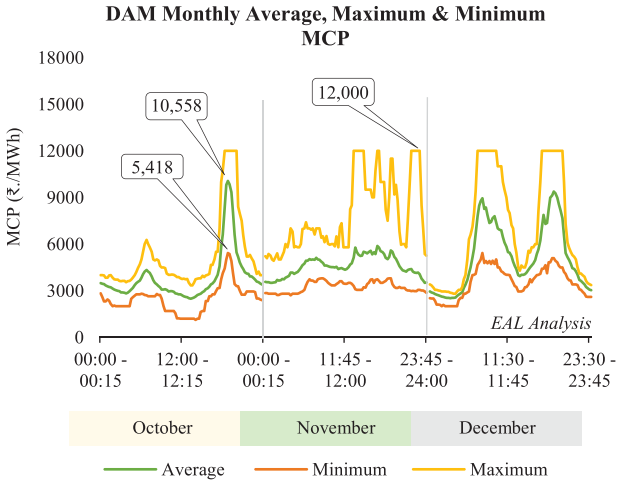
Monthly Short-term (ST) Purchase and Sale Quantum across States

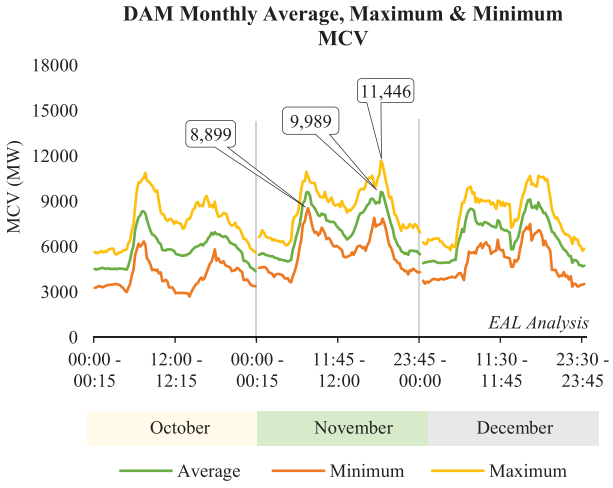




Power Market Overview & Analysis

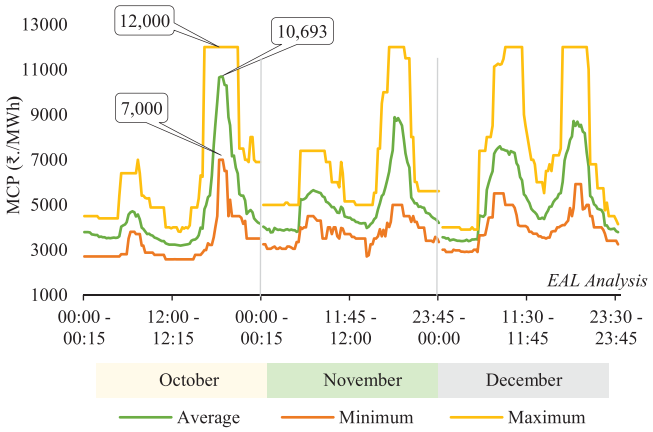
DAM – Market Clearing Price (MCP) & Market Clearing Volume (MCV)



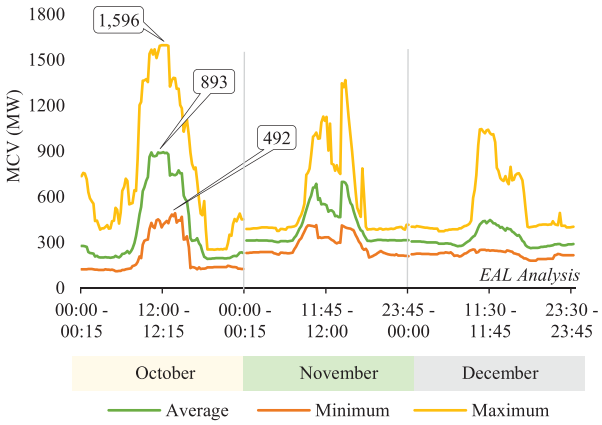


Green Day-Ahead Market (G-DAM)

G-DAM Monthly Average, Maximum & Minimum MCP

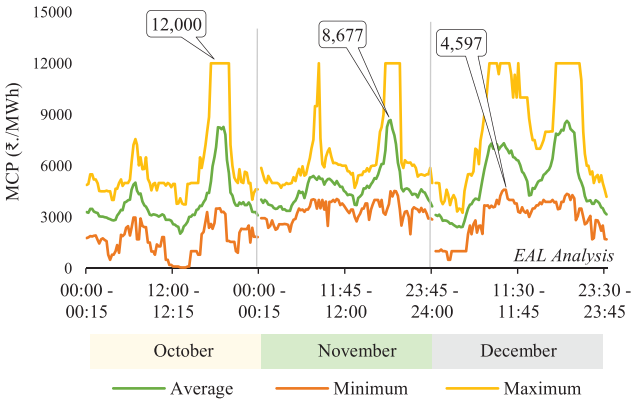


G-DAM Monthly Average, Maximum & Minimum MCV

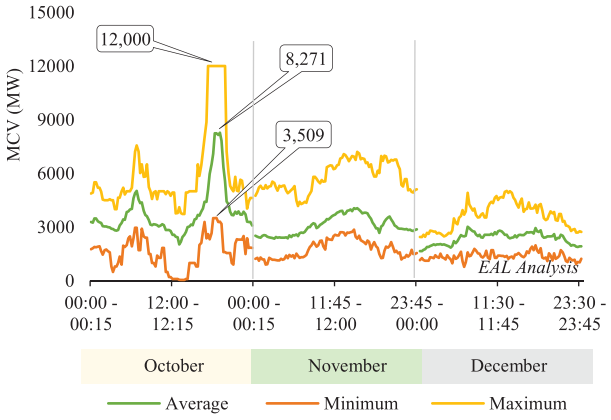


RTM- Market Clearing Price (MCP) & Market Clearing Volume (MCV)

RTM Monthly Average, Maximum & Minimum MCP

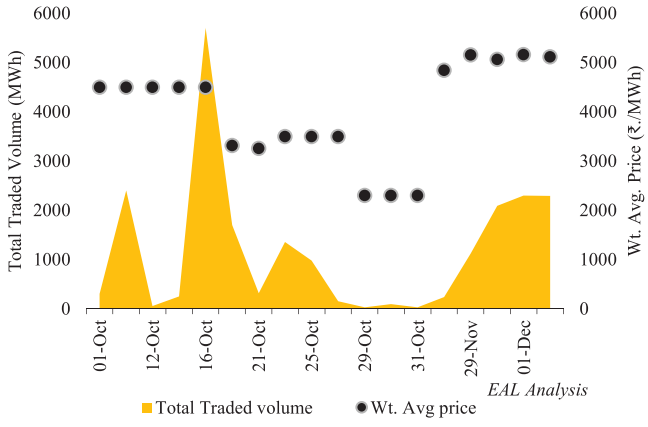


RTM Monthly Average, Maximum & Minimum MCV

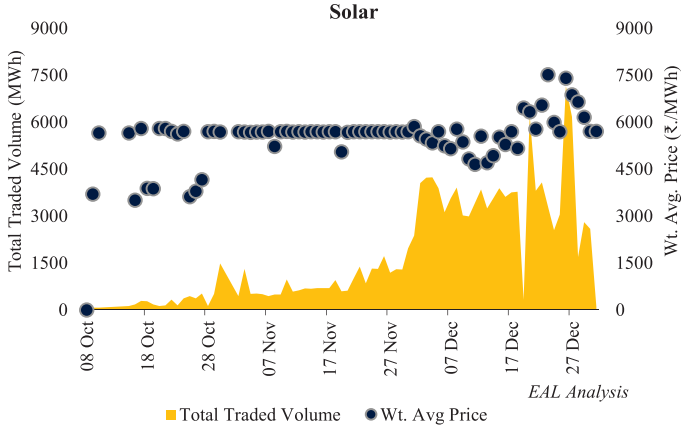


Green Term-Ahead Market (G-TAM)

Day-Ahead Contingency Transactions - Solar



Day-Ahead Contingency Transaction - Non Solar



The total traded volume and weighted average clearing price of Non-Solar is higher in comparison to Solar in the Day-Ahead transaction Contingency during October to December quarter.

Note: The above power market overview and analysis are based on the data from IEX Website

Regulatory & Policy Perspective

CEA (Draft Guidelines for Resource Adequacy Planning Framework for India) Regulations, 2022 [Draft]

Central Electricity Authority (CEA) notified a draft on Guidelines for Resource Adequacy (RA) Planning Framework for India on 23rd September, 2022. The key highlights of the draft are mentioned below:

- **Objective:** The sole objective of RA framework is the reliable fulfilment of the peak demand with the help of adequate supply of generation and demand response.
- The RA framework will cover the following important aspects:
  - Availability of adequate generation capacities to reliably serve demand under multiple scenarios.
  - Optimal capacity mix based on minimization of overall system cost.
  - Time horizon for the implementation of the framework should be 5-10 years.
  - Incorporated energy storage, other flexible resources, and short-term (ST) sale/purchase under bilateral contracts.
- **Important Definitions:**
  - Loss of Load Probability (LOLP): Measure of probability that a system's load will exceed the generation and firm power contracts available to meet that load in a year.
  - Expected Energy Not Served (EENS): Expected amount of load (MWh) that may not be served for each year within the planning period.
  - Net Energy Not Served (NENS): Total expected load shed due to supply shortages (MWh) as a percentage of the total system energy.
  - Planning Reserve Margin (PRM): It is expressed as a certain percentage of peak load forecast of the system.
- **Procedure to Determine RA Targets:**
  - Step 1: Initialization of nominal value of PRM.
  - Step 2: Determination of generation capacities at nominal PRM.
  - Step 3: To meet the demand reliably for multiple future scenarios by calculating LOLP and EENS.
  - Step 4: The whole process above will be iterated again and again until the value of LOLP and EENS does not converge to a minimum standard value.
  - Step 5: To estimate the value of the PRM asked on the evaluation of the optimized marginal cost of reducing load shed.

EAL Opinion

- **Necessity of RA Framework:** The ongoing challenge of catering to the peak demand reliably is currently being faced by the utilities in India. Sufficient amount of power supply coupled with demand response framework and sharing of inter-state and inter-region power should be adopted to meet the peak demand reliably. The overall objective of RA framework is to avoid demand-supply mismatch, ensure system security and reliability at the national level. Power procurement cost is a major part of the RA study. Power Procurement Plans and contracts typically have a long-term horizon hence, need to be worked out well in advance, based on reliable and dependable forecast. CER, IIT Kanpur carried out a research on the importance of these aspects and published a book on "Regulatory Framework for Long-term Demand Forecasting (LTDF) and Power Procurement Planning (PPP)"[1], highlighting the need for a regulatory framework for the same. CER and EAL IITK have also worked on numerous

[1] Singh et al. (2019), *Regulatory Framework for Long-term Demand Forecasting and Power Procurement Planning, CER Monograph, Book ISBN:978-93-5321-969-7, https://cer.iitk.ac.in/assets/downloads/CER_Monograph.pdf*

similar assignments and have provided their opinion on "Power Purchase and Procurement Process Regulations"[2], and "Terms and Conditions for ST Procurement/Sale of Power Regulation, 2021"[3].
Given the experience of CER and EAL in carrying out LTDF and PPP for the Uttar Pradesh and Chhattisgarh states, we reinforce the need for a robust regulatory framework for the same. **From these studies, it was inferred that significant economic benefits in terms of reduced private and social costs is possible through RA.**

- **RA vs Generation Adequacy:** Draft Clause No. 2 (1) (1) states *"A key aspect of Resource Adequacy planning is to ensure that adequate generation capacities are available, round-the-clock, to reliably serve demand, under various scenarios. This naturally translates into the need for ensuring adequate reserve margin, which could cater to varying levels of demand and supply conditions in the grid. In the wake of high RE generation, it is important to understand demand-supply situation in the grid in more granularity." While Clause No. 2 (1) (2) states "It is necessary to develop a resource adequacy framework to suggest the optimal capacity mix required to minimize the total system cost in meeting the projected demand for the future. This should include determining new generation capacities to meet future demand growth." And Clause No. 2 (1) (3) states " The resource adequacy framework should holistically look at a 5 – 10 year time horizon. This is critical, considering the longer gestation period required for planning and constructing most generation technologies."*
  It's important to point out that role of generation, additional generation capacity is emphasized again and again in the document, whereas the similar association of demand response with RA have not been provided. This undermines the role of demand response in RA.
  Demand response helps in ensuring to address expected demand supply gap in the short run, thus avoiding addition of expensive capacities to meet the peak demand for few hours of the year and hence will avoid the potential burden of the additional costs on the shoulders of the consumer. Thus, demand response should be incorporated properly.

- **Information of Generation Capacities at CEA and Un-Requisitioned Surplus (URS):** Draft Clause No. 1 (1) (b) states *"Presently, states do their power procurement planning and contracting by considering all the possible options available to them. However, sometimes **details of all generation capacity** available at regional or National level **may not be available with states.** Such a situation necessitates designing of a mechanism to ensure adequacy of resources through sharing of reserves and prevent a potential surplus/deficit situation, in an optimal way."* (emphasis added)
  The Clause indicates that the states do not have any information regarding the generation capacities at regional and national level. Hence, there may be a time when there is excess generation taking place at some region, while the other region is suffering from demand deficit and due to the lack of knowledge of capacities available in other region, the power cannot be provided to demand deficit region from surplus generation region. However, the required information regarding the generation capacity is available on CEA and URS.

- **Long-term Power Procurement Mechanism to Ensure Adequacy of Supply:** Draft Clause No. 1 (1) (f) states *" Currently, there is no mechanism to enforce and monitor whether adequacy of supply is being met by state utilities by carefully integrating availability of resources in other states and regions. Hence, situations like overhang of capacity or demand deficits have been common in the recent past."*
  The Clause suggests that currently there is no operating mechanism to ensure that the adequacy of supply but state utilities sign long-term power procurement agreement with generators anywhere in the country to ensure the same. Thus, there is certainly a need to improve the existing mechanism, but it is incorrect to indicate the non-existence of such mechanism.

[2] *Draft Detailed Procedure for Madhya Pradesh Electricity Regulatory Commission (Power Purchase and Procurement Process) Regulations,* Revision-II, 2022 (RG-19(2) of 2022),
https://cer.iitk.ac.in/odf_assets/upload_files/blog/Revision_2_2022_Power_Procurement_Draft_Regulation.pdf
[3] *PERC (Terms and Conditions for short-term procurement/sale of power) Regulation, 2021,*
https://cer.iitk.ac.in/odf_assets/upload_files/Draft_APERC_Terms_and_Conditions_for_short_term_procurement_sale_of_power_Regulation_2021.pdf

- **RA is a Combination of Adequate Generation and Demand Response:** The definition of RA have been provided under the Clause No. 1 (2). It suggests that the RA should ensure either adequate generation capacity or demand responsive resources such that peak load can be met reliably. Ideally, the RA should be implemented in such a way to integrate the adequate generation capacity (AGC) with demand responsive measures.

- **Optimal Reserve Margin Study on Regional Level:** The optimal reserve margin study can be undertaken by the utilities on the state level as per the Clause No. 3 (8). The major disadvantage of conducting the study on state level is that the state level PRM will always be higher than the national or regional level PRM which can lead to the problem of surplus generation. Hence, the study should be conducted on national level or more preferably on regional level, since there are institutional frameworks on regional level for sharing of planning reserves. A mechanism can be made to deploy the resources.

- **Block-wise Data for RA Planning Amidst Growing VRE:** According to Clause No. 4 (5) (b) and Clause No. 4 (6) states, hourly data of demand will be used to prepare the RA plan. In order to capture the variability and uncertainty associated with demand as well as VRE generation, 15-minute time block data will be much more capable of capturing these aspects as compared to hourly granularity for planning for RA. Hence, EAL recommends to use 15-minute time block data and planning thereof.

- **Guideline for Methodology:** The methodology for modelling have been adequately discussed in Clause No. 4 (5) to Clause No. 4 (8). While the suggested approach seems suitable at the moment, flexibility in developing the methodological approach further should be incorporated in the document. The suggested approach would serve as a broad guideline, with flexibility to account for local aspects including unavailability of appropriate data. Based on its experience, EAL suggests that simulation scenarios may also be based on top-3/top-5 days of each month to ensure that the available resources would be able to cater to higher demand scenario for most of the critical days across months[4].

- **Demand Response as Important Component of Resource Adequacy Requirement (RAR) Calculation:** The Clause No. 4 (8) (a) is very important in the perspective of RA as it elaborates on calculation for PRM/RAR. The formulation provides adequate importance to supply side aspects with separate term for each such contributing factor, while demand side gets hyphenated with other factors and seem to lose its visibility and its importance. EAL suggests to incorporate demand response as a distinct component in the calculations so that it gets addressed in planning as well.

- **Coincidental Forced Outage and Calculation of Peak Demand:** The Clause No. 4 (8) (a) contains a formula to calculate supply side RAR, which assumes that forced outage rates of different type of generators will occur at the same time or coincidentally. The coincidence of forced outage rate to calculate the capacity credits may need to be reconsidered, as the forced outages of the plants are not likely to be in practice. The same Clause also discusses the estimation of contribution to coincidental peak demand to calculate demand side RAR. The current methodology in the document is based on the estimation of the peak demand using diversity factor. Unless demand profile for respective states are forecasted, the relative contribution of state level demand to national peak demand could not be arrived.

  The same Clause also discusses the estimation of contribution to coincidental peak demand to calculate demand side RAR. The current methodology in the document is based on the estimation of the peak demand using diversity factor. Unless demand profile for respective states are forecasted, the relative contribution of state level demand to national peak demand could not be arrived. A method incorporating the philosophy has been used by EAL, for undertaking the forecast of demand for three states[1,4].

- **Incorporating Captive, Rooftop and Behind the Meter Generation in the Study:** With the growing capacity of captive generation (459.15 GW capacity of 1 MW & above as on 31st March, 2021)[5], significant amount of power

[4] *Long-term Demand Forecasting and Power Procurement Planning for CSERC,* EAL (Report Submitted)
[5] Source: Economic Survey 2021-22

may be available for sale through open access. Furthermore, there is increasing adoption of rooftop solar or behind the meter generation, which is being witnessed for institutional, non-domestic, industrial as well as domestic consumers. Due to their recent emergence, the historical data does not capture this, and thus needs to be appropriately modelled in forecasting.

- **Demand Response in Integrated Resource Planning (IRP) and the Associated Capacity Credit:** Draft Clause No. 4 (8) (g) states *"Potential for demand side management such as shifting of load or demand response can be considered while undertaking the IRP. Constraints such as periods when load shifting can occur, the maximum quantum in an hour and the maximum quantum of load which can be shifted would need to be included."*(emphasis added).
  Consideration of demand response should be (rather than can be) considered in an IRP exercise. It is recommended to make demand response an integral part of the IRP modelling. At the same time, adequate regulatory framework should be provided by the regulator and institutional mechanism be placed by the respective DISCOM. Capacity credit mechanism for the expected demand response should be considered in the IRP as well as PRM for the respective utility.

- **Month-on-month Optimal Generation:** Draft Clause No. 4 (9) states *"The output of the model would be the quantum and type of resources required in the portfolio of a utility to meet the demand in an optimal (least cost and secure) manner. The model shall give the year-on-year optimal generation (conventional + Renewable) and storage capacities required to meet the system demand and the planning reserve margin condition securely and at least cost."* (emphasis added) The output of the overall study will be year-on-year optimal generation. It is recommended to report monthly optimum generation plan to ensure RA uniformly throughout the year.

- **Alignment of Forecasts used by CEA & POSOCO with DISCOMs Projections:** Draft Clause No. 5 (3) states *"The hourly demand forecasts used by CEA and POSOCO/NLDC should be aligned with the projections as per the individual Distribution Licensees..."*
  The meaning of "aligned" in the Clause is not clear. The meaning and the modality for aligning the hourly demand forecasts by CEA & POSOCO and Distribution Licensees shall be provided.

- **The Process after Long-term DISCOM RA Planning (LT-DRAP):** Draft Clause No. 5 (6) states *"...The distribution licensees shall demonstrate to the SERC 100% tie-up for the first year and a minimum 90% tie-up for the second year to meet the requirement of their contribution towards meeting coincident national peak. Only resources with long/medium/ST contracts will be considered to contribute to the PRM. Power procurement through the power exchanges, such as the Day-Ahead Market segment, will not be considered. For subsequent three years, the distribution licensee shall submit a plan for 100% capacity tie-ups to meet estimated requirement of their contribution towards meeting coincident national peak for SERC's approval."*
  The following comments may be noted in the above context:

- **The LT-DRAP process emphasises capacity tie-ups to PRM, while demand response seems to be sidelined.** Capacity tie-ups (through contracts) are only eligible to demonstrate PRM. Apart from demand response, role of ST market (through power exchanges) also need to be highlighted. **Capacity tie-up should be replaced with resource tie-up (which would include demand response as well) at all relevant instances.**

- The level of 'capacity' tie-up should keep into mind the gestation period for setting up new capacity, especially for the first few years of its implementation. Many DISCOM **may not be able to demonstrate 100% capacity tie up in the very first year of obligation under the RA requirements. This further highlights importance of demand response, which would have relatively much shorter gestation period.** Figure outlines the need for 'capacity' tie-up over a five-year horizon, wherein demand may have been under- or over-projected. It is proposed that the rollout of the RA plan should have sufficient time for the utilities to ensure compliance for the first year of implementation, to the least.

- Furthermore, ST contracts are not decided significantly in advance and, also depend on the market conditions.

While their role would be important, **certainty of capacity credits across states may not be ensured for all DISCOMs during the period of shortages.** The IRP and the RPM should appropriately incorporate capacity credits for the same.

- As per the Clause, the capacity tie-up by the DISCOM is indicated in the Figure 1 below, which indicates that there may be a potential occurrence demand deficits during the 2nd year due to low tie-up capacity (90%) as compared to 1st year (100%). A scenario of surplus capacity can also take place in the 3rd year of 100% of capacity tie-up.
  Thus, the above tie-up process can be implemented in a more effective way. EAL suggests the following rollout plan for RA planning:
  - DISCOM shall demonstrate 85-90% tie-up of resources for the 1st year and 2nd year (immediately after rollout of RA plan).
  - DISCOM shall demonstrate 95% tie-up resources for the 3rd year.
  - DISCOM shall demonstrate 100% tie-up resources for the 4th year onwards.
  - The tie-up resources now can be brought down for the subsequent years.

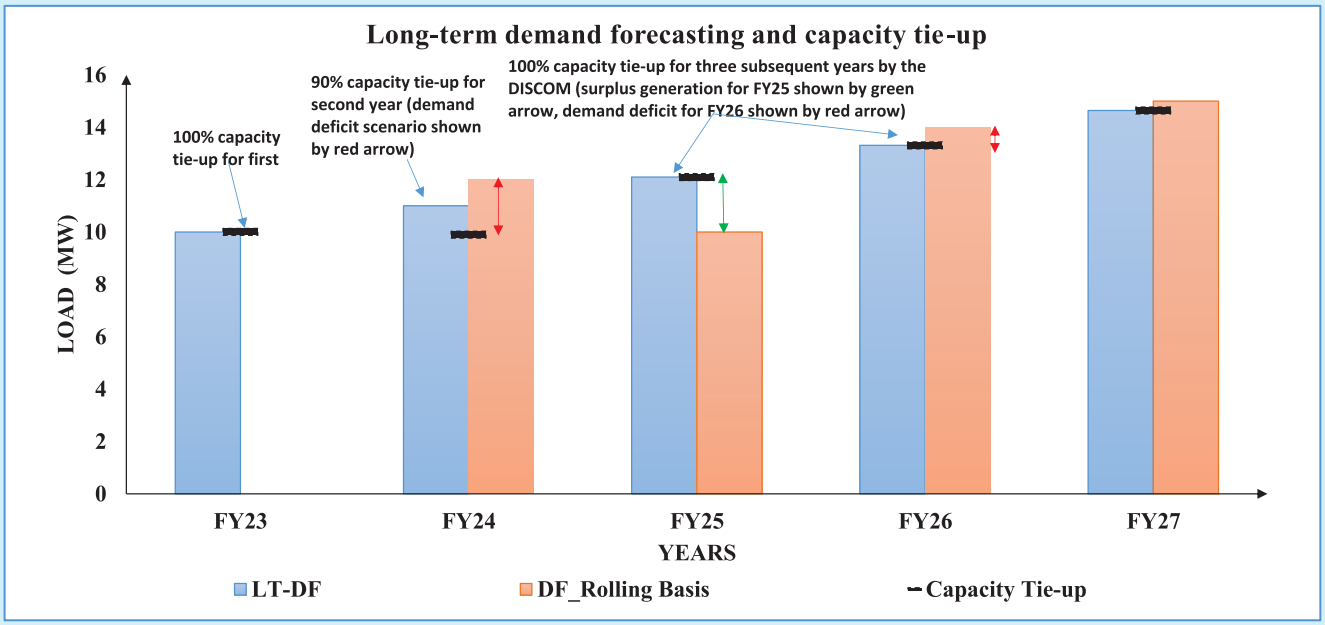


Figure 1: Case demonstration to understand the impact of capacity tie-up

- **A Dynamic Approach to RA:** Let us consider a situation wherein 100% resource tie-up has been ensured for the next 5 years, based on projected electricity demand. Since demand forecasting is a dynamic exercise, it is likely that demand forecast is adjusted downward for the 3rd year onwards. In such a case, RA would likely to be more than 100% for the 3rd year onwards.

- Many DISCOMs in the country have achieved a capacity tie-up of less than 85%. Pushing such DISCOMs to achieve 100% capacity tie-up will lead to signing of Power Purchase Agreements (PPAs) with generators, thus adding to their financial burden of capacity charges. EAL suggests **a gradual approach to implement RA plan so that DISCOMs can work on their demand response program.**

- Many DISCOMs in the country have achieved a capacity tie-up of less than 85%. Pushing such DISCOMs to achieve 100% capacity tie-up will lead to signing of PPAs with generators, thus adding to their financial burden of capacity charges. EAL suggests **a gradual approach to implement RA plan so that DISCOMs can work on their demand response program.**

- **Modified Timelines for Annual RA Planning:** Draft Clause No. 5 (8) states *"...The RLDCs shall aggregate the capacities at the regional level and submit the information to the POSOCO/NLDC by the month of February.*

POSOCO/NLDC shall aggregate the capacities at the national level and check compliance with ST-NRAP and identify shortfall for the ensuing year, if any. In case of shortfall, POSOCO/NLDC shall either communicate the shortfall to the distribution licensees for compliance or facilitate a national-level auction for the balance capacity with participation from distribution licensees with capacity shortfall. The contracting for the balance capacity shortfall shall be completed by the month of March prior to the start of the delivery year (1st April)."
The DISCOMs should submit their contracted capacities for the upcoming year to the STU/SLDC by the month of September or October, i.e., before their submission of ARR in the tariff petition to the respective SERC. Also, contracting for the balance capacity shortfall should be completed by the month of January/February instead of March.

- **Dilemma of Multiple Future Scenarios:** Annexure A (5) suggests that there will be multiple future scenarios that should be created to account for uncertainty and analysis of the occurrence of the lost load. The question is that result from **which scenario should be considered for the actual implementation of RA framework. How would the knowledge from alternate scenarios be incorporated in the RA plan? Would this allow for RA plan flexibility based on the outcome of the scenarios?**

- **Inclusion of Renewable Energy Resources (RES) Included in Round-The-Clock (RTC) Power Generators:** Draft Clause No. b (4) states *"The Capacity Factor Approximation with Top Net Load Hours can be considered to determine the capacity credits for new resources and the Top Load Hours methodology can be considered to determine the capacity credits for existing resources…"*
RE RTC contracts can demonstrate full capacity credits and need to be considered under 'Top Load Hours' methodology instead of 'Top Net Load Hours'. The later methodology can be applied to individual/hybrid RE resources without assured schedulable capacity. Furthermore, RE/hybrid resources with storage should also be considered as firm contribution to the top load hours.
Annexure B highlights different methods for the calculation of capacity credits for Renewable resources. Since there is an emergence of RE RTC contracts in the Indian power sector, the capacity credit for RES included in the tenders should be taken into account.

- **Impact of Fuel Availability on Capacity Credit under IRP/RA:** Given the existing contract for fuels, full capacity credit need to be considered for such tied up capacity. Uncertainty associated with fuel supply would generally be a ST phenomenon and be penalized through appropriate mechanisms in the fuel supply agreement.

- **Graduated Approach and Institutional Capacity:** While DISCOMs are required to undertake load forecast and plan for power procurement while submitting their tariff petition, a lot needs to be achieved in that respect. Given the limited capacity and the learning curve associated with the detailed RA plan, DISCOMs be allowed a grace period of 2-3 years before implementation of the same. This period should be used to develop draft RA for the intervening years. While this draft RA for the respective DISCOMs may be submitted to the NLDC/POSOCO for review and should also be placed on public domain for comments/inputs. Such preparatory period would allow the DISCOMs to explore the methodology, collect relevant data and put an internal institutional mechanism in place. In the meanwhile, SERCs may amend the respective regulations. An earlier study by EAL may provide inputs for the regulatory framework towards the same[6].

CERC (Staff Paper on Power Market) Regulations, 2022

Central Electricity Regulatory Commission (CERC) notified the Staff Paper on Power Market Pricing in October, 2022. The key highlights of Staff Paper are as follows:

- The document gives brief introduction about the functioning of electricity market, the role of power exchanges and percentage share in volume of transactions taking place through power market, bilateral, deviation settlement

[6] Singh et al. (2019), *Regulatory Framework for Long-term Demand Forecasting and Power Procurement Planning, CER Monograph, Book ISBN:978-93-5321-969-7, https://cer.iitk.ac.in/assets/downloads/CER_Monograph.pdf*

mechanism (DSM), PPAs. Brief overview regarding the procedure for transaction taking place that are collective transactions and continuous are explained. The Uniform Price Auction (UPA) and Pay as Bid Auction (PABA) are explained in detail. The global electricity market scenario which includes the scenario of Australia, Europe and India, shows that the unprecedented high prices in electricity markets coupled by increase in demand as well as unavailability of fuel or supply related issues are addressed and explained in the staff paper. Certain important questions are raised regarding the same that are to be addressed by the stakeholders as per their approach.

- **Does Pricing Methodology Need a Change?**
  The idea for change in pricing methodology is proposed in the staff paper. The two pricing methodologies Unconstrained Market Clearing Price (UMCP) and PABA were compared. The idea for Pay As the bid is introduced to address the issue of supernormal profits earned by inframarginal generators. But PABA can give temporary addressal to the issue, as the generators participating in market are paid exactly the same price at which they placed the bid. The generators having low Variable Cost (VC) were bidding at comparatively lower prices in the market and additional component include their margin and also recover Fixed Cost (FC). In PABA, the low VC generators will bid higher gradually to recover their FC and margin. Also by introducing new pricing algorithm, the sellers will analyse the difference in cost between two pricing methodologies and just change their bidding behaviour.

- **What should be the Criteria for Regulatory Interventions?**
  If the price rise is due to change in demand behaviour, the demand side should be addressed. That includes demand reduction through pre-notified demand response. The overall study regarding the case suggests that it is better to compensate the demand than procuring peak power in terms of operation effectiveness and cost. Need for proper load forecasting, RA, demand response, Energy Storage System (ESS) should be considered. If the MCP consistently reaches the ceiling price and considering the reference of time in terms of day, week or month. What should be the criteria to implement the intervention? Requirement to contemplate and suggest the tolerance level and regulatory intervention considering India's case. If the price cap breaches the tolerance level, the dynamic price cap will be activated automatically in which the clearing will take place at 90% or 95% supply clearance. Also the generators are mandated to run and compensated as per the pre-specified norms.

  The excess revenues of power plants other than high cost fuel based power plants should be capped. The cap can be uniform and pre-notified based on the marginal generator among inframarginal generators and all revenues that exceeds the cap will be collected by the system operator. Partial capture profits made by the inframarginal generators. **Price cap of inframarginal generators if levied, should that be levied on generators like gas based stations of Rs. 20/kWh or so or else left without cap.**

- **How to Address Negative Impact of Price Cap?**
  The price cap has been introduced to keep the clearing price in the power market remain reasonable and within bounds. But at the same time the high cost generators tend to go out of the market. **To increase the availability of the supply to meet the demand as well as allow the participation of high cost power producers, Price cap for inframarginal generators has been suggested in Europe while India proposed HP-DAM. In that case on what basis the high cost generators be defined depending or technology or fuel source.**

- **Market Design to Incentivise the Demand Response and ESS?**
  Record breaking temperatures in summer and winter & increase in economic activities led to increase in demand. This increase in demand lead to increase in prices. To decrease the demand of power, the mandatory power saving plans and programmes that would lead to demand reduction are encouraged that include demand response.

EAL Opinion

- **PABA:** As per the question raised in section 3.1, Does Pricing Methodology need a change? The above question is being raised in the context of recent spike in power market prices and price cap placed to address the same. There seems to be a concern that UMCP seems to result in 'windfall' gain for the low cost generators (bidders) (Figure 2). **The very nature of the UMCP is to generate producer surplus allowing recovery of FC and also incentivizing**

investment in capacity creation. The very nature of the UMCP is to generate producer surplus allowing recovery of FC and also incentivizing investment in capacity creation. The very nature of the UMCP is to generate producer surplus allowing recovery of FC and also incentivizing investment in capacity creation. While the price spike is an outcome of multiple aspects, wherein CERC can play a role in the context of market monitoring and incentivizing/penalizing low fuel inventories[7] and addressing the supply chain issues for thermal generation.

- The suggestion to consider Pay as Bid pricing mechanism as an alternate to UMCP would have other implications for the market outcome and the sector as a whole. Under Pay as Bid methodology, sellers are paid as per their bid in the market. While this may suggest a reduction in the windfall gain for low cost producers (bidders) (Figure 2), it would have adverse implications as highlighted below.

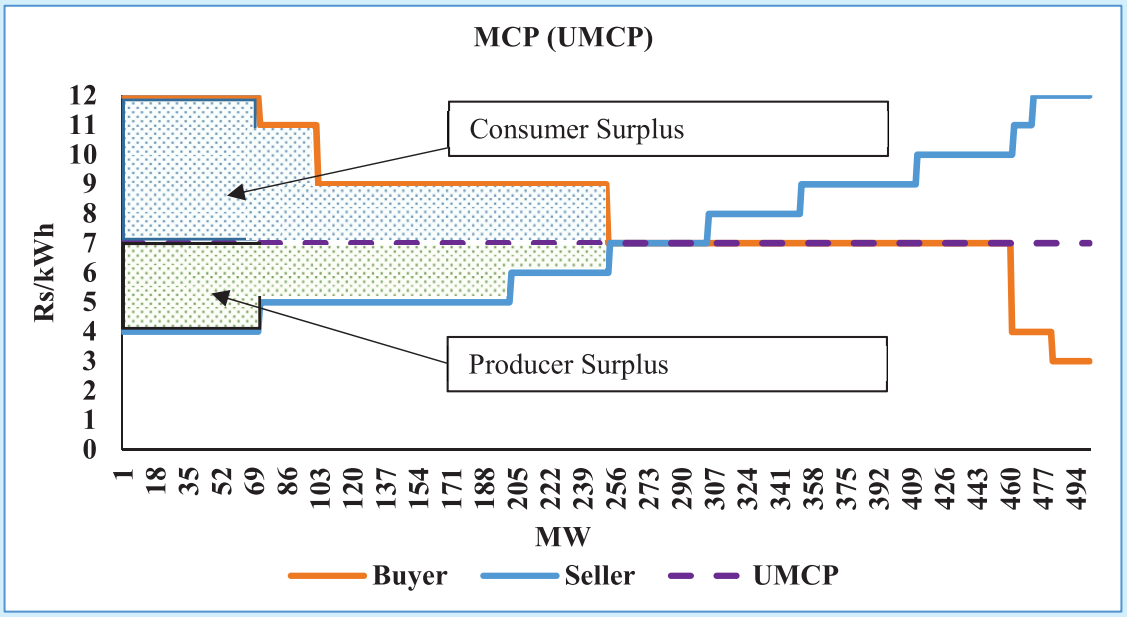


Figure 2: Unconstrained Market Clearing Price

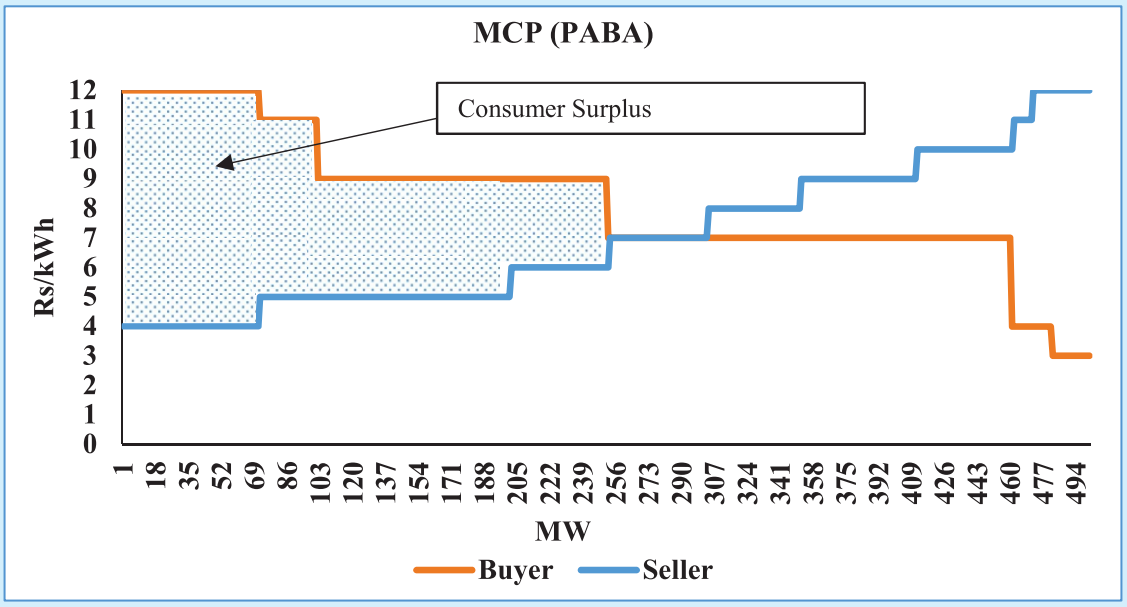


Figure 3: Pay as Bid Auction

[7] CER Comments on "CERC (Terms and Conditions of Tariff) Regulations, 2019", Power Chronicle Volume 03 Issue 04 *https://eal.iitk.ac.in/assets/docs/Power_Chronicle_Vol_01_Issue_03.pdf*

Adoption of the PABA would lead to change in the bidding behaviour of the sellers as they would no longer bid close to their marginal cost, but would try to bid a bit lower than their expectation of MCP (Figure 4). This would reduce the gain to consumer surplus as producers would be able to regain the producer surplus, they may have lost as compared to UMCP. **The expected benefit of reducing the 'windfall' gain to low cost producers would be diminished soon.** This would also reduce the incentive for investment due to less recovery of fixed charges.

- **Pay as Bid without Capacity Market:** Adoption of pay as bid mechanism, in the absence of a capacity market, would be characterized by the above outcome. **Pay as Bid mechanism can be adopted if there is a capacity market that allows for part recovery of FC of generators**[8]**.** However, some of the above side effects would still leave its mark on the outcome.

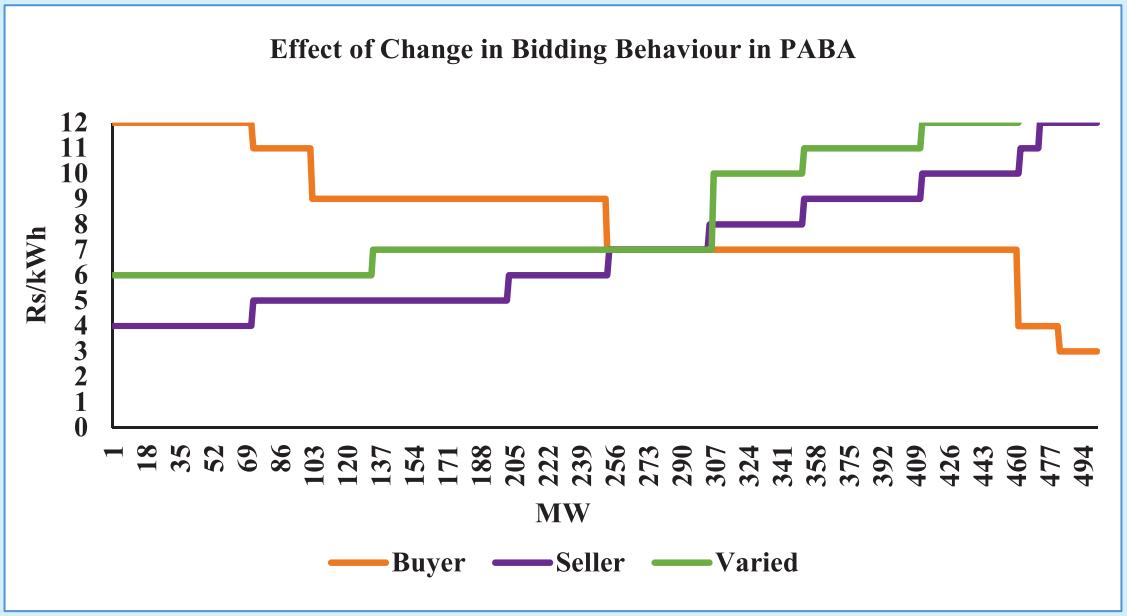


Figure 4: Effect of Change in Bidding Behavior of Seller in PABA

- **Cap on Supernormal Profits:** The proposal to cap the additional or supernormal profits made by the inframarginal generators, and park the 'denied' surplus to a pool may have limited effectiveness and for a limited period. It is proposed that the pool can then be used to address identified priority areas of the sector. However, change in the bidding behavior of the sellers (bidding at a higher price compared to their previous bids) would reduce the scope for the pool. In such a scenario the consumers would continue to pay the 'uniform price' and hence would not be benefited from the market intervention. There would also be implementation issues in identifying the limit beyond which sellers would be denied the additional surplus[9]. Such a criteria cannot be static due to variation in the demand-supply interaction and the market outcome across time blocks within a day and across days.

- **Dynamic Price Cap: The issue of price spikes in the electricity market can also be addressed through a dynamic price cap,** which would be updated based on the market outcome (Figure 5). In case MCP hits the predefined (lowest) price cap, based on a pre-defined criteria (say, MCP for a time block being equal to price cap for two consecutive days) price cap would be set at a higher level. The price cap would be lowered again to Rs.12/kWh (the lowest price cap), in case the MCP is lower than the lowest price cap for a single day for the same time block. This would mean that price cap could also differ across time blocks, with most of the time blocks having a price of Rs.12/kWh, while a few time blocks may have a price of Rs.14/kWh. The mechanism should be supplemented with an effective market monitoring mechanism to identify, monitor and investigate suspected instances of market

[8] EAL Comments on "Discussion Paper on Market Based Economic Dispatch", Power Chronicle Volume 04 Issue 01 *https://eal.iitk.ac.in/assets/docs/Power Chronicle_Vol 04 Issue 01.pdf*

[9] The approach to tax windfall gain (due to high international prices) has been adopted in the domestic crude oil production in India.

abuse/manipulation and take corrective measure thereof. Acronyms used corresponding to the Figure 4 are as below:
MCP = Market Clearing Price; D = Day; Pc= Price Cap; dx = Additional Price Capping

- **Hybrid Approach to Market Clearing:** A hybrid approach, wherein **'Uniform Market Price' based approach is applied to all trades cleared below the price cap** (say Rs. 12/kWh) and **the rest** of the higher bids are cleared **at pay-as-bid approach** (See Figure 5 below). In case the market price is below Rs. 12/kWh, Uniform market clearing is adopted. When MCP is above Rs. 12/kWh, the sellers whose bid was Rs. 12 or below, are paid a uniform price of Rs. 12/kWh. Sellers whose bid was above Rs. 12/kWh are paid on 'Pay-as-Bid' basis. This addresses the concern for 'windfall gain' for low bid sellers (i.e. those below Rs. 12/kWh), but some of the above highlighted concerns regarding incentive for capacity creation remain but in a limited manner. The part of the producer surplus (shown by shaded area in Figure 6), is accumulated in a pool account, may be called as Market Premium Pool Account. CERC would issue regulations for operating and utilization of the said pool account.
  This fund can be used to fund demand response programs across DISCOMs in the country. **This approach would have lesser distributional impact as compared with 'uplift payment', where premium due to higher prices is socialized.**

- **Demand Response:** As per the question raised in section 3.4, *How to incentivize Demand Response?* Demand response will play a very important role in addressing price spike in the power market. This can be referred in *Power Chronicle* Vol. 5 Issue 1 in response to comments on **Price Capping of Rs.12/kWh on 7th April, 2022**[10]**.** Forum of Regulators (FoR) may develop a model regulation for designing and implementing a demand response program. It would make economic sense to design a demand response program that would incentivize demand curtailment than paying significantly higher price for ST power procurement. Separate and detailed comments can be provided for the same, when required.

- **Recommended Measures to be Undertaken by Regulatory Commission:** As per the question raised in section 3.2, What should be the criteria for Regulatory Interventions? Power purchase cost is pass-through and is trued-up by the respective SERC, who place a limit on ST power procurement, both in terms of quantum and price limit. To ensure that the DISCOMs do not undertake significant ST market purchase beyond the limits set by the regulator, a mechanism to disincentivize expensive power procurement, without prior approval, may be set up. The SERCs may specify average as well as maximum price of ST power procurement. Given the poor financial state of the utilities, and their inability to recover all the cost from the consumers in a timely manner, such measures are necessary to protect long-term interests of the

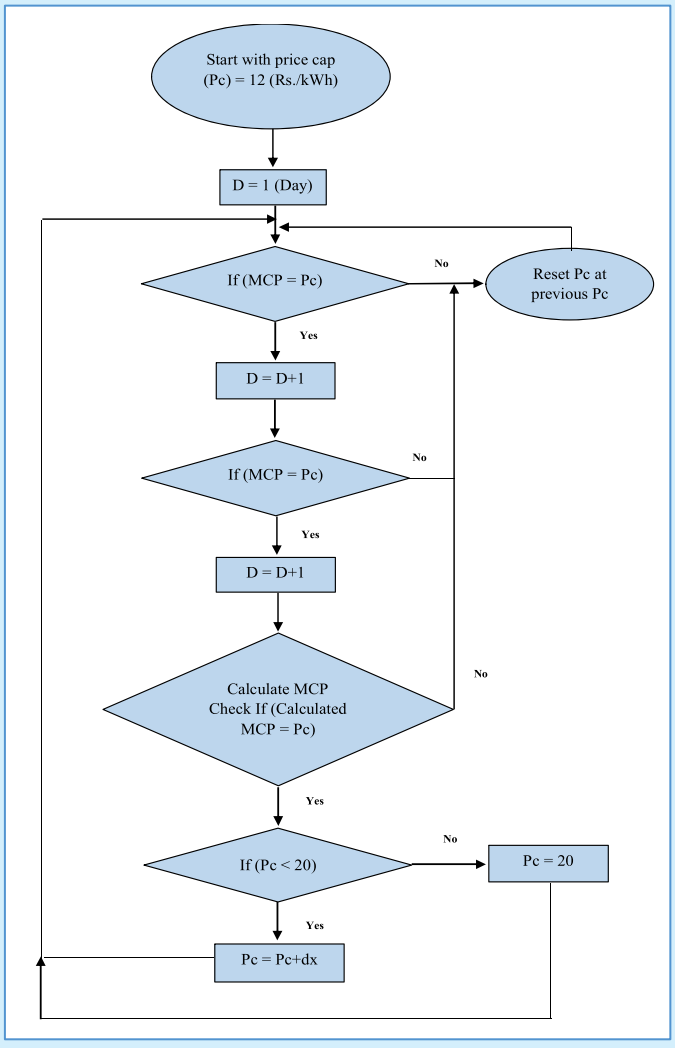


Figure 5: Flowchart on Dynamic Price

[10] EAL Comments on "Price Capping of Rs. 12/kWh on 7th April, 2022", Power Chronicle Vol. 05 Issue 01 https://eal.iitk.ac.in/assets/docs/Power_Chronicle_Vol_05_Issue_01.pdf

consumers. **Furthermore, the additional cost of power purchase should be timely be passed through Fuel and Power Purchase Adjustment charge.**

Term Ahead Market (TAM): The question raised in section 3.3 *"How do we address the negative impact of price cap?"*TAM includes the contracts such as Day Ahead Contingency Contracts, Intraday Contracts, Daily Contracts, Weekly Contracts, Monthly Contracts and Any Day Single Sided Contracts. The brief information related to the contracts in TAM, DAM and RTM is given in the table below. The question is raised in the discussion paper in which the generators having higher VC to be allowed to participate in TAM.

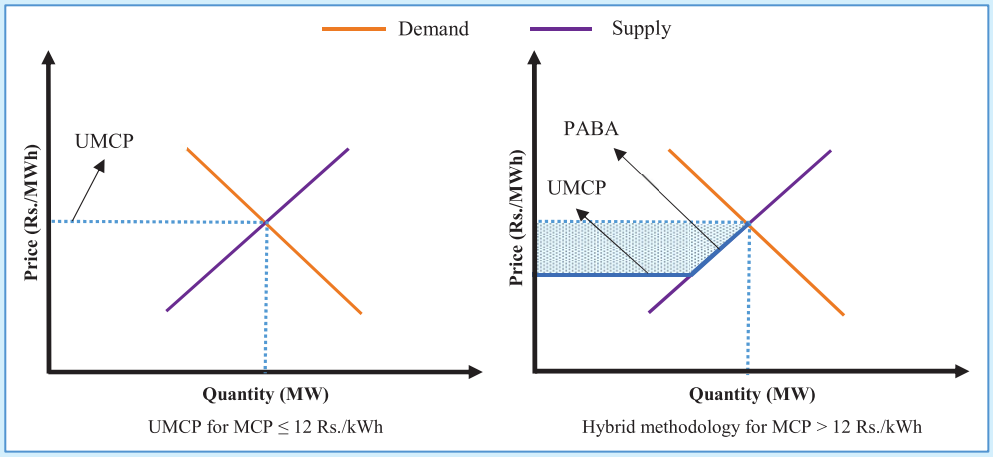


Figure 6: Hybrid Approach to Market Clearing

The TAM transactions are continuous in case of intraday and day ahead contingency contracts and hence the high price in TAM will not affect the other buyers. The other contracts as specified in the table below have price discovery using uniform price step auction. Specific type of contract in TAM (Intraday, DAC, Daily, etc.) may be identified to allow the high VC generators to participate in the market. The duration of contract and bidding varies in this market when compared to DAM and RTM. However, longer time block (hourly or for consecutive hours) for transactions would affect participation and thus impact liquidity as well. Some of the contracts on TAM already suffer from low liquidity. If markets are efficient, the spillover effect of market segments with high price participation would be cast on other market contracts to a varying extent.

Table 1: Summary of Market Products and Respective Contracts Available in Electricity Market

Name of Contracts	Commencement of Bidding	Last Day of Bidding	Bidding Time	Delivery Duration	Price Discovery	Remarks
Daily	Daily	Two Days Before Delivery Day	0 to 24 hrs	T+2 to T+90	Uniform Price Step Auction	For the Pre-specified Time Blocks notified to the market participants well in advance through circulars.
Weekly	Monday of the week prior to delivery	Friday of the one week prior to delivery	12 to 17 hrs	TW+1 to TW+12 Weeks		
Monthly	First day of the zero Month	1st month - 10 days, 2nd month - 5 days, 3rd month last day respectively.	12 to 17 hrs	TM+1 to TM+3 Months		
Any Day Single Sided	Daily	Two Days Before Delivery Day	0 to 24 hrs	T+2 to T+90	Reverse Auction	For User defined days and Time Blocks
Intraday	Daily	-	00:30 to 20:30 hrs	04:00 to 24:00 hrs	**Continuous Auction**	
DAC	Daily	-	15:00 to 23:00 hrs	00:00 to 24:00 hrs		
Integrated DAM	Daily	-	10:00 to 12:00 hrs	Next Day 00:00 to 24:00 hrs	Double Sided Closed Bid Auction	
RTM	Half Hourly	-	15 min	30 min		

CERC (Terms and Conditions for Dealing in Energy Saving Certificates) (First Amendment) Regulations, 2022 [Draft]

CERC notified the draft entitled Terms and Conditions for Dealing in Energy Saving Certificates (First Amendment) Regulations, 2022. The key highlights of the draft are mentioned below:

- In these Regulations, the term 'Floor Price' has been introduced and is defined as the minimum price at which the Energy Savings Certificate shall be traded on the power exchanges.
- The floor price is proposed to be fixed at ten percent of the price of 1 mtoe of energy consumed as notified by the Central Government from time to time.
- Currently, the price of 1 mtoe is Rs. 18402/- as notified by the Ministry of Power (MoP) on 7th January, 2021.

EAL Opinion

- **Determination of Floor Price:** The new draft Clause to be inserted states that *"The floor price for the trading of Energy Saving Certificates as mentioned in the Energy Conservation* ***Rules shall be fixed at ten percent of the price of one metric tonne of oil equivalent of energy consumed*** *as may be notified by the Central Government, by notification in the Official Gazette for every Perform, Achieve and Trade Cycle"* (emphasis added). It is suggested that the **basis and calculation** of the fixed floor price for trading of ESCerts may be mentioned in the draft Regulations. The floor price as ten percent of the price of per mtoe of fuel seems arbitrary and does not reflect the economics of the market conditions.

  In case of competitive and liquid markets, the need for floor price may not ideally arise[11,12,13]. Such a floor price often brings comforts for financing of the projects (by energy service companies) as lenders seek revenue certainty.

- **Equivalence of Floor Price for Renewable Energy Certificates (REC) and Energy Saving Certificates (ESCerts):** While deciding the **floor price of ESCerts, its equivalence with respect to the floor price of an REC should be ensured.** Given that the country is expected to witness launch of a carbon market, which may include conversion of ESCert and REC to equivalent carbon reductions, such a priori equivalence in the floor price would avoid disruption in the respective market providing room for arbitrage, if such instruments are traded near the floor price (as generally is the case).

- **Value of Floor price:** An additional step requiring notification of the price of 1 mtoe may be avoided **by linking this price to a market price/index,** which is available publicly and is derived in a transparent manner. For e.g. this can be equivalent to the price of domestic crude or, weighed average of domestic and imported crude of identified quality.

- **Frequency of Price Notification: The draft amendment does not seek to establish the periodicity of the base price of 1 mtoe. A formal calendar for such a 'notification',** if required should be announced beforehand to remove any uncertainty associated with the same. **In case of the base price being linked to an available price/index, a case of such an uncertainty would not arise.**

[11] Singh, A. 2010. "Economics, Regulation and Implementation Strategy for Renewable Energy Certificates in India" in India Infrastructure Report 2010, Oxford Univ. Press. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3440253.
[12] Singh A. 2009. "A market for renewable energy credits in the Indian power sector", Renewable and Sustainable Energy Reviews; 13(3): 643-652. https://doi.org/10.1016/j.rser.2007.10.011
[13] CER comments CERC's proposal for determination of Forbearance and Floor price for REC framework, 31st March, 2020, https://cer.iitk.ac.in/blog/new_blog/?id=NDYz

MoP (Concept Note on Pooling of Tariff of 25 years Plus Thermal/Gas Generating Stations) 2022, [Draft]

Ministry of Power (MoP) on 15th November, 2022 notified the draft on Pooling of Tariff for Coal/Gas Generating stations which have completed 25 years. The key highlights of the draft are mentioned below.

- **Objective:** The objective of this concept note is to create a Genco-wise common pool (CP) of the plants (excluding Hydro) which have completed or are going to complete 25 years of service, for maintaining grid stability until development of the appropriate storage capacity, to cater the need of increased RE integration.

- **This concept note covered the following important aspects:**
  - The GENCOs shall provide the information regarding CoD of all the stations to respective RLDC/SLDC.
  - Coal/Gas plants crossed 25 years are considered for creation of CP.
  - There is a provision as and when any Station completes 25 years of CoD, the same shall be automatically added to the CP.
  - The DISCOMs have to submit a **letter of intent** for procuring the quantum of power from CP.
  - The willing States/DISCOM(s) shall be made percentage allocations from the CP which will be same as their station-wise percentage allocation and are subjected to change with any addition or deletion of plants.
  - The remaining power in the CP, not allocated to any beneficiary shall be sold by the GENCOs through Power Exchanges.
  - The willing States/DISCOMs shall be subjected to sign station-wise PPA for a minimum of five years with the CP.
  - The States/DISCOMs shall be billed uniform capacity charge based on allocated power and total capacity charge of power from the CP**.**
  - The States/DISCOMs shall also be billed a uniform weighted average pooled energy charge, based on station-wise monthly **Energy Charge Rate (ECR)** and final implemented schedule.
  - Scheduling and dispatch for the pool is based on Merit order Dispatch (MoD).
  - The GENCOs shall endeavour to bundle RE power for Flexibility in Generation and Scheduling.
  - The operational gains if any shall be shared between GENCOs and beneficiaries as per the provisions of extant CERC Tariff Regulations.
  - Further, each GENCOs shall also set a **Dedicated Administrative Cell and Commercial Team** to ensure the capacity of the CP is utilized to maximum scale.

EAL Opinion

- **RA and Power Procurement Plan:** While undertaking a power procurement planning exercise[14], the DISCOMs would have already considered the expiration of PPAs (having completed 25 years) few years in advance. The exercise of making investment in additional capacity by state GENCOs or signing of new PPAs would have already rolled in and financial obligations thereon would have been committed. This would be subject to approvals, by the respective SERC, considering economics of the available power procurement options over long-term. The DISCOMs, which have not taken a decision for signing additional PPAs/undertaking investment, can evaluate economic rationale of the available power procurement options based on capacity as well as variable charges. For some DISCOMs, this may assist in postponement of their decision to enter into a PPA contract and hence may be cost effective. However, an independent exercise to evaluate the same should be undertaken.

- **Pooling as ST Measure:** Available and operational thermal generating capacity can provide needed resources in the **ST. This can partly address the RA concern of imminent nature as there is no gestation period.** However, this capacity would not provide the desired flexibility on the generation side due to increasing share of renewables.

[14] An exercise for long-term electricity demand forecasting and power procurement planning for two states, namely Uttar Pradesh and more recently for Chhattisgarh, undertaken at Energy Analytics Lab (EAL) at IIT Kanpur followed similar principles.

Since long-term economics of power procurement (discussed below) should be based on economics of alternate options and the flexibility they offer, **such a pooling should be treated as a one-time exercise with clear and limited applicability for the next few years only.** Long-term application of the pooling mechanism would perpetuate the inefficiencies identified herein. Further, this would also adversely influence the country's following commitment as per the Intended Nationally Determined Contributions (INDC) communicated to UNFCCC - (i) 40% share of non-fossil fuel electricity generating capacity; (ii) Reduction in emission intensity of GDP between 33-35% over the 2005 level. Given that only about 8 years are left to meet that target, **continued operation of high emission power generation plants, due to PPA extension of high SHR units would place challenge to achieve India's climate commitments.** It is suggested that extension of PPAs should be a limited period, and (hopefully) one time exercise only.

- **Economics of Power Procurement by DISCOMs:** Post expiry of existing PPAs (on completion of 25 years), **the economic consideration for the PPA for the additional period of 5 years or so, would be based on** capacity **as well as energy charges.** This is important as the **power procurement optimization by DISCOM would treat these as new contracts.**

- **'Pool Price' based MoD for Pooled Power by the Beneficiaries:** Since beneficiaries would be paying a **pooled price,** which would be calculated **ex-post (i.e. based on the implemented schedule from plants in the pool),** lack of a priori price visibility would create uncertainty for the merit order dispatch **(MoD) based scheduling decision making by the beneficiaries.** This clearly compromises ability of the beneficiaries to plan and procure electricity in a cost effective manner and thus violate the fundamental ethos of the Electricity Act 2003, National Electricity Policy and the regulation of the respective SERCs.

- **Price Signal for Participation in URS/Security Constrained Economic Dispatch (SCED): Decision on scheduling of power from** the capacity not scheduled by the beneficiaries under the **URS, and the SCED is based on an ex-ante price signal.** In contrast, pooled pooled tariff would only be known ex-post, as it is based on the final implemented schedule. **The gap in availability of the correct price signal would influence the participation of the plants under the pooled mechanism in the URS and SCED mechanisms.** In case of use of a proxy for this price signal, the economic efficiency of decision-making for URS and SCED would be compromised. Furthermore, it needs to be clarified whether **a requisition under URS for an un-requisitioned capacity would be required to pay the proportional capacity charges applicable for the pool as a whole or the individual plants scheduled under the URS mechanism.** Similarly, **the applicability of 'resultant' pooled price or that of the individual plant for the URS/SCED needs to be clarified.**

- **Genco-wise vs Beneficiary-wise Pooling:** It is not clear if the average ECR calculated would be worked out on the basis of the final implemented schedule of a beneficiary or, the final implemented scheduled for all the beneficiaries taken together. In case of the former, the final incidence of the ECR to the beneficiary would be same as if it has scheduled the individual plants in the pool. However, **in case of the latter, some of the beneficiaries would cross subsidize the other beneficiaries in the pool.** In contrast, **beneficiary-wise pooling would mimic the outcome as if the beneficiary scheduled the individual plants of the pool in their merit order.** The capacity charge of generating stations in a pool may also vary significantly (see figure below). From the data presented in the Figures 7 and 8, one can clearly infer that, given a choice, a beneficiary who would choose a set of PPAs that would minimize its cost of power procurement, would now be tied up with a combination of PPAs which would enhance the beneficiaries cost of power procurement. **Since beneficiary would be making a decision based on capacity as well as energy charges, pooling would thus result in inefficient economic outcome for the beneficiaries.**

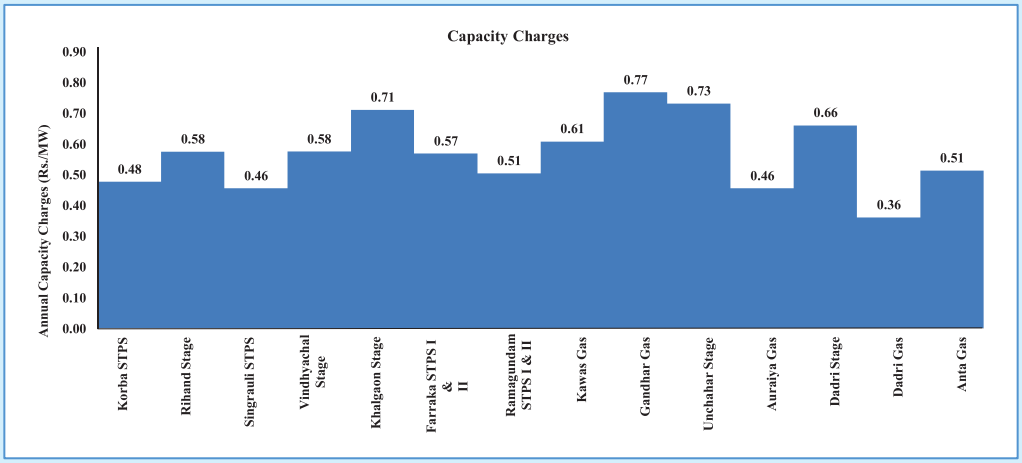


Figure 7: Capacity Charges of Generating Stations in a pool

- **Equivalence of Amount Payable Based on Pooled Vs Un-pooled ECRs:** Based on the pooling mechanism described in the paper, the total amount payable (area MNOP in figure below) based on ex-post pool price calculated as weighted average of the implemented schedule (line PM) will be exactly equal to the sum of ECR multiplied by the implemented schedule of each plant (i.e. area OQRSTN).

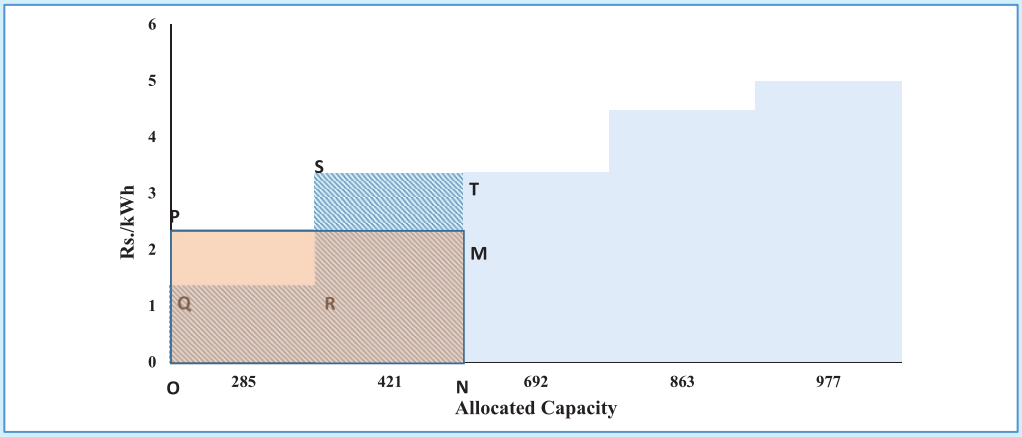


Figure 8: Equivalence of Amount payable under pooled ECR and that based on ECR of plants scheduled individually

The effective result of pooling would thus be only 'locking' in to the pooled PPA instead of individual plants as financial outgo for the energy charge would remain the same (as explained above).

- **Non-Congruent Pool Beneficiaries and Regulatory Process:** Genco-wise pooling, resulting in a common nation-wide pool for the respective GENCO, would bunch plants with varied set of beneficiaries. Post pooling, a 'beneficiary' would be able to or would be supplied power from generation plants with which it did not have a PPA (e.g. Karnataka DISCOMs being supplied power from, say, Singrauli). While the URS and SCED mechanism explicitly provide for this, the same needs to be provided for in the regulatory framework across states. **Would the 'effective' PPA with such plants need approval of the respective SERCs?**

- **Cluster Based Pooling:** Pooling of plants based on different fuels (coal, natural gas, etc.) bundles expensive/inefficient plants with diverse technologies, reducing competition between the technologies, and incentives for the plants to operate efficiently. Using the data shared in the example provided in the concept paper, a 'merit order' of the plants in the pool is as shown in Figure 9 below.

A cluster may be formed as explained in the following illustration:

Cluster A – Coal/ Lignite based plant with ECR ⩽ Rs. 2.25/kWh

Cluster B – Coal/ Lignite based plant with ECR > Rs. 2.25 ⩽ Rs. 3.0/kWh

Cluster C – Gas based plants with ECR above Rs. 3.0/kWh

*Note: The clusters have been made on the basis of the information shared in the concept paper for the ECR of the plants.

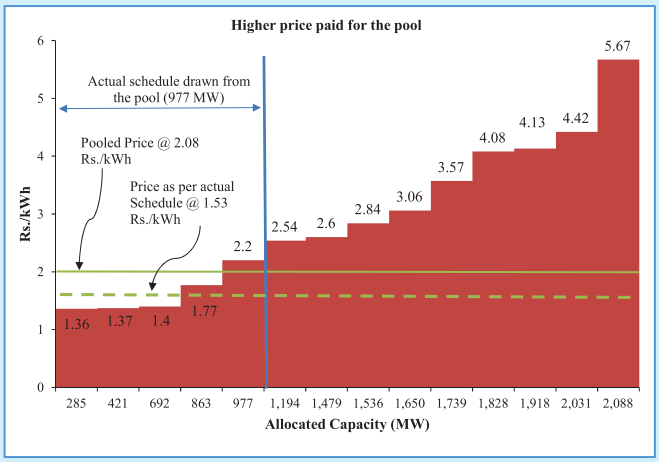


Figure 9: Higher price to be paid for the schedule of lower VC plants due to pooling

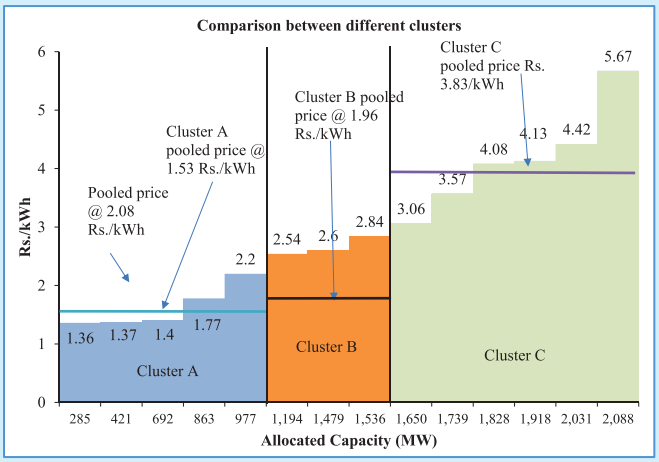


Figure 10: Cluster based pooling

Those beneficiaries who would have extended the PPA for Cluster A would be able to optimize their power procurement portfolio in a relatively more effective manner as compared to the case wherein the beneficiary would have signed for extension of the PPAs comprising a single pool for all such power plants. A beneficiary in need of greater resources to meet upcoming demand for electricity would sign for the next cluster (Cluster B), and so on.

Under such a scenario, Cluster C may witness limited interest. This cluster comprising of the gas based generators can effectively provide the ancillary services (to be launched shortly) for the grid and also participate in a **market for flexible resources,** which would assist greater RE penetration.

- **Locking-in High Cost and Inefficient Plants:** The Electricity Act 2003 as well as the National Electricity Policy as well as National Electricity Plan emphasise the need for cost effectiveness, efficiency and optimum use of resources. The plants having low ECR would find acceptability for extending the PPA by the beneficiaries (DISCOMs) based on economics of power procurement. Whereas, the mandate for **pooling low cost plants with expensive ones will lock-in the contracts associated with high VC plants for the beneficiaries, allowing limited room for optimization.** While there is a clear push for the DISCOMs to reduce cost of power procurement, long-term application of the proposed mechanism of pooling would work otherwise. The proposal for pooling may find merit only in the context of short-term RA, and hence could be adopted for ST and a one-time measure only for the plants completing 25 years of PPA, say over a period of 3-4 years.

- **Further Tariff Implications as per CERC's T&C for Tariff and Ministry of Environment, Forest and Climate Change (MoEFCC) Notification regarding FGD:** Till 25 years of PPA, CERC approves additional capitalization (ADCAP) required to ensure normal operation of the power plant. Extension of PPA may also (and likely) be accompanied with renovation and modernization adding to tariff determined under section 62 of the Electricity Act 2003. Post completion of 25 years of PPA, the generating plants, would be allowed **special allowance as per the CERC Regulations, which would add further to the tariff.** Furthermore, such coal-based plants would be required to make investment in FGD to meet the MoEFCC standards that were notified in December 2015. This would add further to the tariff of such generating plants and thus would further alter the economics of their consideration in the power procurement portfolio of the DISCOMs. Thus, **the expected**

approved tariff, taking into account the likely impact of the above-mentioned factors, should be the basis for decision making by a beneficiary (DISCOM).

- **Retaining Cheaper Power Plants:** As per the Clause No. 1 *"...many States/Distribution companies based on commercial considerations are making an exit from PPAs of costlier plants (non-pit head coal stations and Gas based thermal generating station) while retaining the PPAs of cheaper plants...."*

  Over the period of time, the DISCOMs have been encouraged to purchase electricity in a cost effective manner. Thus, the decision of the DISCOMs to exit from the plants with costlier PPA is a good sign. However, different DISCOMs may have varying level of gap in their RA. Thus, **flexibility in choosing the PPAs is important for furthering the philosophy of 'commercial operation' enshrined in the Electricity Act 2003 as well as National Electricity Policy.**

- **'Necessity' of Pool for Grid Security:** As per the Clause No. *2 "...ensuring continued operation of the plants which have already completed 25 years of operation will be in the interest of the electrical grid, taking care of balancing needs until development of adequate storage capacity...."*

  The availability of flexible generation is key to ensure grid security with increasing share of renewables. It is important to highlight that the extension of expiring PPAs would not add to the flexibility/balancing need (except gas based generation) as these plants do not have additional flexibility.

- **Rebalancing Portfolio Post Changes in Pool Price due to Entry/Exit of a Plant:** Once a pool price has been arrived at, considering the available capacity of the generator having completed their 25 years of PPA, the beneficiaries would evaluate such pool price and take a decision on requesting the capacity as per their requirement to a RA plan.

  The addition of a new plants into the pool or exit of an existing plant from the pool having completed its technical life may lead to change (say, increase) in the pool price. Under such circumstances, the pool price will be re-evaluated. **It needs to be clarified whether the beneficiary would be allowed to re-balance their portfolio for the procurement of the pooled power based on the revised pooled power price.**

- **Time/Season Based PPA:** Shortage, if any, with the DISCOMs is largely during the peak hours/seasons. Post expiry of current PPAs, the beneficiary would find greater value in the available capacity if peak-hours/season-based PPA can be designed with appropriate design of tariff, with relatively higher capacity charge for such hours/months, to compensate the generators for the risk on account of lower recovery during off-peak hours/season. This may require development of a framework allowing the generators to hedge their risk while also providing value proposition to the beneficiaries[15].

Policy paper for Indian Carbon Market, 2022 [Draft]

Bureau of Energy Efficiency (BEE), MoP, Government of India (GoI) released draft entitled policy paper for the Indian Carbon Market (ICM). The key highlights are given below:

- The policy paper is an initiative to develop a domestic carbon market, where the emission credits issued to private and public entities will provide incentives for decarbonisation measures within many entities across multiple sectors. The development of such a market is expected to contribute to achieving India's updated nationally determined contribution (NDC) of reducing emission intensity of GDP by 45% by 2030, from the 2005 level, as pointed out in the 26th UNFCCC's Conference of Parties (COP) held at Glasgow.
  - The domestic carbon market will be created by transitioning from the existing Perform Achieve and Trade (PAT) Scheme, REC, and Clean Development Mechanism (CDM) in two phases viz. phase-I in the period 2023-25 and phase-II from 2026 onwards.

[15] EAL comments on Ministry of Power's proposal on 'Relinquishment of PPA beyond tenure', Power Chronicle, Volume 3, Issue 3, 2021, https://eal.iitk.ac.in/assets/docs/power_chronicle_vol_3_issue_3.pdf

- Market will be divided into two dimensions viz. compliance market and offset market. The compliance will be responsible for transitioning from the PAT scheme whereas the offset market will be transitioning from project-based REC/CDM to a carbon credit trading mechanism.
- The Carbon Credit Certificates (CCCs) are divided into three types which would be issued under following conditions:
  a) **Converted CCCs (C-CCC)** – To be issued to entities after converting ESCerts and RECs.
  b) **Offset Carbon Certificates (O-CCC)** – To be issued to entities under carbon offset mechanism.
  c) **Mandatory Carbon Credit Certificates (M-CCC)** – To be issued to entities after achievement of target set in phase II of ICM.

- The policy document suggests the creation of an Apex Committee for the Implementation of the Paris Agreement (AIPA) for international linkage of domestic ICM. AIPA would overlook the ICM governing board created for domestic carbon market administration. The CERC, Grid Controller of India (erstwhile POSOCO) and Power Exchange (IEX/PXIL) will act as regulatory authority, registry agency and trading exchanges respectively.

EAL Opinion

- **EScerts, REC and the Carbon Market:** It is suggested that the **EScerts be initially be converted on a voluntary basis and later be subsumed completely by the carbon market.** Such a transition be planned in advance ensuring seamless transition from EScerts market to the carbon market in terms of target setting as well as compliance framework.

  The REC market has a number of additional benefits for the Indian power sector including development of the RE development and green electricity products[16]. **The RECs should remain voluntarily convertible even in the later phase,** thus ensuring that the REC market, with its institutional framework continues to play its role in development of the RE resources in the country.

- **A Unified Framework of Carbon Emission Reduction Target (CERT):** The introduction of carbon target should subsume the targets under the PAT mechanism thus providing a single target to the obligated entities. Such a unified approach would provide economic flexibility and lead to optimized cost of compliance. **During the transition phase, the obligated/designated entities may be offered a choice of complying with the energy efficiency target or the associated carbon target.**

- **Annualised Target from the Terminal Year Target:** Annualised Target setting, based on NDC commitments, and translating the same to the annual targets of the identified sectors/entities would be a very important task for the market design. In the absence of a 'demand' for carbon, which would have a multi-year horizon, the carbon market would suffer from low liquidity, and loss of competition and market efficiency. The target setting approach should be defined beforehand so that the market participants have clear visibility of the same.

- **Rolling Multi-year Target Setting and Banking: The Indian Carbon Market development should be based on multi-year target (e.g. 3-year rolling based targets) for the identified obligated entities. The compliance would thus be measured as an average over the three-year rolling target period.** In case of a shortfall/excess over the target, the same need to be allowed to be banked/rolled over for the next three-year target cycle. This would give flexibility to the obligated entities to achieve the target and take appropriate decision for investment in new technology, and or other participation in alternate options.

[16] Anoop Singh, A market for Renewable Energy Credits (REC) in the Indian Power Sector: Renewable and Sustainable Energy Reviews, *https://www.researchgate.net/profile/Anoop-Singh-28*
Anoop Singh, Comments on MoP Discussion paper on Redesigning the REC Mechanism, June 2021, *https://cer.iitk.ac.in/blog*
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Anoop Singh, Comments on *"CERC (Terms and conditions for recognition and issuance of Renewable Energy Certificate for renewable energy generation) (Second Amendment) Regulations, 2013."*
Anoop Singh, Comments on *"WBERC (Co-generation and Generation of Electricity from Renewable Sources of Energy) (First Amendment), Regulations, 2020."*

- **Continuous Emission Monitoring System (CEMS):** The efficacy of a market mechanism and a compliance regime significantly depends on the accuracy, transparency and effectiveness of the monitoring, reporting and verification (MRV) framework. **Energy use based accounting with third party validation, should be supplemented with implementation of CEMS for stationary sources of pollution.** This would not only help validate the reduction in emissions but also help to evaluate impact on change in other pollutants and, hence, serve a larger public goal. This would also enable the regulators and the policymakers to design a comprehensive framework for addressing various pollutants.

- **Deemed Conversion of SCERs/RECs:** At the onset of the ICM, there would be limited liquidity as ESerts/RECs would be voluntarily converted to carbon credits. Given the uncertainty associated with the carbon market in terms of discovered price as well as cleared volume (due to lower liquidity), there may be hesitation in such voluntary conversion. Such concerns would be exacerbated in case the equivalent cleared price is lower/higher than that discovered in the respective EScerts/REC market.

- **This concern can be addressed by permitting deemed conversion during the first phase,** i.e. allowing the EScerts/RECs to be available for trade in carbon market without conversion (till the trade is cleared). The respective EScerts/RECs would be blocked (in the dematerialized form) while these are submitted for trade in the ICM[17]. These would only be converted to carbon credits if cleared during trade at the price-quantity pair bid submitted by the seller. If not, the EScerts/RECs would continue to be held in their original form and would be tradable in their respective market. This would provide flexibility of trade and would also reduce revenue risk for the market participants, thus supporting liquidity (to the extent of availability of participation from EScerts and REC players) in the carbon credits market.

- **Transparent and IT-enabled MRV:** All stages of the MRV process should be transparent with visibility in public domain to ensure that there are no slippages/leakages/miscalculations during the process. The real- time/daily data (on 15-min block basis) should be available through a publicly accessible portal[18]. The monthly, quarterly and annual reports thereof should be available in public domain to bring transparency in the process. To make the MRV process stringent, regularly updated data should made available on public portal by the verifiers/auditors. Data should be updated at each step of MRV in a timely manner such that the historical data cannot be revised at latter stage of MRV by the auditors. Time-stamping of the data would further add to its authenticity.

  International Standard and Cost of Compliance: Current development of carbon market needs to be aligned with global carbon market. Carbon market standards differing from international standard would reduce international tradability (in future) as well as availability of international funding.

- **Policy and Regulatory Aspects:** Development of the carbon market may require amendments to the relevant acts including the Energy Conservation Act 2001 (with respect to PAT) and the Electricity Act 2003[19] (with respect to REC market), and the associated CERC regulations (for REC and the EScerts market). In case of inclusion of carbon credit under the CSR program, appropriate notifications would also need to be issued under the Companies Act 2013. The Companies Act 2013 may also need to be suitably amended to ensure monitoring and compliance at plant (and the company level, if applicable). The Form-B under the Director's report, which forms a part of the Annual Report of the Companies should be suitably amended/expanded to capture the required data in a structured fashion.

- **Regulatory Jurisdiction and Amendments:** The proposed carbon market seems to step over the existing jurisdiction of the CERC, SERCs and the BEE respectively. Appropriate amendments need to be undertaken to ensure that REC and EScerts conversion is duly recognized in the respective CERC regulations.

[17] Units available for trade would be worked out on the basis on the lower integer of the equivalent carbon credit.
[18] It is important to highlight that most of the developed nations provide access to the CEMS data through a publicly accessible portal. This enhances overall transparency and policy research.
[19] And the associated CERC regulations (for REC), and rules (for RPO).

- **Pass through of Compliance cost in ARR:** The cost of emissions reduction compliance would lead to additional cost element in the cost of generation and supply of electricity. The process for approval of tariff under section 62 of the Electricity Act and the tariff policy would have to accommodate such costs to be passed through.
- **Clean Energy Cess (Coal Cess) and Carbon Reduction Target:** With the introduction of GST, abolition of coal cess was expected. If such a cess on production/import of coal continues to be levied, cost of compliance for meeting the CERT (on account of various fossil fuels including coal) would be an additional burden. A clarity on phasing out/removal of the coal cess, with effective compliance framework for ICM[20], would provide incentive for greater compliance.
- **Data Accessibility:** The ICM should have clear provision for data access and availability in the public domain in detailed granularity for supporting research related to carbon market design. This would include data generated from CEMS as well as those submitted to for compliance monitoring and market participation and its outcome (including aggregate demand and supply curve).
- **Market monitoring framework:** Like any other market framework, the ICM should provide for market monitoring to identify market domination/manipulation and the mechanism to redress the same. Periodic market monitoring should be able to identify market concentration as well as any specific price/market clearing event that needs the desired attention.

[20] Imposition of coal cess is relatively easy due to tracing of production, import and shipment.

EAL News

Regulatory Certification Program

CER in association with EAL, is pleased to announce the 3rd **Regulatory Certification Program on "Power Sector Regulation: Theory and Practice"** commencing from **19th February to 5th March, 2023.** The program would help to understand and analyse the key issues in the power sector from economic, legal and regulatory prospective. **The last date for registration is 15th February, 2023. For further program details including duration, key topics, schedule, registration process and fee, please visit** *https://cer.iitk.ac.in/psr_reg/?id=1.*

eMasters on "Power Sector Regulation, Economics and Management"

The classes for Cohort II of **eMasters Degree Program on "Power Sector Regulation, Economics and Management"** will commence in January, 2023. It is a multidisciplinary online program, approved by Senate, IIT Kanpur. It focuses on developing insights into the development of electricity markets in India and discussing the challenges and way ahead. The program content explains the Regulatory process considering the applicable engineering, economics, legal and environmental viewpoints. Apart from faculty from relevant departments of IIT Kanpur, the sessions for the program would be contributed by leading national and international experts. The program is delivered in **online** mode, with recorded and live interactive sessions, to offer flexibility to working professionals. The target includes Electricity Regulatory Commissions, Generating Companies, Licensees (Transmission, Distribution, and Trading), Financial Institutions, Consultants, Equipment Manufacturer and Academic Institutions. The Regulatory Capstone Projects will help the students to apply the concepts and devise solutions for real-life challenges. *https://emasters.iitk.ac.in/powersector.*

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