

CENTRAL ELECTRICITY REGULATORY COMMISSION (CERC)
3rd & 4th Floor, Chanderlok Building, 36, Janpath, New Delhi – 110 001
Tel : 23353503, Fax: 23753920

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PUBLIC NOTICE

Sub: Staff paper on “**Introduction of Ancillary Services in Indian Electricity Market**”.

The staff of the Commission has prepared a consultation paper on "Introduction of Ancillary Services in Indian Electricity Market". Ancillary Services are aimed at supplementing efforts at maintaining power quality, reliability and security of the electricity grid and optimum utilization of resources. To facilitate discussion on the subject, the staff paper highlights various issues involved in the context.

2. Comments of the stakeholders are invited on the staff paper latest by **30.04.2013**.

3. It may be noted that staff paper does not necessarily represent the views of the Commission. The Commission would take a view on various issues after receiving the suggestions of the stakeholders.


(Rajiv Bansal)
Secretary

Staff Paper

**Introduction of Ancillary Services in Indian
Electricity Market**

April 2013



**CENTRAL ELECTRICITY REGULATORY COMMISSION
NEW DELHI**

Introduction of Ancillary Services in Indian Electricity Market

I. Introduction

1. Ancillary Services are support services which are required for improving and enhancing the reliability and security of the electrical power system. Ancillary Services are an indispensable part of the electricity industry. World over these services have evolved based on the prevailing structure of electric supply system and operational practices in the country. In India also, ancillary services have grown along with the grid. They have traditionally been a part of grid operation and mostly mandatory.
2. In vertically integrated utilities the responsibility of generation, transmission and distribution was with one organization. Ancillary services were therefore an integral part of electrical supply and not dealt with separately. However, since the liberalization of the electricity supply industry, the resources required for reliable operation have been treated as an ancillary service that the system operator has to obtain from other industry participants. In a deregulated power system the system operator often has no direct control over individual power stations and has to purchase these services from other service providers. The design of Ancillary Services market should be such that it complements system reliability.

II. Ancillary Services in Indian Electricity Market- Statutory Provisions

3. Ancillary Services are defined, under Regulation (2)(1)(b) of the CERC (Indian Electricity Grid Code), Regulations, 2010 (IEGC) as follows :

“in relation to power system (or grid) operation, the services necessary to support the power system (or grid) operation in maintaining power quality, reliability and security of the grid, e.g. active power support for load following, reactive power support, black start, etc;”
4. One of the objectives of the IEGC, as given in Regulation 1.2 is the “Facilitation for functioning of power markets and *ancillary services* by defining a common basis of operation of the ISTS, applicable to all the Users of the ISTS”.

5. The IEGC, under Regulation 2.3.2 (g) also made operation of Ancillary Services as an exclusive function of Regional Load Despatch Centres (RLDCs).
6. Regulation 8 of the Central Electricity Regulatory Commission (Power Market Regulations) Regulations, 2010, provides for the introduction of new products in Indian Electricity Market in the future, including Ancillary Services Contract. The Regulation 8 is reproduced below :

“Notwithstanding anything contrary contained in these Regulations, no person shall enter into or transact in any of the following types of contracts unless the same has been permitted to be so launched or introduced by the Commission in terms of notification issued in this behalf -

- (i) Derivatives Contracts*
- (ii) Ancillary Services Contracts*
- (iii) Capacity Contracts”*

7. Regulation 11 (1) (b) of the Central Electricity Regulatory Commission (Unscheduled Interchange Charges and Related Matters) Regulations, 2009 provides for utilization of the amount left in the UI pool account fund towards providing ancillary services. The Regulation is reproduced below :

“(1) The amount left in the UI pool account fund after final settlement of claims of Unscheduled Interchange charges of the generating station and the beneficiaries shall be transferred to a separate fund as may be specified by the Commission and shall be utilised, with the prior approval of the Commission for either or both of the following activities:

(a)

(b) Providing ancillary services including but not limited to ‘load generation balancing’ during low grid frequency as identified by the Regional Load Despatch Centre, in accordance with the procedure prepared by it, to ensure grid security and safety.”

8. In view of the above, an approach paper on ‘Ancillary Services in Indian Context’ was developed by NLDC in consultation with RLDCs. The paper was submitted to the Central Commission. The Commission directed the NLDC to seek comments of the stakeholders on the approach paper. Based on the comments received, NLDC filed a petition for implementation of Frequency Support Ancillary Services (FSAS) in the country.
9. The issue of introduction of Frequency Support Ancillary Service (FSAS) was discussed in the meeting of Central Advisory Committee of CERC held on 14th March 2012. In the meeting there was agreement on the following points:

- (i) There was a general consensus on the need for introduction of ancillary services in India for greater security and reliability of grid operation.
 - (ii) Introduction of ancillary service is expected to reduce dependence on UI which should be resorted to only as a last mile imbalance settlement mechanism.
 - (iii) The framework should be explained in greater detail to the stakeholders before launching it.
10. A National level workshop under the umbrella of Forum of Load Despatchers (FOLD) was organized on 15th June 2012 to explain the ancillary services mechanism to the stakeholders. The workshop was attended by representatives from CERC, Northern Regional Power Committee, Load Despatch Centres, Generating Companies and Power Exchanges.
11. Subsequent to the developments, during the hearing of the petition filed by NLDC on 10th July 2012, the Central Commission directed the staff of the Commission to come out with regulation on Ancillary Services. However, it has been felt that before drafting a regulation on Ancillary Services, views of stakeholders on the proposal may be invited through a staff paper.

III. Staff Proposal

12. There are basically three main types of Ancillary Services, viz. real power support services or Frequency Support Ancillary Services (FSAS)/ Load following, Voltage or reactive power support services and Black start support services. To start with, Ancillary Services could be introduced for improving the reliability and security of the grid. However, given the power deficient situation in the country, it would be desirable that to start with the ancillary services be simple to implement.

Frequency Support Ancillary Services (FSAS)

13. FSAS would be the service offered through bids by a generating station or any other authorized entity on behalf of the generating station to make itself available for despatch and get despatched/ scheduled by the nodal agency to support the system frequency.

Hence, the focus of introducing Frequency Support Ancillary Service (FSAS) would be to maintain the frequency within the band specified in the IEGC.

14. It is seen that there is some surplus generation capacity lying unutilized at some point of time but at the same time load shedding is being carried out by the utilities. Similarly, there is captive generation capacity available with industrial users like steel industries, sugar industries, etc. which are lying un-utilized and could be harnessed to supply to the inter-State grid at the time of utter need to maintain grid security. There is, therefore, a need for a mechanism such as Frequency Support Ancillary Services (FSAS) to utilize these un-despatched/surplus capacities to enhance the power supply to the grid, when required, to maintain grid security.
15. To start with, the generators having surplus capacity, (i.e. either un-requisitioned surplus capacity by the beneficiaries of that capacity or generators who could not find buyers for that capacity or surplus captive capacity) may be enabled to bid into the power exchange for enhancing grid security when their services are sought by the system operator.
16. FSAS, at present in the Indian context, aims to stabilize the grid frequency by maximizing unutilized generation and minimizing load shedding, under certain conditions, for ensuring grid safety and security. Gradually as this market grows and imbalances are better handled with improved system security and reliability, this market could phase out the UI Mechanism. It is however pertinent to mention that introduction of ancillary services may not automatically mean a good frequency profile.
17. Integration of renewable energy in the grid is one of the biggest thrust areas. The installed generation capacity of renewable generators is expected to grow manifold in the coming years. Considering the high variability and unpredictability of generation from renewable, the FSAS would serve to stabilize the frequency for increased integration of renewable sources into the grid. Frequency Support Ancillary Service (FSAS) can be used to complement the diurnal changes in renewable generation. FSAS can thus also be used as a mechanism to facilitate renewable integration by reducing the impact of their variation.

Eligibility Criteria

18. All the sellers and regional entities which are part of the scheduling and deviation settlement mechanism for real and reactive power with voice and data telemetry facilities in accordance with the regulations framed by the Central Commission and Central Electricity Authority to be eligible to participate in the ancillary market.

No Objection Certificate (NOC)/ Standing Clearance issued by the concerned SLDC/RLDC for participation in the day ahead market in the power exchanges to be considered valid for participation in the ancillary services market subject to the condition that the capacity cleared for day ahead transaction in power exchanges for any participant plus the capacity cleared for FSAS shall not exceed the total capacity for which SLDC clearance has been obtained. Further the un-requisitioned surplus from the inter-State Generating Stations (ISGSs) whose tariff is determined by the Commission should mandatorily bid in the FSAS.

Market Platform

19. The implementation of FSAS would be facilitated through bidding in the Power Exchanges. A separate product could be constituted for this purpose, comprising of sellers interested in participating in the Ancillary Service market. Competitive bidding process would be followed for procurement of FSAS. The Commission may by an order provide an overall ceiling for charges for services rendered through power exchanges including service charges for any subordinate service providers. The market participants would be free to bid in any of the Power Exchanges for providing ancillary services. The power exchanges and members of the user group to enter into ancillary services contract.

Bidding and Price Discovery

20. The window for receiving bids in Frequency Support Ancillary Service market to be opened after closure and clearance of the day-ahead market (DAM) in the power exchanges. The bids to be invited on a day ahead basis for which the window would be open for submitting bids considered for despatch next day.

21. The participants in FSAS market to submit time-block-wise bid quantum and price along with the location, for the next day in the power exchanges. Bids to be placed for standard time blocks of 2 hours, to facilitate stacking of the bids by the nodal agency. The window for receiving bids in FSAS to remain open for 2 hours after the opening of the window for the FSAS. The power exchanges to provide information to the nodal agency.
22. The ISGSs having un-requisitioned surpluses shall also bid for the FSAS. The combined stack of bids would be prepared by the nodal agency based on the bids received on the power exchanges. The revenue earned over and above the fuel cost by such ISGSs for providing FSAS to be shared in the ratio of 1:1 with the beneficiaries of the ISGS.
23. The nodal agency would be responsible for preparing combined bid area-wise, time-block-wise stack of the bids received from all the power exchanges. The stack to be prepared on the principle of merit order of bids.
24. The prices payable to the providers of FSAS would be based on the principle of “pay-as-bid” and the amount payable would be for the despatched quantum at the bid price of the participant.
25. Based on the estimated additional generation requirement in the system as identified by the nodal agency and merit order stack, bids to be despatched under FSAS would be identified.

Despatch of FSAS bids in real time

26. If the frequency remains 0.05 Hz below the lower operating frequency range as specified in the IEGC for two consecutive time-blocks, the nodal agency to give instructions to the FSAS provider to despatch in the third time block for despatching generation from the fifth time block.
27. The principle of ensuring merit order in despatch of FSAS bids to be discounted in case of real time congestion in the network. If despatch of a lower cost stacked bid is likely to further stress an already congested corridor, then that bid would be skipped and the next bid in the stack would be considered for despatch provided it also does not aggravate the condition of congestion in the network.

28. The limit of the Available Transfer Capability (ATC) across the control area would also be followed while despatching the bids.
29. If the frequency remains at 50.0 Hz for two consecutive time blocks, after kicking-in of the FSAS, the nodal agency to give instructions for withdrawal of FSAS. The generation despatched under FSAS would be given a despatch certainty for 8 time blocks (i.e. 2 hours). In case withdrawal instructions are given by the nodal agency before the completion of 2 hours, 50% of the bid price to be paid to the seller for the period falling short of 2 hours. Further, in case a seller, whose power has been scheduled, fails to provide the committed generation in real-time then the seller would be liable to pay 1.5 times the bid price or the applicable UI rate whichever is higher.

Scheduling of Frequency Support Ancillary Services (FSAS)

30. Once the despatch decision is taken, scheduling request under FSAS to be routed through Power Exchanges. The quantum of bids despatched to be directly incorporated in the schedule of respective FSAS providers.
31. The despatched bid quantum under FSAS to be booked to the overdrawing regional entities in proportion of their overdrawal.
32. The scheduling and delivery of contracts on the power exchange to be in accordance with Central Electricity Regulatory Commission (Open access in inter State Transmission) Regulations, 2008, Central Electricity Regulatory Commission (Power Market) Regulations, 2010, and Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 and as amended from time to time.

Accounting and Settlement of Frequency Support Ancillary Services (FSAS)

33. The power despatched under FSAS to be incorporated into the schedule of the overdrawing entities by the respective LDC.
34. The payment to bidders would be through the power exchange from the overdrawing entities in proportion of the quantum of overdrawal.

35. Payment to the bidders under FSAS to be on the basis of the scheduled quantum after accounting for under-injection. No commitment charges payable to the bidders for making itself available in the FSAS market.
36. The upper limit of UI rate without additional UI rate, as specified by the Commission from time to time to be the ceiling price for the scheduled bids. The highest UI rate (i.e. the rate for a frequency of 49.5 Hz at present and as modified from time to time, not counting the additional UI rate) is linked to the variable cost of the costliest generation (which is generation mostly based on liquid fuel). The logic is that when frequency goes below 49.90 Hz., the States would be incentivized to use the liquid fuel based generation, whether their own generation or their share from Central Generating Stations, since that would be cheaper than drawing unscheduled power through the UI mechanism. One would like to question that since the choice for requisitioning this generation is already with the States, they could do that themselves. The reason is that the Regional Load Despatch Centre is the apex body in real time grid operation in the region, is the quickest to respond for maintaining frequency, as compared to the States who have to follow the process of procurement of short-term power.
37. The energy despatched under FSAS would be deemed to be delivered at the Regional periphery. The under injection by the FSAS provider to be treated as per the CERC Unscheduled Interchange Regulations.
38. Any over injection by the FSAS provider shall not be paid for.

Voltage Control Ancillary Services (VCAS) & Black Start Ancillary Services (BSAS)

39. The Electricity Act 2003 entrusts the responsibility of transmission system planning on the CEA and the CTU. While the CEA forms perspective plans, the CTU fine tunes them over a shorter period in coordination with the CEA amongst others. While planning for the grid, the CEA and CTU, use system studies for ensuring a proper voltage profile at various points in the grid. However, the planning is done in anticipation of generators and loads coming up at various points in the grid. Due to variations between the anticipated and the actual for generation and load, the reactive power requirements change. The reactive power

requirements also change as more and more elements get added to the grid. Since voltage is a local phenomenon and not a global phenomenon like frequency, the requirement of capacitor and/or reactor at a various nodes (sub-station or switchyard of generating station) may need to be changed. Therefore, we feel that the provision of reactive power, which may require a change in location, could be allowed under reactive power support ancillary services. There is already a commercial mechanism in the IEGC under Regulation 6.6 of the IEGC Regulations, w.r.t. voltage reference at the interchange point, which incentivizes maintaining a proper voltage profile at all interchange points between control areas in the grid. However, in case it is observed by the system operator that there is a critically low voltage in the grid at one or more such interconnection points persisting during a season, the system operator may requisition voltage support ancillary services from any service provider, who may bid the same through the power exchange. Given that mobile sub-stations, installed in trailers, which allow flexibility for quick installation to restore supply, are gaining popularity, we feel that mobile reactors or capacitors would be a big advantage and also result in reduction in cost, since they could easily be moved from one sub-station to another, as per requirement. But to start with, the mobile reactive compensation would be provided by the government owned transmission companies only.

Presently, Part II “Grid Connectivity Standards applicable to the Generating Units” in the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 mandate hydro generating stations for providing black start facility. Incentives may be provided to all the flexible generators who would provide black start facility when such services are sought by the system operator.

Execution of Voltage Control Ancillary Services (VCAS)

40. The price bids for providing VCAS on nodal basis for the generating units other than those providing active power and scheduled by Load Despatch Centre, to be submitted in the power exchanges.
41. Power exchanges to furnish the stack of node-wise bids for VCAS to the nodal agency based on which the nodal agency would prepare combined node-wise stack.

42. The payment to be made on “pay as bid” on the actual node-wise reactive support subject to the maximum ceiling rate of reactive energy as provided in the IEGC as amended from time to time.
43. The providers of VCAS to be paid as specified in Regulation 6.6 of the Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 as amended from time to time.
44. The mobile VCAS may be provided by the Government owned transmission companies. The despatch and withdrawal of node-wise voltage support instruction for VCAS to be as per the IEGC. The payment to be made to the supporting entity by booking against the reactive energy drawing utility.

Execution of Black Start Ancillary Services (BSAS)

45. The generators capable of providing start up power to mandatorily provide the Black Start Services as per the instructions of the load despatchers.
46. BSAS to be paid as when the same is required by the nodal agency. The generators capable of providing start up power to mandatorily provide the Black Start Services as per the instructions of the load despatchers.
47. The generators to be paid for one day capacity charges to such generators on the day of providing the BSS, as determined by the Commission. The energy charges to be paid at twice the energy charges determined by the Commission for the volume of energy supplied during the restoration process.
48. Other flexible generators providing BSAS to be paid fixed and energy charges on the normative figure to be specified separately.

Nodal Agency

49. Frequency Support Ancillary Services (FSAS) envisage harnessing of the generation resources on pan India basis to achieve economy and efficiency. Similarly, Voltage Control Ancillary Service (VCAS) is proposed on the reactive compensation required

node-wise. Black Start Ancillary Service (BSAS) is also proposed, which needs to be implemented in a coordinated manner. It is proposed that the system operator, namely National Load Despatch Centre (NLDC) should be the nodal agency for implementation of the ancillary services as NLDC monitors the real-time grid conditions on the round the clock basis.

50. Section 27 (2) of the Electricity Act provides as under:

“Provided further that no Regional Load Despatch Centre shall engage in the business of generation of electricity or trading in electricity.”

Operation of the Frequency Support Ancillary Services (FSAS), however, does not qualify as trading of electricity as the mechanism would work similar to the Day Ahead Market (DAM) in power exchanges. Role of the system operator will be limited to preparing combined merit order stack based on the stacks of bids received from all the Power Exchanges and the despatch decision shall be routed through the Power exchanges. The system operator will, therefore, not be involved in trading.

Market Surveillance

51. Market surveillance would be a pre-requisite for successful implementation of the ancillary services market. Hence, a Market Surveillance Committee may be constituted comprising of the representatives from NLDC, RLDCs, RPCs, Power Exchanges and traders.
52. The sum of short term contracts and bid quantum in FSAS market not to be greater than the standard clearance or NOC issued by the appropriate Load Despatch Centre. A penalty may be imposed in cases of persistent under-injection by a participant in FSAS.

Issues

Based on the experience of implementation of various regulatory interventions the staff of the Commission have tried to identify the likely challenges in implementation of the Ancillary Services as outlined above. Some of the implementation challenges identified and pros and cons on the issues are discussed below.

53. **Need for Ancillary Service:** Concerns have been raised by NLDC at regular intervals before the Central Commission regarding grid in-discipline by the States, followed by incidences of grid collapses twice in two days. Strong corrective measures are being taken up so that such an event does not recur in future. Among other things, it is understood that there are proposals to enhance powers of the regulators in terms of enforcing grid discipline. It has been reported that system has achieved stable grid frequency since the twin grid failures owing to efforts made by various agencies. In view of this, one of the questions that arises is as to whether there is a need to introduce Ancillary Services at this stage for better grid security and stability.

The argument on the other side is that the Ancillary Services primarily aim at improving the reliability of System Operation. Further, ancillary services may also be seen as one of the mechanisms which could be developed to replace UI mechanism in a long run. Moreover, development of Ancillary market has not emerged from the incidences of grid failure but is already imbibed in the statutory provisions as discussed above. NLDC has filed a number of petitions in the past regarding grid indiscipline by grid participants to the Central Commission which severely affected grid stability and security. Since the objective of Ancillary Services is to facilitate a framework for ensuring grid security, introduction of such services should not therefore depend on frequency of grid indiscipline.

54. **Payment Risk:** There have been instances of default in payment of UI charges by the overdrawing entities in the past and cases are still pending in the High Courts. As many buyers of FSAS would be the same entities who are defaulting under UI mechanism, it would be necessary to ensure that these players pay for overdrawl. Since the transactions/payment would be routed through power exchanges, the power exchanges would inherit the risk of default in payment by buyers. It would require a mechanism to

ensure that the buyers pay for overdrawl and secure power exchanges from such huge financial obligation/risk.

CERC Power Market Regulations provide for the establishment of a Clearing House. A possible solution could be considered by routing all trades by market participants through the clearing house irrespective of the participation in the Power Exchanges or Bilateral Market. Thus, some form of payment security mechanisms may be evolved for handling the payment risk through the Clearing house.

55. **Linkage to the UI Ceiling Rate:** It has been proposed to keep upper limit of UI rate, without additional UI rate, as specified by the Commission to be the ceiling price for scheduled bids. This may be seen as in conflict with the philosophy of doing away with UI mechanism in future. It may be contended that the link with UI mechanism may encourage the players to benefit by resorting to similar gaming tactics under FSAS if the prices are close to UI rate.

While one would be open to other proposals, it has been proposed to link the ceiling rate with UI rate to start with. Going forward, the ceiling prices may be de-linked or changed according to changing UI mechanism or indexed against a new reference in future.

56. **Possible Breach of PPAs:** One would like to contend whether we should identify flexible generation plants before implementation of Ancillary Service. It has been considered that hydro stations, especially pumped storage hydro stations, open cycle gas stations and partly load coal stations would have the capability to provide Ancillary Services in 30 minutes. It is possible that the generators may get lured by the high cost of dispatch under FSAS. This may result into in a situation where some generators try to breach the contracts/PPAs in order to supply power under FSAS. As only existing generators would ramp up and supply power as FSAS, it would be necessary to ensure that such plants do not give preference to FSAS at the cost of their PPAs. Similarly, there would be upcoming generators who would not have identified beneficiaries. Such generators may try to indulge in gaming to get better price for their power.

One probable solution against breach of PPAs could be to mandatorily obtain a declaration from the providers of the Ancillary Services (generators) regarding the un-requisitioned surplus capacity being committed under Ancillary Services in an affidavit submitted to Power Exchange where they participate.

57. **Load management by utilities:** Under the UI mechanism, once intimated, the overdrawing entities have an option to shed load to reduce their overdrawl. However, it may be contended by some stakeholders that in case of FSAS, high cost power shall be imposed on them which could have been avoided through load shedding. It has already been proposed that charges for the ancillary services would be payable only by the overdrawing entities. Utilities may choose not to overdraw and in such an event there might not be any occasion to incur the cost on this account. Thus, there is no imposition of additional burden as apprehended.. Further, at a future date, the Commission may consider introducing “Demand Response” as a separate product.

58. **Market Design:**

In the initial stage of Ancillary Service, market design based on Sequential Auction is proposed in which Energy Market would be cleared first and bid for balance unsold quantity of power can be made in Ancillary Service market. Experience from International market suggests that sometime this market design leads to problems of economic withholding and price reversal. As such, different market designs like Simultaneous or Simultaneous Co-optimization Auction of Energy and Ancillary Service are prevalent in the advanced markets. With introduction of different products like 10 minute and 30 minute Ancillary service, these new market designs can be tried in India.

59. **Commitment Charge:** Under the proposed FSAS mechanism, the generators may assume risk in terms of cost incurred in bidding everyday for supplying power under FSAS. A generator does not get surety of dispatch even if it gets clearance for the next day as its despatch is first dependent on lowering of frequency and secondly on its position in merit order.

There is a view that on account of the uncertainty in the despatch of generation through the Ancillary Service Market, there may a requirement to pay a commitment charge to provide sufficient incentive to attract generators to this market. However, the generator has the freedom to sell in the short term bilateral market subsequent to submission of his bid for the ancillary services. In such a case, the generator may intimate the Power Exchange and his bid would be treated as withdrawn. Thus the ancillary services provide an additional avenue for sale of power to the generators. Another option could be that the service provider be allowed to bid in two parts. While Capacity charge (which may include Start up cost) may be paid as commitment charge, energy charge can be paid for actual Ancillary Service Energy provided during system operation.

60. Forecasting:

For optimum decision making for procurement of Ancillary Services, it is necessary that the system operator provides load generation balance forecasting on daily basis. In the Indian power System where Decentralized System operation has been adopted, providing such forecasting is a challenging job for system operator in view of the fact that it would depend on correct inputs from State Load Despatch Centers.

However in view of increasing Renewable participation in Indian Grid, it is required that Load Forecasting capabilities at all level are improved to avoid uneconomic decisions in procurement of Ancillary Power.

61. The stakeholders are requested to submit their views on the above proposal of Staff of CERC.