To,

Secretary

CERC,

New Delhi

Sub: Comments on Draft Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) (Fifth Amendment) Regulations, 2019

Sir,

Please find enclosed herewith comments on the subject mentioned above. These comments are under personal capacity and my organization assumes no responsibility or liability for any part of the comments given by the undersigned.

Thanking you

Your's faithfully

Anil Thomas

Executive Engineer

Southern Regional Power Committee(SRPC)

Date: 17-05-2019

Place: Bangalore

A. Back Ground

1. Central Electricity Regulatory Commission brought Deviation Settlement Mechanism and related matters regulation on 6th April 2014. Clause 7(10) of the Regulations provides as follows:

   "In the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity, such regional entity (buyer or seller) shall have to make sign of their deviation from schedule changed, at least once, after every 12 time blocks. "

2. Subsequently with fourth amendment to the principle regulation issued on 20th November 2018 Clause (10) of Regulation 7 of the Principal Regulations got substituted as

   "In the event of sustained deviation from schedule in one direction (positive or negative) by any regional entity (buyer or seller), such regional entity shall have to change sign of their deviation from schedule, at least once, after every 6 time blocks.

   Provided that violation of the requirement under this clause shall attract an additional charge of 20% on the daily base DSM payable / receivable as the case may be."

3. Commission stated the major reasons to bring this particular clause as follows:

I. Ensure entities plan day ahead and invest in improving their load forecasting techniques.
II. Ensure entities maintain sufficient reserves to meet contingency.
III. Ensure entities does not leaning onto the grid to meet their demand-supply gap.
IV. Discourage entities from habitual deviation.
V. As per report of expert group it is expected that in the measures for bringing Power System Operation closer to National Reference Frequency Adequate the sign change requirement of six time blocks needs to be implemented.
VI. Large grids like the US and Continental Europe, the sustained deviation from the schedule is allowed for maximum 15 minutes (Continental Europe) and 30 minutes (in the US).

B. Sign Change requirement Genesis and requirement

1. Explanatory Memorandum to draft CERC(Deviation Settlement Mechanism and related matters regulation) issues on 20.6.2013 provided reasons for introduction of sign change once in at least 12 blocks as follows:

   "27. In USA the area control error of each control area is mandated to be brought to zero in every 10 minutes. In Indian context it would suffice if it is provided that sign of deviation from schedule is

changed in every 6 time blocks. This would call for corrective action in every 6 time blocks and this would help in dissuading each control area from consistent deviation from schedule in one direction over long periods of time.

28. Accordingly, it is proposed to provide that each of the regional entity such as generating station, beneficiary, buyer or the seller shall have to make sign of their deviation from schedule changed, at least once, in every 6 time blocks. To illustrate, if a regional entity has positive deviation from schedule from 07.30 hrs to 0.845 hrs, then it must have negative deviation from schedule in the time block 08.45 hrs to 09.00 hrs."

The comments received on above proposal and the reasons for final decision are not available since Statement of reasons for DSM Regulations 2014 is not available.

2. Report of Expert Group to review and suggest measures for bringing power system operation closer to National Reference Frequency & Review of the Principles of Deviation Settlement Mechanism (DSM has suggested to reduce the requirement of 12 blocks to 6 blocks. The major reason stated for this requirement of sign change is stated in the referred Report as to

(1) establish "True Inadvertency in Deviations" and (2) to measure performance metrics for assessing a control area's performance. (3) Apart from this requirement of proposed based on international experience where sustained deviation from the schedule is allowed for maximum 15 minutes (Continental Europe) and 30 minutes (in the US) (4) To bring Power System Operation closer to National Reference Frequency.

3. The reasons stated in the Report are discussed in succeeding paragraphs:

(1) Establish "True Inadvertency in Deviations".

The report of Expert Group has stated as follows:

> " Imbalance is inevitable in real time operations and the imbalance price plays an important role in ensuring system balance and secure and reliable grid operation. Hitherto, the imbalance price was often interpreted as a penalty mechanism, but with improved adequacy being achieved and better system parameters, the Expert Group feels that the imbalance should be dynamic and capture the market realities. Presently, the day-ahead market prices are the prices discovered closest to the time of delivery. In order to improve the imbalance price discovery the market needs to function in multiple iterations. Hence, it is suggested that 4-hour ahead or 6-hour ahead markets need to be introduced so as to get a better price discovery closer to the time of delivery."

Comments:

a) Segregating True Inadvertent is possible when the power is available and can be procured at cheaper cost than the cost of imbalance energy. This would require a real time market which can give power at cheaper cost, than the cost of imbalance energy. Linking the imbalance price with average ACP is as step forward, but as the ACP is block wise, in some blocks the price of imbalance energy would be less than Average ACP cost hence may create a desire for intentional deviation.

b) Wrong usage of imbalance settlement needs to be curbed by ensuring the pricing of imbalance settlement is effective such that only "Actual Inadvertent Flows". Sign change is actually the ability of control area to change "Inadvertent". The entities who can control inadvertent can only participate in complying with sign change.

(2) Measure performance metrics for assessing a control area's performance.

Comments:

a) The average volume in DSM is about 60-70 MU/day (in the range of 1.5% – 2% of all India energy generated). In the month of January 2018 and January 2019 for Southern region there was a dip in demand by 0.2%. The major reason for the dip in demand was reduction in temperature by 0.5 ^{O}C. Therefore the weather forecast plays a major role in Load forecast. India being in tropical zone has higher error in forecast than for temperate zone which will directly affect load forecasting. Similarly the control area with high renewable penetration would also have high inadvertent error.

Southern Region with demand of 40,000 MW has deviation within +/-1,000 MW for 97% time in last four years (2014 - 2018). This is achieved without AGC and real time markets.

b) Error of 2% needs to be reduced by using automated technologies like AGC and providing real time markets to the control areas.

Measuring performance metrics for assessing a control area's performance based only on volume of DSM, without providing AGC, Real time market, constraints in flexing generation may not give true picture.

(3) International Experience

The author has done extensive literature survey on international practices in frequency control in the light of sign change. A brief of practices is quoted below for analysis of the issue of sign change:

a) Continental Europe

i. COMMISSION REGULATION (EU) 2017/2195 of 23 November 2017(establishing a guideline on electricity balancing) Article 53 Imbalance settlement period

1. By three years after the entry into force of this Regulation, all TSOs shall apply the imbalance settlement period of 15 minutes in all scheduling areas while ensuring that all boundaries of market time unit shall coincide with boundaries of the imbalance settlement period.

ii. As per EU) 2017/2195 an imbalance energy which is known as “deviation” in Indian system has to be settled for each imbalance period (15 Minutes). There is no provision/requirement by balancing authorities to change from positive imbalance in previous imbalance period to negative imbalance in successive imbalance period. That is balancing authority need not take any additional corrective action to control the imbalance, if it continues to be in the same direction of the previous period.

iii. Further International Grid Control Cooperation (IGCC) a implementation project chosen by ENTSO-E where Imbalance netting process agreed between TSOs of two or more LFC areas that allows avoiding the simultaneous activation of frequency restoration reserves (FRR) in opposite directions by taking into account the respective frequency restoration control errors as well as the activated FRR, and by correcting the input of the involved frequency restoration processes accordingly.

iv. Finally, alternative imbalance pricing is used in Germany when ‘the TSO notices a wrong usage of regulating power', measured by the violation of several imbalance settlement criteria. These include a frequent significant imbalance, striking shortage at times of a high power exchange price and vice versa, clear and one-sided financial optimization of imbalance cash balances, and no equalized quarterly-hour load balances for BRPs. According to the conceptual Balance Agreement from 2006, the TSO penalizes the BRP for the relevant PTUs by not giving any compensation for positive imbalances and charging the double power exchange price for negative imbalance

b) US

i. In US imbalance energy settlement takes place is multiple ways like : Energy “in-kind” payback, Bilateral payback, Unilateral payback and has Other payback methods namely Automatic Time Error Correction in which Primary Inadvertent Interchange payback are effectively conducted in a manner that does not adversely affect the reliability of the Interconnection.

ii. The imbalance settlement has different accounting methodology where balancing authorities chooses methodology based on business practices.

iii. Practice of Automatic Time Error Correction:

$$ACE_{ATEC} = (NI_A - NI'_S) - 10B_i \times (F_A - F_S) - T_{0b} + I_{ME}$$

Where

T_{0b} = Remaining Bilateral Payback for Inadvertent Interchange created prior to implementing automatic payback (MW).

The time error correction is only a business practice in which settlement is in kind.

c) Sign Change in Indian Context

i. Sign Change in Indian context is implemented which vaguely correlates to "manual Time error correction" as documented in BAL-004-0 of NERC. BARC 2 PRT recommended that Reliability Standard BAL-004-0 be retired and that manual Time Error Correction (TEC) be eliminated as a continent-wide NERC standard.

> "*The BARC 2.2 SDT determined that manual TEC would not support the reliability of the BPS. Conducting manual TEC in any form directly contradicts NERC Reliability Principle 2: "The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand." The practice of using manual TEC to place the Interconnection closer to the settings for automatic under frequency load shedding does not support or enhance reliability. Therefore, BAL-004-0 should be retired*.

ii. **History of Time Error Correction:**

a. In 1916, Henry E. Warren invented the self-starting synchronous motor and three years later the motor was used for the production of the Telechron Clock. The Telechron Clock was a synchronous electric clock, which used alternating current electricity to measure time. Its accuracy depended on the frequency of the power grid. To incentivize electric system operators to regulate frequency in a way that kept the clocks running accurately, the Warren Clock Company, which was manufacturing the Telechron Clock at the time, gave electric clocks to electric system operators. The idea worked and system operators began regulating the frequency as desired by the Warren Clock Company. During the 1920s, other companies developed synchronous motor clocks and used the same marketing strategy, giving electric clocks to system operators. As the penetration of the synchronous electric clock increased, the incremental electric revenue to utilities from the additional electric clock motors justified the relatively small cost to utilities to regulate system time by modifying system frequency. This additional

revenue helped ensure that manual TEC would be an ongoing service provided by the electric utility industry.

b. As the electric system became more interconnected, the service of providing manual TEC was incorporated into the industry's general operating practice. The current form of manual TEC is a legacy commercial practice that originated in the 1920s as a commercial service and was not related to the reliability of the electric grid.

iii. Participation in a Time Error Correction:

a. Each Balancing Authority, when requested, shall participate in a Time Error Correction by one of the following methods (1) The Balancing Authority shall offset its frequency schedule by 0.02 Hertz, leaving the Frequency Bias Setting normal; or (2) The Balancing Authority shall offset its Net Interchange Schedule (MW) by an amount equal to the computed bias contribution during a 0.02 Hertz Frequency Deviation (i.e. 20% of the Frequency Bias Setting).

b. Any Reliability Coordinator in an Interconnection shall have the authority to request the Interconnection Time Monitor to terminate a Time Error Correction in progress, or a scheduled Time Error Correction that has not begun, for reliability considerations. Balancing Authorities that have reliability concerns with the execution of a Time Error Correction shall notify their Reliability Coordinator and request the termination of a Time Error Correction in progress.

c. The frequency of an Interconnection is a contributor to the reliability of that Interconnection is. In North America, the system is designed to operate within a specified range, with 60 Hz as the center point of that range. Under and over frequency limits have been established to protect the equipment of both the providers and the users on the Interconnection from failure. As described above, Reliability Standards BAL-003-1 and BAL-001-2 support this by helping to ensure that frequency approximates 60 Hz in addition to modifications made to other standards, such as Interchange and Emergency Operations standards, increasing focus on data accuracy and frequency. As manual TEC is not required for reliability, a Reliability Standard focused on manual TEC is only necessary for ensuring that any manual TEC is implemented consistently across an Interconnection. The BARC 2.2 SDT maintains that elimination of manual TEC will allow each Interconnection to be operated closer to the design frequency of 60 Hz more often, by avoiding the over-corrections that arise in manual TEC accomplished under BAL-004-0 and NAESB WEQ-006.

d. BAL-001-2 Requirement R2, "Each Balancing Authority shall operate such that its clock-minute average of Reporting ACE does not exceed its clock-minute

Balancing Authority ACE Limit (BAAL) for more than 30 consecutive clock-minutes", is the short term real-time feedback to the system operator of frequency control of the interconnection. Requirement R2 combines frequency versus ACE information to give the operator the immediate feedback to make corrections to move frequency back to within Frequency Trigger Limits.

e. When actual frequency is equal to Scheduled Frequency, $BAAL_{High}$ and $BAAL_{Low}$ do not apply. When actual frequency is less than Scheduled Frequency, $BAAL_{High}$ does not apply, and When actual frequency is greater than Scheduled Frequency, $BAAL_{Low}$ does not apply.

iv. Conclusive Comments

a. In US there is a requirement ACE does not exceed its clock-minute Balancing Authority ACE Limit (BAAL) for more than 30 consecutive clock-minutes. Balancing Authority ACE Limit do not apply irrespective of frequency, which was in place in the case of manual TEC which got retired.

b. Similarly in Continental Europe imbalance settlement period is proposed for 15 minutes and there is no limits set for Balancing Authority ACE Limit (BAAL) for more than 15 consecutive clock-minutes.

c. Un coordinated TEC is not reliable and contradictory to reliable standards. Implementation of sign change of deviation which is not automated time error correction and not as implemented in NERC document would be contradictory to reliable standards as observed in Manual Time error correction.

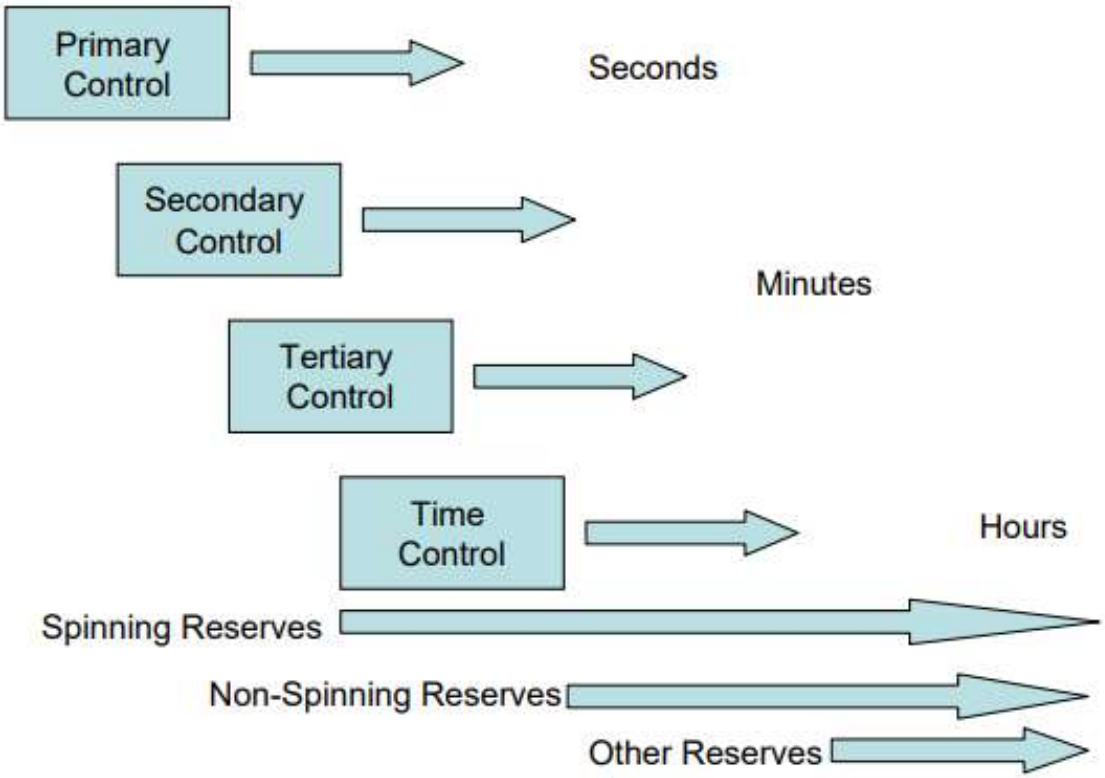
Hence sign change as observed in NERC "The BARC 2.2 SDT determined that manual TEC would not support the reliability of the BPS. Conducting manual TEC in any form directly contradicts NERC Reliability Principle" .

(4) Sign Change for bringing operating frequency close to reference Frequency

a. Proposed sign change actually accumulates the sign of imbalance in previous one and a half hour irrespective of the operating frequency in this one and half hour. The sign of the imbalance has to be changed in next 15 minutes if sustain imbalance persist for more than one and half hour. An uncoordinated manual action to be taken by system operator based on accumulated imbalance and not on system parameters the task of maintaining system security would then be rendered difficult, if not impossible. Hence sign change may render difficulty rather than support to achieve operating frequency close to reference frequency.

Control Continuum

Balancing and frequency control occur over a continuum of time using different resources, represented in
Figure 5.



b. A manual time control proposed is a business practice and without having secondary, tertiary control can have no impact on frequency control.

c. NERC explains that the fact that an Interconnection Time Monitor chooses to act and initiate a Time Error Correction based on the NAESB procedure has no reliability relevance and that NERC Reliability Standards should not compel an entity to comply with NAESB business practices, and that eliminating Requirement R2 accomplishes this.

d. Conclusions

An uncoordinated manual action to be taken by system operator based on accumulated imbalance and not considering system parameters (frequency, ACE) the task of maintaining system security would then be rendered difficult, if not impossible. Such

scenario can lead to confusion in system operation. Situation would exist where any action by system operator would lead to penalty.

NERC Joint Inadvertent Interchange Task Force (JIITF)

"*Zero UI is a coincidence rather than expectation*"

4. Summary of Comments

Sign Change is stated to have been brought to segregate "true inadvertent" from "intentional", performance monitoring of control area, based on international experience and better operation of grid. It can be inferred that though there is no method to segregate "true inadvertent" from "intentional" and the entity who can change sign have better control on inadvertent than the others. With lack of AGC, real time market and huge penetration of RE , in-ability to sign change cannot be the matrix for performance monitoring of control area. Many large counties have time error correction but automatic and as a business practice rather than a reliability factor. Countries having manual time error correction have retired the provision as it was contradictory to reliability provisions and may hamper better grid operations. Sign change without considering frequency may lead to such effects on the grid which are counterproductive.