


भारत सरकार केंद्रीय विद्युत प्राधिकरण दक्षिण क्षेत्रीय विद्युत समिति बेंगलूरु - 560 009	 सत्यमेव जयते	Government of India Central Electricity Authority Southern Regional Power Committee Bengaluru - 560 009
Web site: www.srpc.kar.nic.in	<a href="mailto:mssrpc-ka@nic.in">mssrpc-ka@nic.in</a>	Ph: 080-22287205 Fax: 080-22259343
सं/No. SRPC/SE-II/2017/		दिनांक / Date 02.03.2018

To  
As per enclosed list

**Sub: Special Meeting on AGC-Reg**

In the 7<sup>th</sup> NPC meeting held on 08.09.2017, two aspects had been deliberated as given below:

- AGC is the requirement of system operation where in generators had to participate in frequency regulation.
- Ramification of implementation of AGC on tariff.

It was felt by NPC forum that since this issue pertains to generators and Discoms, it could be discussed at RPC level. The discussion would include aspects of implementation of primary and tertiary control also. For this agenda would be separately by POSOCO and routed through NPC Secretariat to have a commonality and National perspective. Chief Engineer, NPC vide letter dated 06.02.2018 (**enclosed as Annexure**) had forwarded the agenda on AGC for discussion in the TCC/SRPC Meetings. In the 32<sup>nd</sup> TCC / 33<sup>rd</sup> SRPC meetings, it was agreed to discuss the issue in a special meeting and SLDCs participation was also required.

It is proposed to convene a meeting at **10:30 hrs of 28.03.2018 (Wednesday) at SRPC, Bengaluru**. It is kindly requested to attend the meeting or nominate the concerned officials. SLDCs are kindly requested to ensure the participation of the Discoms and Hydro/Major generators in their control area.

धन्यवाद /Thanking you,

भवदीय / Yours faithfully

संलग्न : यथोपरि / Encl: As above



(असित सिंह / Asit Singh)

अधीक्षक अभियंता / Superintending Engineer

**Mailing list for the Meeting**

1. Chief Engineer (GO), APTRANSCO, Vijayawada
2. Chief Engineer (GO), TSTRANSCO, Hyderabad
3. Chief Engineer (Elec.), Load Despatch Centre, KPTCL, Bengaluru
4. Additional Director, PCKL, Bengaluru
5. Chief Engineer (System Operation), KSEBL, Kalamassery
6. Chief Engineer (Operation), TANTRANSCO, Chennai
7. Chief Engineer (Gen), APGENCO, Hyderabad
8. Chief Engineer (ED), KPCL, Bengaluru
9. Chief Engineer (Project & ED), KSEBL, Thiruvananthapuram
10. Chief Engineer (Mech. Thermal), TANGEDCO, Chennai
11. Chief Engineer (Gen.), TSGENCO, Hyderabad
12. GM, SRHQ, NTPC, Hyderabad
13. GM, NTECL, Vallur
14. CGM (Thermal), NLC, Neyveli
15. GM, NTPL, Tuticorin
16. Senior Vice President, JSWEL, Toranagallu
17. Head Operation, UPCL, Padubidri, Udupi
18. General Manager, SEL, Nellore
19. General Manager, MEL, Nellore
20. Head Operations, SEIL, TPCIL, Hyderabad
21. GM, SGPL, Nellore
22. O&M Head, IL & FS, Nagipatnam
23. GM, Coastal Energen, Tuticorin
24. VP, O&M, HNPCL, Vishakapatnam
25. GM, SRLDC, Bengaluru

Special invitees:

1. Chief Engineer (NPC), CEA, New Delhi
2. GM, NLDC, New Delhi



भारत सरकार/Government of India  
विद्युत मंत्रालय/Ministry of Power  
केंद्रीय विद्युत प्राधिकरण/Central Electricity Authority  
**राष्ट्रीय विद्युत समिति/National Power Committee**

No. 4/MTGS/NPC/CEA/2018/ 119-120

Date: 06<sup>th</sup> February 2018

To

**The Member Secretary  
Southern Regional Power Committee (SRPC)  
29, Race Course Cross Road  
Bengaluru – 560009**

**Subject: Agenda on AGC for discussion in SRPC - Regarding**

Sir,

As you are kindly aware, National Power Committee (NPC), in its 7<sup>th</sup> meeting held on 08.09.2017 at Indore, has decided that Automatic Generation Control (AGC) would be discussed in detail at RPC level. For this, the agenda would be sent by POSOCO and routed through NPC Secretariat.

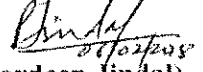
Accordingly, we have received inputs from POSOCO vide their letter dated 29<sup>th</sup> January 2018. The details furnished by POSOCO is **enclosed**.

In view of the item No.13 of Agenda for the 32<sup>nd</sup> TCC /33<sup>rd</sup> SRPC Meetings, to be held on 16/17.02.2018, it is requested that the material on AGC furnished by POSOCO may please be considered for deliberation in SRPC.

Thanking You,

Encl: as above  
(The detailed input is sent by email)

Yours faithfully,

  
(Pardeep Jindal)

Chief Engineer & Member Secretary (NPC)

Copy for information to:  
Member (GO&D), CEA, New Delhi.

पावर सिस्टम ऑपरेशन कारपोरेशन लिमिटेड  
(भारत सरकार का उद्यम)  
**POWER SYSTEM OPERATION CORPORATION LIMITED**  
(A Govt. of India Enterprise)



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Registered & Corporate Office : 1st Floor, B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi -110016  
CIN : U40105DL2009GOI188682, Website : www.posoco.in, E-mail : posococo@posoco.in, Tel.: 011- 41035696, Fax : 011- 26536901

Ref: NLDC/SO/NPC/

Date: 29<sup>th</sup> January 2018

To  
Chief Engineer,  
National Power Committee (NPC),  
NRPC Building, 18-A,  
Shaheed Jeet Singh Marg, Katwaria Sarai,  
New Delhi – 110016

**Sub: Follow up of the decisions in 7<sup>th</sup> meeting of NPC**  
**Ref. Letter no. 4/MTGS/NPC/CEA/2018/69-71 dated 17.01.18**

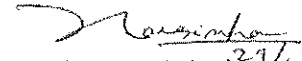
Sir,

With reference to your communication above, the agenda on Automatic Generation Control (AGC) for discussion in forums of different Regional Power Committees (RPCs) is enclosed at Annex-I. Formats for data collection from constituents for common transmission system data base is also enclosed at Annex-II. It is felt that as the CERC is already in the process of notifying the Transmission Planning Regulations, data repository in respect of transmission could be covered under this Regulation.

Thanking you,

Encl: as above

Yours faithfully,

  
(S R Narasimhan) 29/1/2018  
General Manager,  
System Operation, NLDC

Copy to:

- 1) Chairperson, CEA
- 2) CMD, POSOCO

**Power System Operation Corporation Limited  
National Load Despatch Centre  
New Delhi**

29<sup>th</sup> January 2018

**Agenda Note on Automatic Generation Control (AGC) for discussion in RPCs**

**A. Background: Developments regarding Operationalising of Reserves at the regulatory level from 2015 onwards**

1. Roadmap to operationalise Reserves in the country was released by Central Electricity Regulatory Commission (CERC) on 13<sup>th</sup> October 2015. Primary, Secondary and Tertiary controls were identified as essential components for reliable grid operation. Quantum of Reserves were also earmarked by the Hon'ble Commission. Details are available at [http://www.cercind.gov.in/2015/orders/SO\\_11.pdf](http://www.cercind.gov.in/2015/orders/SO_11.pdf)
2. Central Electricity Regulatory Commission (Ancillary Services Operations) Regulations, 2015 were implemented from 12<sup>th</sup> April 2016. A detailed half yearly feedback was given by POSOCO to CERC. <https://posoco.in/reports/half-year-feedback-to-cerc/>
3. POSOCO organized a two day brainstorming session on the topic of Spinning Reserves on 19<sup>th</sup> and 20<sup>th</sup> Jan 2016 attended by CERC, CEA, POWERGRID (CTU) and POSOCO. Professor Anjan Bose, Regents Professor, Washington State University also attended the same. Reserves were a key agenda in the 16<sup>th</sup> meeting of Forum Of Load Despatchers (FOLD) held on 2<sup>nd</sup> March 2016.
4. Based on all consultations, a pilot project in each region was envisaged. NTPC Dadri stg-II (2x490 MW) was selected as the first pilot project for Automatic Generation Control (AGC).
5. Petition no. 79/RC/2017 was filed in the matter of AGC pilot project by POSOCO with CERC in April 2017. <https://posoco.in/download/petition-filed-by-nlhc-regarding-agc-pilot-project/?wpdmdl=13543> CERC in its order dated 6<sup>th</sup> December 2017 approved the Commissioning of the AGC Pilot Project between NLDC and NTPC Dadri Stage-II.
6. For the first time in India, a mock test was successfully conducted on 29<sup>th</sup> June 2017 by connecting NTPC Dadri stg-II with NLDC through AGC, and the test yielded desired results. During the test, signals were sent directly from NLDC control centre in New Delhi to NTPC Dadri control centre. The generator responded as per the requirement.
7. The Commission observed that development of secondary reserves in the country will lead to grid security and reliability. The Commission also directed that similar pilot projects may be replicated by NLDC, in at least one other regional grid of the country. CERC Order on the AGC petition was issued on 6<sup>th</sup> December 2017. [http://cercind.gov.in/2017/orders/79\\_rc.pdf](http://cercind.gov.in/2017/orders/79_rc.pdf)

8. Following the orders of CERC dated 6<sup>th</sup> Dec 2017, from 1225 hrs of 04<sup>th</sup> Jan 2018, Dadri stg-II has been taken under remote as a part of Automatic Generation Control pilot project from NLDC. Data is being submitted by NLDC to NRPC in the format on weekly basis based on 2 second data available from the AGC server at NLDC. The entire Northern Region has been considered as a larger balancing area (instead of each State control area) using the Area Control Error of NR.
9. NLDC SCADA upgradation started from October 2017 and is scheduled to be complete by March 2019. AGC integration work involving software modelling, hardware and communication work also has to be done in parallel. NLDC AGC set up is envisaged to be capable of sending and receiving AGC signals to all the Regional Entity generating stations to start with for the first time in India.
10. Report of Expert Group by CERC to review and suggest measures for bringing power system operation closer to National Reference Frequency of 50.0 Hz was released recently. It was recommended that the frequency control continuum chart as given in this report be adopted and included as part of the Indian Electricity Grid Code (IEGC) through an amendment for addendum. The Executive Summary of this report containing the recommendations is enclosed as **Exhibit-I**. The full report is available at [http://www.cercind.gov.in/2018/Reports/50%20Hz\\_Committee1.pdf](http://www.cercind.gov.in/2018/Reports/50%20Hz_Committee1.pdf) A brief presentation on this report made in the 20<sup>th</sup> meeting of FOLD on 25<sup>th</sup> January 2018 is enclosed at **Exhibit-II**.
11. The Technical Committee of the Forum of Regulators in its 11<sup>th</sup> Meeting held at Chennai on the 28<sup>th</sup> March 2017 constituted a Working Group on a region wise basis under the Chairmanship of Member Secretary, RPC for Regional Cooperation with the objective of optimum utilization of RES. The Working Groups in SR, WR and NR have held meetings and an overarching agreement is under discussion in these regions. This cooperation at the Regional level would facilitate implementation of a mechanism for sharing of intra-state reserves.
12. A detailed implementation plan to operationalize the spinning reserves in the country was also submitted to CERC on 14<sup>th</sup> July 2017 highlighting the issues involved. Secondary Control was recommended to be added as an Ancillary Service.  
<https://posoco.in/download/detailed-modus-operandi-on-operationalization-of-spinning-reserves/?wpdmdl=13461>

Extracts of the important points of the detailed implementation plan mentioned above are given below:

Secondary Reserves quantum, mandated by CERC, is given in the table below.

Secondary Reserves quantum needed in MW (Region wise)	
NR	800

<b>ER</b>	<b>660</b>
<b>WR</b>	<b>800</b>
<b>SR</b>	<b>1000</b>
<b>NER</b>	<b>363</b>
<b>Total</b>	<b>3623</b>

It is suggested in the detailed implementation plan that the pan India AGC implementation is done in the following manner:

#### **Phase-I**

To start with, all the Inter State Generating Stations (ISGS) generators whose tariff is regulated / adopted by CERC are proposed to be made capable of participating in secondary control. The tariff for these generators is already available, there are fewer communication issues, and Ancillary Services Framework is available for settlement and is expected to be dispute free. However, availability of the full quantum of reserves as mandated by CERC may be an issue.

#### **Phase-II**

To improve the availability of Reserves, all Regional Entity generating stations scheduled by RLDCs (over and above the Phase-I power stations mentioned above) can be made capable of participating in secondary control. But, Declared Capability (DC) at present is not taken from these generating stations by RLDCs. Some Independent Power Producers (IPPs) have part PPA (Power Purchase Agreement) and part merchant contracts. Tariff for these generators has to be decided and agreed upon apriori for secondary control participation of these generators. DC and Schedule have to be obtained from these generators similar to Central Sector generating stations for reserve estimation. Many of these regional entity generating stations operate in the day ahead energy market and the day ahead prices play a significant role on the status of these generating units as far as availability to the grid at any instant. Low prices in the Day Ahead Market (DAM) on a sustained basis may lead to all these units remaining off the grid. Hence, monitoring & measuring the quantum of reserves may be an issue.

#### **Essential requirements for Secondary Control through AGC:**

For the Regional entities to be equipped under Secondary Control, the mandatory requirements include:

- i. Shall bear the cost of secondary control hardware at the plant end including the cost of the fibre optic cable from the plant control room to the nearest communication node.
- ii. Shall share DC and Schedule like ISGS generators on day ahead basis and subsequent revisions with RLDCs.
- iii. Payment for the energy and incentive will be as decided by the Hon'ble Commission.

- iv. The generating units shall have working control systems for turbine, boiler and governor. Governor response plots/graphs of past incidents have to be submitted to RLDC.
- v. Existing wide band communication node within a radius below 30-40 km from the plant to communicate with the nearest RLDC. Distance need not be a binding limitation and can be seen on case to case basis based on the merit.

CERC has mandated to carry a total of 3623 MW secondary reserves combined in all Regions. It was observed that Northern Region (NR) and Western Region (WR) have considerable Un Requisitioned Surplus (URS) on bar for 90% of the time. But, Southern Region (SR), Eastern Region (ER) and North Eastern Region (NER) have very less URS for most time of the and may not be able to provide the CERC designated Reserves from URS alone.

## **B. Agenda Issues for discussion in the RPC Forum**

Primary, secondary and tertiary generation reserves are required for frequency control and ensuring reliable operation of the grid, particularly under high Renewable Energy (RE) penetration. Primary control has been existing in the Indian Electricity Grid Code (IEGC) but its enforcement has been an issue that has been brought several times before the CERC. Secondary control had been absent in the system so far while tertiary frequency control was introduced only in April 2016 through the Reserves Regulation Ancillary Services or RRAS Regulations of CERC. The following issues become important when one looks the entire spectrum of frequency control.

### **i. Ensuring accurate load forecasting and Renewable Energy (RE) forecasting.**

This is the first step towards reliability as generating units need to get committed based on these forecasts. Starting from DISCOM level, the forecasts need to be aggregated for the state at SLDCs level, at RLDCs for the regional level and at NLDC for the All India level.

### **ii. Proper scheduling by each state including indication of reserves**

After the above forecast of load and RE generation, the scheduling of conventional generation resources by the states assumes importance. Here, apart from scheduling, the states also need to indicate the amount of hot spinning reserves it is holding. The reserves could be held either within the state or at the ISGS where the state has a share but it should be replenished whenever there is a contingency such as a generating unit tripping within the state. The share of the states in the ISGS is also a form of tertiary reserves as the state reschedules the generation from these ISGS to re-balance the supply-demand within a time frame of 4 time blocks.

Unless such a mechanism is in place, the secondary control would not work as all the reserves would get depleted quickly. This would be evident from the figure below which shows the Declared Capability (DC) of ISGS, DC on bar and the schedules for Dec 2017.



The (DC on bar less the schedules) equals the hot spinning reserves. As would be seen, this gets depleted daily during the morning and evening peak hours when states requisition their full entitlement. Under this situation, the state utilities must demonstrate that they have reserves elsewhere within the state.

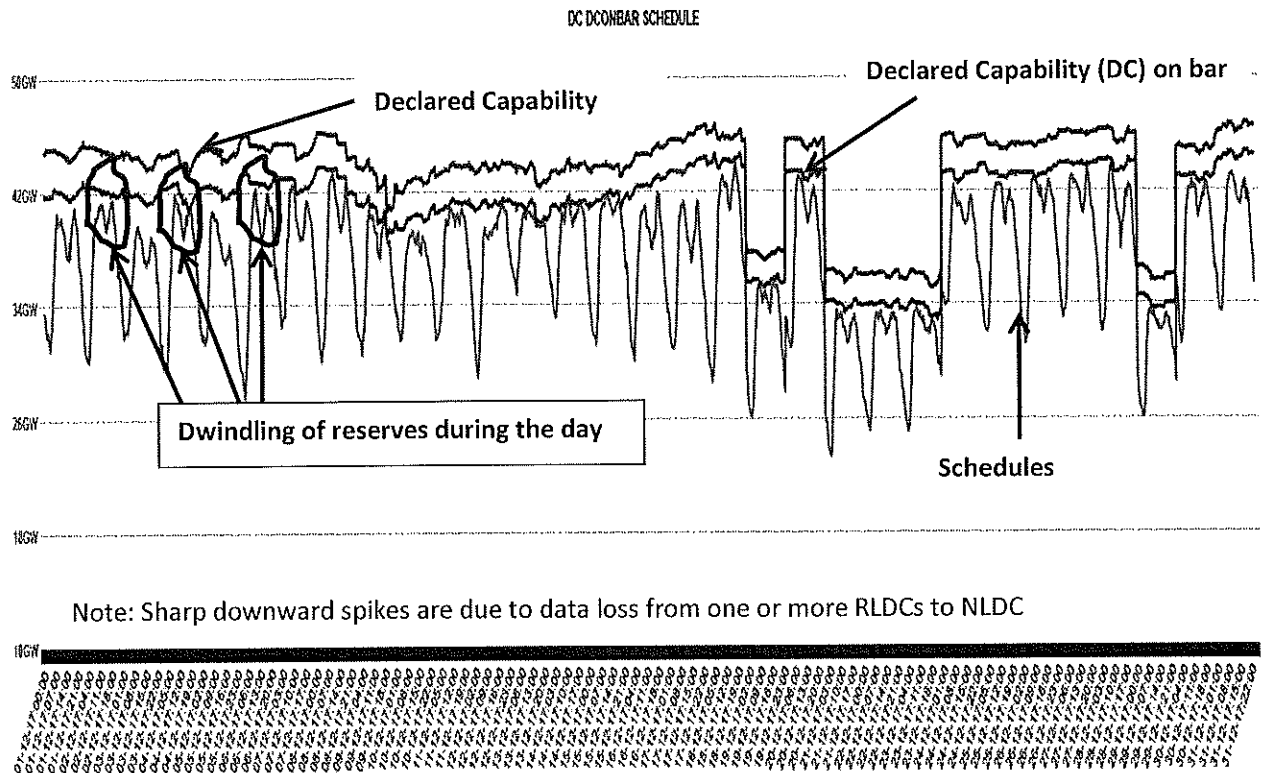


Fig 1: DC, DC on bar and schedules for All India stations in Dec 2017 under Ancillary Services

- iii. **Harnessing Reserves within the States.** The intra-state generation is also capable of providing reserves and these are also being used by the states. However, there is a need for declaration of Declared Capability (DC), DC on bar and the schedules of all such intra-state generation which would help quantify the amount of reserves available inside the state. The information regarding the quantum of reservers could be made available online through the web-portal of the concerned state. This would also help sharing of reserves/regional cooperation between states and could ultimately evolve into a mechanism of joint-despatch between cooperating states.

The Report of the MOP Technical Committee on RE Integration, April 2016 also mentions need for harnessing flexibility in existing fleet of conventional generation as well as Pumped Storage Plants. A regulatory framework for operationalization of reserves at the intra-state level is also required to be implemented. Further, the Committee also recommended that a regulatory framework similar to the ancillary framework by CERC is needed to be implemented in the States for harnessing the intra-state reserves.

- iv. **Gate Closure:** IEGC provides for schedule revisions within 4 time blocks and presently such rescheduling requests keep pouring in continuously in one or the other stations by one of the stakeholders (beneficiary or the generating stations). The generating stations are also changing the Declared Capability as and when required. All this is leading to a situation where the accurate assessment of available reserves by the real time shift operator is just becoming an impossible task. This has particularly been observed in the RRAS despatch where as compared to the UP or DOWN instruction given by NLDC and much lower quantum gets actually implemented. Thus, parallel windows open all the time for rescheduling is leading to this situation.

Internationally, this situation is addressed by the implementation of a "Gate Closure" mechanism where all scheduling changes by stakeholders are barred say about 60 minutes to 30 minutes ahead of the actual time of despatch. It is in this window that the real time shift operator evaluates the system conditions and despatches the firm reserves available at his disposal for balancing the system. Such a "Gate Closure" mechanism is urgently needed in India and the RPC Forum may deliberate the mechanism for implementation of gate closure.

- v. **Evaluate Area Control Error (ACE) of each control area.** Bias maybe taken as equal to Frequency Response Characteristics (FRC) of the state in past ten events. For ACE, high quality measurement of line flows and frequency at 10 seconds or better periodicity at LDCs is a must. Further seamless transfer of schedule data from off-line systems to SCADA must be ensured. RLDCs are already bringing forth the non-availability of real time data in the RPC forums and this needs to be addressed promptly. ACE, though being used for AGC, is still to find a mention/recognition in the Grid Code and feedback may be given to CERC in this regard.
- vi. **The SLDCs must also monitor the primary response from the generating units within the state** and report to the respective SERCs as directed by CERC vide its order dated 31<sup>st</sup> July 2017 in petition no 84/MP/2015. The primary droop characteristics of all stations also need to be monitored.
- vii. For AGC high quality measurements are needed for inter-regional tie lines and power plants under AGC. As stated above, **periodic monitoring of the data quality needs to be done at the RPC forums** and chronic problems of non-availability of data addressed promptly so that real time operation is smooth.
- viii. **Fibre optic communication from Regional Entity power plant to nearest CTU node and there on to RLDCs/NLDC** is a must and could be closely monitored through the RPC forums. This is required irrespective of whether we have a regulated system of secondary reserves procurement or a market based one.

- ix. **Shifting AGC services from NLDC to RLDCs' progressively.** The RLDCs' SCADA/EMS system have been recently upgraded over the last three years before AGC was notified through the CERC orders. Hence, AGC considering region as a larger balancing area is being implemented through NLDC, which is a unique experiment as five (5) AGCs are being operated from a single control centre. Further discussion could start on the roadmap as far as AGC is concerned; of shifting it progressively to RLDCs over the next 3-5 years. Considering the fact that SCADA systems at the RLDCs have recently been upgraded, additional hardware/software for implementation of AGC at RLDCs may be considered.
- x. **How to ensure adequate reserves for secondary control?** As seen from Figure 1 above, the spinning reserves viz. DC on bar minus schedules available in real time in ISGS is identified as available hot reserve. This is used for (a) rescheduling/tertiary reserves by states, (b) tertiary frequency control through Reserves Regulation Ancillary Services (RRAS) and (c) envisaged for secondary control through AGC. It is also available for primary control though the IEGC clearly specifies that the schedules should not exceed capacity on bar less Normative Auxiliary Consumption. This ensures that even if the power plant is fully scheduled, the overload capacity and margins in auxiliary consumption is able to provide primary response. SR is already following a philosophy of restricting the maximum schedules so as to ensure availability of margin for primary reserves. The RPC forum may discuss & suggest ways to ensure adequate availability of reserves for secondary control.
- xi. **Renewable Energy (RE) resources under AGC:** RE sources are generally must-run and the output of RE generator is uninhibited and normally at the maximum possible output. This implies zero margins for up-regulation under AGC, though down-regulation is still possible. There could be a need for RE curtailment either due to the transmission network security issues or an economic curtailment, say when all coal fired units have already been backed down to the minimum 55% levels and there is no scope for further backing down or closing down of units (as peak load has to be catered to later). Under such situations, signals to RE plants could be given from the Load Despatch Centres (LDCs). Most of the new RE procurement bid documents already have a provision for a minimal curtailment levels. Rather than a chaotic system of curtailment in real time, the same could be done more elegantly through AGC (with suitable checks to ensure that RE is backed down last). For facilitating up-regulation through AGC, internationally some margin is being kept in the RE generation. It is suggested that RPCS discuss these issues and make recommendations for the future so that necessary regulatory and policy changes can be brought about.
- xii. **Encouraging Market Procurement to balance the system in advance:** The 24 x 7 market needs to be rejuvenated and the provisions in the Tariff Policy for section 62 generators to utilize the market must be used suitably for this purpose so that states can balance their systems closer to real time. RPC forums may like to deliberate how the situation can be corrected so that better system balance can be achieved ahead of the time of despatch.