Comments on
Staff paper on "Introduction of Ancillary Services in Indian Electricity Market"

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1. **Need and Timeliness of Market for Ancillary Services:** Quality and reliability of supply is one of the important aspects of a power system. Over the past two decades, the sector has witnessed significant reforms leading to competition in the sector. Functioning of power markets has demonstrated the resilience of the power system and the institutional ability of most of the stakeholders to assimilate the spirit the of market forces. The sector also continues to face challenges due to power shortages, overdrawals, frequency variations and even grid failures as witnessed in the recent past. Narrowing of the frequency band under IEGC would itself not ensure stability in the system frequency in the real time. While the UI mechanism continues to play a vital role in addressing larger system imbalances, in its current form, it cannot play a significant role in managing real time frequency of the system. This underlines the necessity of a mechanism for ancillary services particularly those related to system frequency. Reactive power support is largely shouldered by the utilities and to some extent by large consumers who are given incentives for higher power factor. Given a suitable compensatory mechanism for additional reactive power support, the existing constituents of the grid especially generation facilities that can generate additional reactive power would endeavour to incorporate the same in their operational strategy.

2. **PPP model for Reactive power support:** The existing system constituents have limited ability to address needs for reactive power through existing facilities. This would necessitate additional investments. CERC may provide an investment framework for private/public investment in facilities (such as capacitor banks) that can provide static/mobile reactive power support in the system. While location of such facilities would be determined through system studies, CERC may propose terms and conditions for payment of services to be provided by such facilities. Since these are to be location specific, one cannot see a regional/national market emerging in this context. CERC/SERCs may develop standards of performance and grid deployment of such facilities. A framework for return can be developed similar to that for generation/transmission plants. A mechanism for sharing of cost of reactive power support should be based on the location and beneficiaries of such facilities.

3. **Free Riding Behaviour and Socialisation of cost of FSAS Services:** Procurement of Frequency Support Ancillary Services (FSAS) would improve system frequency and cost of these services would be shared by all utilities in the region. How would FSAS be incentive compatible to ensure that such a free riding behaviour is curbed? A FSAS mechanism should provide appropriate incentive to utilities to reduce overdrawal, and to improve load management, short-term forecasting and power procurement practices

Will FSAS act as a cheaper alternative than UI for grid indiscipline? Since FSAS would essentially cover for someone's overdrawal, it would directly lower their cost of 'indiscipline' as cost of procurement of FSAS by the system operator would be socialised.

This also highlights the need to incorporate price sensitive demand as a part of FSAS mechanism (discussed below). In the meanwhile, CERC and the system operator should monitor the behaviour of market participants to evaluate equity impact of cost of FSAS across various stakeholders in the power system.

4. **Short-term load forecasting, load management and power procurement practices:** Short-term frequency variations depend significantly on the ability of the demand as well as supply side to respond in real time. This can be significantly assisted by short-term load forecasting, pro-active load management (including reliability based tariffs as discussed below) and dynamic power procurement. Short-term generation planning (especially for conventional plants) is relatively predictable. There are technical capabilities and operational procedures/mechanisms available (though these can be improved upon) to reasonably forecast short-term plant availability. However, the same does not hold true for the demand side. There are significant gaps in terms of the ability of the distribution companies / state level trading companies to make short-term load forecasting, undertake pro-active real time load management and to develop dynamic power procurement strategies. Ministry of Power / Forum of Regulators should facilitate development of such skills at state level to supplement effective implementation of the FSAS mechanism.

5. **RE and Short-term Generation Forecasting:** Share of renewable energy sources (RES) is growing as a percentage of total generation capacity. Given that RES are characterized by significant generation variation, a greater capacity share in future would raise significant concerns for the ability of the system to maintain frequency within desirable band. This would significantly depend on the ability of RES based plants to provide fairly reliable short-term generation forecast. International experience shows that it is possible to provide more reliable short-run forecast (at least within a range of 4-6 hours) to be able to assist the system operator in procurement and deployment of ancillary services. It is suggested that RE generators should adopt/develop tools for reliable forecasting of short-term generation forecasting. This can begin as a voluntary exercise for a period of 1-2 years followed by its mandatory adoption across all such plants (except micro-plants) and subsequent applicability of UI mechanism with narrow band of error for all RES based plants. It is also desirable that existing band of error for RE plants be narrowed down in a phased manner. This would itself provide incentive to improve short-term forecasting.

   It would also be prudent to evaluate the cost of ancillary services (especially FSAS) on account of variation / unreliable generation forecasting. This may help highlight the need for improvement in generation forecasting by RE plants. While it may not be possible to have a very reliable forecast during the initial phase, reliable data input and model adjustments can provide more reliable estimates over time. This would help CERC and SERCs to evaluate the extent to which RE need to improve short-term generation forecasting so as to reduce the ancillary cost burden on the system.

6. **Pay as Bid Vs Uniform Price Auction:** The expected benefit from pay-as-bid auction is based on the assumption that the suppliers would consistently bid around their marginal cost thus ensuring large economic benefits to the buyers. Literature provides evidence supporting as well as contrary to the efficiency of pay-as-bid auction over uniform price auction. In fact, efficiency of

'pay-as-bid' auction to ensure long-term efficiency is debatable. This largely arises due to the concerns for strategic bidding by the generators, who can collude to bid higher than their marginal cost.

If one expects largely ISGS based supply bids, a case for strategic bidding may be secondary. However, one does expect participation of private power plants including captive power plants. Strategic behavior can emerge sooner than later as soon as 'interested' market participants are able to gauge the behaviour of others. **This further highlights the need for demand side bidding, which can reduce the impact of strategic behaviour to some extent.**

7. **Importance of Demand Side Bids:** The proposed FSAS mechanism relies on supply side bids only. In fact, given a shortage scenario, it should bank more on the demand side. The following two reasons substantiate the need for demand participation in an FSAS mechanism. (i) Lack of incentive to reduce 'indiscipline' by distribution utilities as part of cost of their 'indiscipline' would be socialized across utilities in the region. (ii) Limited supply side flexibility.

   The Indian power system continues to face shortages especially during peak hours when FSAS would be required the most. During peak hours, ISGS may not have significant unrequisitioned capacity across all days. Few utilities, which may otherwise have less requirement than total power allocation/availability during some periods, may continue power requisition from ISGS plants out of their allocation as this power can be offloaded in the market to derive financial benefits. Private power plants including captive power plants would also behave in a similar manner. Since, bids for FSAS market would open after the DAM closes, the above mentioned 'owners' of capacity would prefer to sell electricity in the DAM first and offer unsold capacity in for FSAS market. Clearly, supply side would have less flexibility to address the needs of FSAS market. It is important to make demand side bidding an integral part of the FSAS mechanism.

8. **Demand Response and Reliability based Tariff for large consumers:** In the context of the above discussion, SERCs should develop mechanisms for demand response and introduce reliability based tariffs especially for large consumers. With improved metering and communication capability, large consumers would bring in significant demand flexibility to address the grid requirements.

   In case of supply response, especially for 'ramp up' of supply, there is a significant delay in response especially from coal based power plants[1]. Demand response is expected to be much faster than the supply response as the former may not need much 'demand ramp down' time with limited associated costs. Large industrial consumers, which are not based on continuous process should be able to assimilate the desired response associated with reliability based tariff. A reliability based tariff essentially allows a utility to communicate to consumers / or itself directly remove a particular load so as to allow immediate demand response. This would of course be acceptable to the consumers only if consumers are offered incentives through reliability based tariff design. Such tariff can only be implemented with adequate communication and real time data monitoring of consumers by the distribution utility.

[1] In case of hydro and gas/liquid fuel based power plants time response is relatively faster but his may still span over 15-30 minutes.

9. **FSAS as a Substitute for UI Mechanism?:** It is a point of discussion if the proposed FSAS market in its current form can replace the UI mechanism in the near term. UI mechanism embodies flexibility and price response on demand as well as supply side. A market for FSAS as envisaged in this staff paper currently focuses only on supply side. Further, response to UI is in response to a known price curve, whereas that for FSAS would be determined on a daily basis. Proposed FSAS market would have larger time granularity. It may be feasible to work forward with the FSAS mechanism and develop it further to augment/replace UI mechanism in future. The intervening time should be used to study the outcome of the proposed FSAS mechanism and weight its benefits along with/over the UI mechanism.

10. **Supply Side Bidding State Generation Plants:** The proposed FSAS mechanism envisions that inter-state generating stations (ISGS) mandatorily build their unrequisitioned capacity in the FSAS market. In a similar manner state level plants should also be made part of supply side bidding through SERC level regulations to that effect.

11. **User Equipments and Role of BEE:** Given that most of the reactive power requirement arises due to equipments and appliances at the consumer end, improvement in end used equipment in terms of their power factor would significantly address the reactive power need in the long-term. Inadequate capacitor with motors, compressors, pump sets, ballasts, CFLs etc. are adding to the reactive power burden of the system. There is an urgent to develop a long-term road-map to gradually improve power factor of electrical equipments and appliances, and incorporate the same in the star rating system of Bureau of Energy Efficiency (BEE). Further consultations at institutional level should be undertaken to develop a long-term roadmap for the same.

12. **Sharing of Revenue from FSAS:** It should be clarified if revenue earned over and above the normative or actual fuel cost to be shared between the ISGS and the beneficiaries. Share of beneficiaries to be distributed as per their respective allocated capacity from a particular ISGS plant.

13. **Market Platform:** Ancillary services are best procured through a mechanism organized at one market platform. The existing market design with two operating power exchanges (PXs) is already giving sub-optimal solution as liquidity gets divided among two platforms and there is no mechanism to consolidate the bids across two power exchanges. The suggested solution (# 23) to allow the operating power exchanges to collect supply bids and pass on the same to the 'nodal agency', who would help make a consolidated supply bid curve. In fact, a similar approach should also be proposed for price determination of DAM and other market segments across the two PXs. It is to be clarified if the 'nodal agency' needs specific approval from the CERC to manage 'price discovery' mechanism. It may also require the 'nodal agency' to have rules for the mechanism approved by the CERC.

14. **Criteria for deployment and withdrawal of FSAS:** The proposed mechanism for deployment and withdrawal of FSAS is reactionary in nature and does not seem to gauge the potential grid activity. The lag between the monitoring block and deployment is more than 30 minutes, allowing significant changes to occur in the grid condition due to dynamic demand and supply conditions.

15. **Reduce Bid Span Granularity:** On many occasions during the day, FSAS services may be required for an hour for even less. By inviting a bid for a time block of 2 hours, we may take away flexibility from the hands of the nodal agency as well as the suppliers (especially in the case of demand response). A smaller time block may also enhance participation in FSAS mechanism

as many suppliers with a relatively smaller window of flexibility would also participate. It is recommended that a smaller time block of 30 minutes or 1 hour may be considered.

16. **Need for Effective Market Monitoring:** Since pay-as-bid auction is expected to theoretically permit recovery of marginal cost, this would be consistent with the participation of ISGS plants, which would have recovered their fixed cost from beneficiaries through regulated tariff. In case of private plants, the investors may expect to recover part of their fixed cost or make above normal profits. This would necessitate effective monitoring mechanism by CERC to detect strategic bidding behaviour. The market monitoring activities of CERC should go beyond 'reporting' and device effective mechanism to monitor behaviour of market participants. Further, the strategic behaviour may also include cooperation across DAM, FSAS or other market segments. This requires much effective monitoring market participants. **CERC should develop stronger regulations for market monitoring.**

17. **Uncertainty of Despatch and Commitment Charges:** There is a need to provide incentive against uncertainty of despatch to generators bidding in the FSAS market. The proposal to allow flexibility to the generators to sell later in short-term bilateral market would increase uncertainty for stakeholders. The alternate proposal to pay capacity charge as commitment charge would provide incentive to the generators. However, care should be made in determining the appropriate level of capacity charge. Three alternatives are possible. (i) Capacity Charge quoted by the generator along with energy charge; (ii) A normative Capacity Charge determined by CERC for each plants based on different fuels; (iii) Capacity charge based on capacity utilitsation of the plant excluding the capacity bid in the ancillary market. Quotation of capacity charge by generators, lead these to quote very high capacity charge. This would also make it difficult to stake bids with two parameters i.e. capacity and energy charge. The other two alternatives would be preferable in the present context. However, case should be taken to ensure that the charges are fair. In case of ISGC plants, if all the capacity charge is paid by the beneficiaries, there should not be any case for payment of additional capacity charges as commitment charges. Such plants should continue to remain on standby for the capacity offered in the FSAS market.

    An alternate strategy with capacity and energy bids could be to adopt a two stage bidding process wherein generators are first selected on the basis of capacity charge bid and then these bidders give energy bids at the second stage. With limited number of market participants, this proposal would be prone to strategic play unless suitable measures are put in place to monitor behavior of market participants. However, this provides ample incentive to reveal true costs as generators bidding too low to qualify for the second round would be paid 'low capacity' charges as bid at the first stage.

18. **Payment to plants "identified to be despatched" or "despatched":** A reading of the clauses #24-27 does not provide a clear idea as to which plants would be paid by the nodal agency for providing FSAS. Those identified a day earlier for despatch or those actually dispatched?

19. There is a need to differentiate clearly between the 'time block of 2 hours' mentioned in clause 21 and time block of 15 minutes referred in clause 29.

20. To ensure transparency and market confidence, it is important that the nodal agency spell out the criteria to define and declare "real time congestion". Further, such information be archived and reported to CERC for monitoring/ex-post analysis. This is to ensure objectivity in treatment of such cases.