

**MINUTES OF 21ST MEETING OF THE CENTRAL ADVISORY
COMMITTEE (CAC) HELD ON 6.7.2018**

**VENUE: “CERC's CONFERENCE HALL”, UPPER GROUND FLOOR
(FRONT SIDE), CHANDERLOK BUILDING, 36, JANPATH, NEW
DELHI**

The meeting was chaired by Shri P.K. Pujari, Chairperson, Central Electricity Regulatory Commission (CERC). A list of participants is enclosed at Annexure-I. Shri Pujari welcomed the members of the Central Advisory Committee (CAC). In his opening remarks, he expressed his appreciation for the advice and valuable suggestions given by the Central Advisory Committee on several important issues facing the sector and the Central Commission in particular. The Commission benefitted immensely from the advice of the CAC in the past.

Power sector is transiting through a crucial phase and facing several challenges. In this context, he mentioned that three important issues have been brought before the Committee for discussion, (a) the staff Consultation Paper on terms and conditions for determination of Tariff Regulations for 2019-24; (b) the report of the Expert Group to review and suggest measures for bringing power system operation closer to national reference frequency; and (c) review of principles of deviation settlement mechanism including linkage with frequency in the light of emerging markets. He requested the Committee to deliberate upon the issues raised in these papers and to share their considered views.

Agenda Item 1:

A presentation was made by Shri M.K. Anand, Chief (Finance), CERC on Consultation Paper on Terms and Conditions of Tariff Regulations for Tariff Period 01.04.2019 to 31.03.2014. A copy of the presentation is enclosed at Annexure-II. The presentation highlighted approach for tariff design for thermal / hydro / RE generation, transmission, deviation from norms, optimum utilization of capacity and the key issues of tariff regulations viz. Capital cost, R&M, Depreciation, Debt-Equity Ratio, Rate of Return on Equity, cost of debt, Interest on Working Capital, O&M expense, issues related to fuel, operational norms, RE generation by existing thermal stations, energy storage, alternative approach to tariff design, transparency in billing and accounting of fuel, merit order operation etc.

The presentation summed up the following issues for discussion: -

- a. Future plans for Thermal Generating stations which have completed useful life of 25 years ;
- b. Possibility for broadening the scope for deviation from norms and tariff ;
- c. Multi-part tariff structure – to facilitate merit order operation of RE generation ;
- d. Inter-state Transmission Tariff ;
- e. Two part tariff structure for inter-State transmission ;
- f. Scope for Energy Storage System by the generation entities and transmission entities ;
- g. Bidding of unutilized generation capacity ;
- h. Possibilities for extension of life of hydro generating plants ;
- i. Utilization of gas-based generation for the purpose of balancing at regional level ;
- j. Review of present level of depreciation ;

- k. Review of norms for interest on working capital, O&M expenses, Operating norms etc. ;
- l. Scope for introduction of differential incentive structure for peak / off-peak generation ;
- m. Alternative approach for tariff design which inter alia include, Normative Tariff by Benchmarking of Capital Cost, Normative Tariff by fixing AFC as a percentage of Capital Cost, Normative Tariff by fixing each component of AFC as a percentage of total AFC, Principles of Cost Recovery - Approach towards Multi-Part Tariff etc.

Discussion:

The Committee appreciated the Consultation Paper prepared by the Staff of the Commission. Following observations were made by the members.

Generation:

1. As regards the concept of multipart tariff, the tariff design should be simple and should avoid complexities. The peak and off-peak pricing mechanism may be explored.
2. Share of hydro generation capacity is decreasing and this sector needs more focus. Hydro generation has a bigger challenge in terms of cost. The concept of backloading of tariff or levelized tariff could be explored to address the concerns around initial high cost.
3. The initiatives proposed in the Consultation Paper, viz. blending of coal / revised operational norms etc. appear to positively impact the sector.
4. The debt-equity norm of 80:20 may be considered for balance sheet funded projects whereas the ratio of 70:30 be continued for greenfield projects.
5. As Railways hold the key responsibility of fuel transportation, there is a need for sharing the commercial risk between the transporter and the power utilities.

6. The Commission should also discuss about the stressed generating assets along with possible options for effective utilization of these assets.
7. Cost of power and its affordability need be seen from the point of view of all stakeholders. As regards RoE, effective RoE turns out to be lower than 15.5%.
8. The maintenance schedule for generating stations should be fixed in the beginning of the year, so that discoms get a clear view of the availability of power.

Transmission:

9. Over the period cost of transmission electricity has become substantially high. Therefore, it needs to be examined how the per unit transmission tariff has increased over the last 15 years. CERC may consider commissioning a study on transmission tariff.

Distribution:

10. Bundling of RE power with thermal power is likely to increase financial burden to the distribution companies.
11. The distribution utilities are saddled with long term PPAs and they have to bear the fixed cost liability despite their declining utilization, especially on account of RE penetration.

Alternative Approach for Tariff:

12. The idea of Conversion of physical contracts into financial contracts should be examined and a dispatch mechanism should be so evolved as to induce the generators to reveal their true costs.
13. The idea of increasing the life of hydro projects to 50 years is a welcome move.

Summary of Discussion:

1. The operating norms, chiefly the Station Heat Rate (SHR) are specified by the Commission from time to time. However, a study should be

commissioned to examine the status of adherence by super critical plants to SHR norms notified by the Commission.

2. Longer tenure loan and corresponding spread of depreciation on a longer time horizon are the need of the hour.
3. The Commission may consider examining the feasibility of converting physical contracts into financial contracts.
4. Possibility of determining advance maintenance schedule for generating plants may be examined, so that discoms could appropriately plan their power procurement.
5. Hydro sector needs boost. Backloading of tariff or levelized tariff approach could be considered.
6. The Central Electricity Regulatory Commission should take up the task of publishing an independent “Power Survey” on annual basis on lines of “Economic Survey”. The survey may include, critical issues and inter departmental issues, which are very relevant to the growth of the sector.

Agenda Item 2:

The Committee took up the second agenda item, i.e. “Report of the Expert Group to review and suggest measures for bringing power system operation closer to National Reference Frequency”. A detailed presentation was made by Shri S.C. Srivastava, Chief (Engineering), CERC. A copy of the presentation is enclosed at Annexure-III. In the presentation, it was brought out that, CERC constituted an Expert Group chaired by Shri A S Bakshi, Member, CERC with representatives from CEA, POSOCO and CTU and others concerned with the mandate to suggest further steps required to bring power system operation closer to the national reference frequency of 50 Hz. The Expert Group has recommended adoption of frequency control continuum in the order of inertial (first few seconds), primary (few seconds to about 5 minutes), secondary (30 seconds to about 15 minutes), fast tertiary (5 to 30 minutes), slow

tertiary (15 to 60 minutes), generation re-scheduling (more than 60 minutes), unit-commitment re-scheduling (hours & Day-Ahead) etc. The Expert Group has also recommended that the reference frequency for the purpose of frequency control be considered as 50.0 Hz. The Expert Group further recommended monitoring inertia of the system, inertial response, primary control, secondary control through automatic generation control, slow tertiary control through Reserves Regulation Ancillary Service, fast tertiary control at the inter-State level, computation of frequency response characteristics, operationalizing roadmap for reserves, monitoring of area control error and time error etc.

The Committee noted the recommendations and appreciated the efforts made by the Expert Group. CERC should take action to implement the recommendations of the Expert Group.

Agenda Item 3:

The Committee took up the third agenda item, i.e. “Review of the Principles of Deviation Settlement Mechanism (DSM), including linkage with frequency, in the light of emerging markets”. A detailed presentation was made by Dr. Sushanta K. Chatterjee, Joint Chief (Regulatory Affairs), CERC. A copy of the presentation is enclosed at Annexure-IV. In the presentation, it was brought out that, the Expert Group constituted by CERC reviewed the existing operational band of frequency with due regard to the need for safe, secure and reliable operation of the grid and reviewed the principles of deviation settlement mechanism (DSM) rates, including their linkage with frequency in the light of the emerging market realities. The Commission considered the recommendations and noted that deviation price is the lowest of bilateral, power exchange (DAM), DSM Prices and the cost of Ancillary Services, which leaves room for arbitrage for participants to lean on grid and endanger grid security. The Commission felt that deviation prices are the real real-time prices and

should be designed in a manner, so as to drive the utilities to plan & procure power in advance. Accordingly, the Commission has proposed the following amendments to the existing DSM Regulations.

- Revision of DSM Price Vector by linking it (the price at 50 Hz) to the daily average Area Clearing Price
- Revision of reference frequency band (viz. 49.85 Hz to 50.05 Hz) for DSM Price Vector
- DSM price vector to have a dynamic slope determined by joining the identified price points at 50 Hz. (daily average ACP), low frequency of 49.85 Hz (Rs. 8 per unit) and 50.05 Hz (zero) on a daily basis.
- The maximum ceiling limit for average Daily ACP discovered in the DAM segment of Power Exchange at 50.00 Hz to be Rs. 8/- per unit.
- The DAM price (of PX market share of 80% or more) on a daily basis to be linked to the DSM price vector.
- Linking the cap rates for generators using coal / lignite / APM gas to the energy charges as billed for previous month.
- Reduction in number of time blocks (from 12 to 6 time blocks) for change of sign in case of sustained deviation in one direction.
- Levy of an additional sur-charge of 20% on the daily base DSM payable / receivable in case of violation of the stipulation regarding change in sign.
- Total deviation from schedule during a day not to be in excess of 3% of the total schedule for the drawee entities & 1% for the generators. Violators to be levied 20% of the daily base DSM payable / receivable

The Advisory Committee deliberated upon the recommendations of the Expert Group which *inter alia* include linking DSM Price Vector to the daily average Area Clearing Price, change in reference frequency band for the

purpose of DSM Price Vector, linking of cap rates for generators using coal / lignite / APM gas to the energy charges for the generator as billed for previous month, reduction in number of time blocks for change of sign in case of sustained deviation in one direction, levy of additional surcharge of 20% on the daily base DSM payable / receivable in case of violation of stipulation regarding sign change etc. The Committee observed that the above regulatory interventions are in the best interest of the electricity markets and appreciated the efforts made by the Commission in this regard.

The Committee felt that the sector being dynamic in nature, frequent meetings at regular intervals would be beneficial to the Commission as critical issues from time to time could be discussed.

Secretary, CERC thanked for the suggestions given by the Members of the Central Advisory Committee and Members of CERC. He thanked the Officers of the Commission for their arduous efforts in organizing the Meeting

The meeting ended with vote of thanks to the Chair.

**LIST OF PARTICIPANTS ATTENDED THE 21ST MEETING OF
CENTRAL ADVISORY COMMITTEE (CAC)**

**HELD AT CERC, NEW DELHI
ON 06TH JULY, 2018**

S. No.	NAME	Organization
01.	Shri P.K. Pujari Ex-Officio, Chairperson, CAC	Chairperson, CERC
02.	Shri A.K. Singhal Ex-Officio Member, CAC	Member, CERC
03.	Shri A.S. Bakshi Ex-Officio Member, CAC	Member, CERC
04.	Dr. M.K. Iyer Ex-Officio Member, CAC	Member, CERC
05.	Shri Pankaj Batra	Chairman (I/C.), CEA
06.	Ms. Shefali Shah Additional Secretary	Department of Consumer Affairs
07.	(i) Shri Shalabh Goel, ED (EEM) (ii) Shri Sudhir Kumar Saxena, CEO/RE (iii) Shri Punit Agrawal, Director (PS)	Railway Board
08.	Shri R.V. Shahi	Former Secretary, MOP
09.	Shri Tulsi Tanti Chairman	SUZLON
10.	Prof. Ajay Pandey	Dean (Programmer) IIM, Ahmedabad
11.	(i) Shri Gurdeep Singh, Chairman & Managing Director (ii) Shri A.K. Gupta, Director (Commercial)	NTPC Ltd.
12.	(i) Shri M.K. Mittal, Director (Fin.) (ii) Shri N.S. Parameshwaran Executive Director (O&M)	NHPC Ltd.

13.	(i) Shri I.S. Jha, Chairman & Managing Director (ii) Ms. Seema Gupta, Director (Operns.) (iii) Shri A. Chowdhury, Executive Director (Commercial) (iv) Ms. Manju Gupta, AGM (Commercial)	PGCIL
14.	Shri Rajeev Sharma Chairman & Managing Director	PFC Limited
15.	Dr. Ajay Mathur Director General	The Energy & Resources Institute (TERI)
16.	Shri Shantanu Dixit Group Coordinator	Prayas (Energy Group)
17.	Shri Satish Chavan Director (Commercial)	MSEDCL
18.	Shri Ajit Kumar Director (Coml. & Oprns.)	PTC India Limited
19.	Shri Ashok Sethi Executive Director & Chief Operating Officer	TATA Power Co. Ltd.
20.	(i) Shri Lakhwinder Singh, CE/GHTP (ii) Shri Rajan Gupta Jt. CE (iii) Er. Sachin Verma	PSPCL
21.	(i) Shri Binoy Mohan Saikia, GM (TRC) (ii) Shri Atul Boro AGM (TRC)	ASEB & Assam Power Distribution Corporation Limited
22.	(i) Shri Sanjiv K. Goel (ii) Shri Sanket Srivastava (iii) Shri Puneet Munjal (iv) Shri P. Devanand	Representative of Confederation of Indian Industry (CII)
23.	Shri Vishal Dev Additional Director (Power)	Representative of Federation of Indian Chambers of Commerce & Industry (FICCI)
24.	(i) Shri Ashok Kumar Samantaray, Sr. GM (PP) (ii) Shri Umakanta (iii) Shri Harapriya Behera (iv) Ms. Rutuparna Mansingh	Representative of GRIDCO Ltd.
25.	Shri Simran Grover Fellow, CUTS	Representative of CUTS, Jaipur (Rajasthan)

26.	(i) Shri Anurag Gupta, AGM (SO) (ii) Ms. Ranjana Gupta AGM (BD)	Representative of NVVNL
27.	Shri Sanoj Kumar Jha Secretary	CERC
28.	Shri M.K. Anand Chief (Fin.)	CERC
29.	Shri T. Rout Chief (Legal)	CERC
30.	Shri S.C. Shrivastava Chief (Engg.)	CERC
31.	Dr. Sushanta K. Chatterjee Joint Chief (RA)	CERC

Meeting of Central Advisory Committee (CAC)

Tariff Regulations commencing from 1.4.2019

Presentation by Chief(fin)
Central Electricity Regulatory Commission
New Delhi, 110001

6th July,2018




In this presentation


- Introduction
- Availability & Cost of Supply
- Value chain of Electricity
- Some Key Challenges
- Revised Tariff Policy,2016
- Review of Tariff Design
- Financial Norms
- Operational Parameters
- Fuel Related issues
- Additional issues



Background

- Central Commission determines the tariff for
 - a) Generating companies owned or controlled by Central Government
 - b) Other Generating companies having composite scheme for generation and sale in more than one state
 - c) Inter-State Transmission of electricity
 - State Commission is guided by the Terms and Conditions laid down by Central Commission as per Electricity Act, 2003
 - Central Commission issued a Terms and Conditions of Tariff Regulations for the period 2001-04, 2004-09 ,2009-14 and 2014-19
 - Commission determined the tariff for about 76 GW capacity of generating station and associated inter-state transmission system
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Broad consideration for Approach for Tariff fixation

- Safeguarding Consumer interest as well as ensuring recovery of cost of electricity in reasonable manner
 - Attracting investment in the sector
 - Inducing efficiency through incentive and disincentive mechanism
 - Commission specified financial and operational norms for generating station and transmission system
 - Encourage competition, efficiency, economical use of the resources, good performance and optimum investments
- 


Availability and Cost of Supply

- All India deficit: Reduced to 0.66 - 0.70% in 2016-17 from about 10 - 11% about 10 years ago.
- Average Cost of Supply (ACoS): Increased to 691paise/unit in 2015-16 from 476 paise/unit in 2009-10.
- Contribution of Power Purchase Cost in ACoS: 63-71%
- AT&C losses : Reduced to 21.81% in 2015-16


Comparison of cost in value chain of electricity

Year	(Figures are in Rs per KWh)		
	2009-10	2016-17	%Change
Basic Price (ROM)	0.42	0.56	33.33%
Taxes and Duties	0.13	0.40	207.69%
Coal Transportation	0.33	0.51	54.54%
Taxes & Duties on Transportation	0.03	0.12	
	0.91	1.59	74.72%
Generation Plant(Fixed Cost)	2.01	1.66	-21.08%
Transmission Cost(Inter)	0.23	0.39	69.56%
Transmission Cost(Intra)	0.12	0.14	16.67%
Transmission losses	0.29	0.33	
	2.65	2.52	-5.16%
Distribution Cost	0.48	1.39	189.58%
Distribution Losses (AT&C)	1.03	1.17	
	1.51	2.56	69.54%
Cost of Supply	5.07	6.67	31.56%

Issues in Cost & efficiency of value chain

- Average Cost of Supply increased
 - Coal Mine Cost:
 - Increase in coal price
 - Increase in Taxes & duties due to introduction of taxes;
 - Loss of quality due to Grade Slippage and transit loss;
 - Increase in Railway transportation Cost
 - Above 78% increase since 2009.
 - High level of Capital Cost in Projects
 - Transmission Cost increased
 - Distribution cost increases while AT&C losses reduced
 - Improvement in losses – offsetting increase in purchase cost
- 


Some Key Challenges

- Growth of demand
 - Coal based thermal generation:
 - Low Plant Load Factor;
 - Transparent Coal quality assessment;
 - Pollution Control System;
 - Optimization of the power generation
 - Impact of renewable generation
 - Gas based thermal generation:
 - Short supply of gas;
 - Utilization for peaking power;
 - Hydro generation:
 - Reduction in share;
 - High Capital cost;
 - Encourage PSPS for emerging need
 - Flexible operation of hydro power
- 


Tariff Design : All Generating Stations

- ▶ **Fixed Component:** Debt Service Obligations, Interest on Loan & Risk free return; Recovery of fixed component may be linked to target availability

 - ▶ **Variable (Semi fixed) Component:** Incremental return, O&M Expenses, Interest on Working Capital; Recovery of variable component may be linked to the difference between availability and dispatch


 - ▶ **Fuel Charges component** – Recovery of fuel charges in proportion to dispatch
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Tariff mechanism for Pollution Control System


- Supplementary tariff in addition to original tariff stream based on the separately defined principles & norms.
 - Recovery of Depreciation based on balance life of Plant
 - Additional O&M expenses and Operational Norms
 - Other income from by-products – Sale of Gypsum
 - Flexibility in equity investment less than 30% may also consider the additional capitalization fully as loan
- 

Bundling of Renewable & Conventional Plants


- ▶ **Option I-Renewable plant at the same location**
 - Pool the Capital Cost of Renewable & Conventional Plant
 - Contracted capacity shall remain unchanged while the availability shall increase (combined)
 - Specific norms for determination of fixed cost

 - ▶ **Option II: Renewable plant at a different locations**
 - Pool the energy generated on ex-post facto basis or at the time of scheduling
 - Availability of plants to be considered separately
 - Separate transmission access to be taken for the Renewable Plant
- 


Tariff framework

- ▶ **Thermal Generating stations –more than 25 years**
 - ▶ **Deviation from norms and tariff – scope to be broaden**
 - ▶ **Renewable energy generation**
 - Two part tariff structure – to facilitate merit order operation
 - ▶ **Inter-state Transmission Tariff**
 - Two part tariff structure
 - ▶ **Energy Storage System**
 - Option I: Energy storage by Generation Entities
 - Option II: Energy storage by Transmission entities
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Regulatory framework - Optimum utilization of Capacity

- Coal based Thermal Generation
 - Annual contracted capacity (ACC) –guaranteed contracted capacity
 - Unutilized capacity –to be dispatched through bid out tariff
 - Hydro Generation
 - Extension of useful life
 - Framework for Regional level dispatch
 - Gas based generating station
 - Framework for Regional level dispatch for balancing purpose
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Capital Cost

- Normative or Benchmark of Capital Cost
 - Significance of disclosure of estimated cost at the time PPA (investment approval)
 - Additional capitalization (PCS, PAT)
 - Controlling of cost escalation
 - Incentive and disincentive mechanism for
 - Completion time,
 - Cost variation,
 - Technology (efficiency);
 - Interest rate
 - Increasing trend of Capital cost
 - Project basis v/s actual cost
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Renovation and Modernization

- Inclusion of Residual Life Assessment
- Life extension in case of R&M
- Continuation of special allowance
- Treatment of additions in case of R&M
- Efficacy of special allowance and compensation allowance



GFA approach and Return on Investment

GFA Approach

- Continue with GFA approach
- Modified GFA approach (partially net fixed asset)

Return on Investment

- ROE Approach – well settled
- Tax treatment in ROE
- Differential rate of return
 - Generation, Transmission
 - Size of project
- Review of rate of return
- Additional return for storage based project
- Disincentive in return in case of delay or cost escalation



Depreciation

- Extension of useful life (50 years for hydro and transmission) and 35years for coal
- Review of present level of 12 years period for Spread over of depreciation
- Framework for charging lower depreciation
- Status or checking conditions of plant while extension of useful life
- Exit option for PPA while extending useful life




Interest on Working Capital

- Review of quantum of fuel stock for working capital.
- Review of maintenance spares in IWC (specifically overlapping with O&M expenses)
- Review of norms of maintenance spares in IWC (specifically for hydro as its capital cost includes higher number of employee cost)
- Stock of Fuel for working capital




Operation and Maintenance expenses

- Variations in WPI & CPI index
 - Fixed escalation rate for the entire tariff period.
 - O&M expense of hydro stations (% of CC)
 - Review of normative O&M of generating plants in view of lower dispatch.
 - O&M expenses may be worked on the basis of MVA capacity for transmission.
 - Review of overlapping of the O&M expenses and the compensation allowance.
 - Treatment of other income in O&M costs
 - Treatment of O&M cost of CTU
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Operational Norms

- Review of operational norms
- Separate operational norms for vintage based plants or life of plant
- Sharing mechanism for gains due to operational parameters
- Review of Normative PAF for thermal generating station (in view of fuel shortage)

Incentive

- Linking incentive to fixed charges and availability
 - Differential incentive for off peak and peak period
- 

Fuel (Coal) Related issues Alternate Tariff Design

- **Gross Calorific Value** – assessment method and location for domestic coal, imported coal and blending coal
- **Blending of Imported Coal** - limit
- **Determination of Landed Cost of fuel**
- **Standardization of components of fuel**
- **Determination of coal price for procurement from alternate source**
- **Determination of coal for the integrated project with mine**
- **Pass through mechanism of coal cost**



Alternative Approach to Tariff Design

- **Normative Tariff by Benchmarking of Capital Cost**
- **Normative Tariff by fixing AFC as a percentage of Capital Cost**
- **Normative Tariff by fixing each component of AFC as a percentage of total AFC**
- **Principles of Cost Recovery - Approach towards Multi-Part Tariff**



Suggestions/Views of CAC members are
solicited by 15.7.2018

Thank you





Measures required for bringing Power System Operation closer to National Reference Frequency

For
Central Advisory Committee Meeting
on 6.7.2018

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In this Presentation

- ▶ Background
- ▶ Terms of Reference (TOR) of the Committee
- ▶ Recommendations of the Expert Group

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Background

- ▶ The Commission in its meeting held on 23rd March, 2017 had resolved to declare national reference frequency as 50 Hz.
- ▶ Further, The Commission had also decided to constitute a high level Expert Group with the mandate to suggest further steps required to bring power system operation closer to the national reference frequency.
- ▶ The Commission vide order dated 27th April 2017 constituted an Expert Group under the chairmanship of Shri A S Bakshi, Member, CERC with representatives from CEA, POSOCO and CTU.

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Terms of Reference (TOR) of the Expert Group

- ▶ To suggest measures required to bring power system operations closer to national reference frequency of 50 Hz
 - Review the experience of grid operation in India.
 - Review international experience and practices on grid operation including standards/requirement of reference frequency.
 - Review the existing operational band of frequency with due regard to the need for safe, secure and reliable operation of the grid.
 - Review the principles of Deviation Settlement Mechanism (DSM) rates, including their linkage with frequency, in the light of the emerging market realities.

Expert Group submitted its Report in November 2017.

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Recommendations of the Expert Group

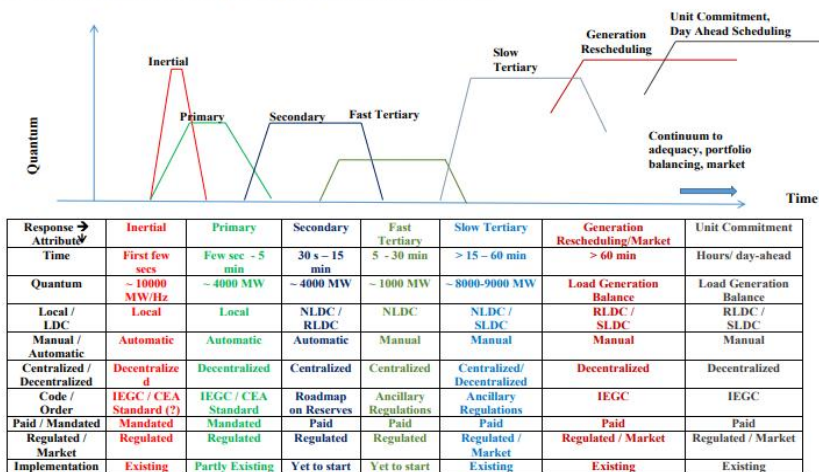
1. Frequency Control as a continuum in terms of time horizon

The frequency control continuum chart be adopted and included as part of the Indian Electricity Grid Code (IEGC) through an amendment for addendum.



5

Schematic of Reserves, Balancing and Frequency Control Continuum in India



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Recommendations of the Expert Group

2. Reference frequency for the purpose of control

The reference frequency for the purpose of frequency control is considered as 50.0 Hz, and the same is notified in the IEGC.



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Recommendations of the Expert Group (Contd...)

3. Monitoring inertia of the system and inertial response

- ▶ As a first step, inertia of the system be monitored at the regional and All India level in real time so that a baseline is established and monitored for low net load periods.
- ▶ Simulation studies may also be carried out to assess the inertia and any adverse impact on stability due to low inertia.
- ▶ There is a need for suitable provisions for stipulating minimum inertia in Standards and Code in near future besides provision of synthetic inertia from RE resources.

4. Primary control

- ▶ RGMO may be phased by 1st April 2018 and replaced with 'speed control with droop'.
- ▶ Further, the dead band of ± 0.03 Hz (ripple factor in IEGC) may be gradually phased out as is being done in ERCOT Texas and Europe.
 - This could be a voluntary approach initially.
- ▶ The Expert Group also recommends that the Central Electricity Authority (CEA) may notify the Technical Standards for connectivity to the grid in respect of RE generation at the earliest mandating primary control from RE resources also.
- ▶ Primary control testing would also be done periodically in line with provisions of IEGC for which the performance metrics would be defined in the test procedures by CERC.



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Recommendations of the Expert Group (Contd...)

5. **Additional parameters to be notified in IEGC**
 - a. Frequency band permissible: 49.90-50.05 Hz currently, which would be further tightened to 49.95-50.05 Hz by 2020 when secondary and tertiary reserves would be operationalized in substantial quantum both at the inter-state and intra-state level.
 - b. Reference contingency for primary response: 4000 MW UMPP outage
 - c. Minimum frequency (nadir value) following the above reference contingency: 49.50 Hz
 - d. Quasi steady state frequency value after primary response following the above contingency: 49.80 Hz

6. **Frequency Response Characteristics (FRC)**
 - a. RLDCs/NLDC would continue to compute FRC as being done presently. However, the same would also be worked out additionally for All India and region at the 'nadir' frequency so that the impact of inertia can be tracked.
 - b. While no target FRC is required to be prescribed now, the control area wise FRC and percentage of ideal response would be tracked for each event. A minimum response expected is at least 40% of ideal response (based on international experience). Any violation would be reported to the CERC for levy of penalty.

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Recommendations of the Expert Group (Contd...)

7. Roadmap for operationalizing reserves

- ▶ The roadmap for operationalizing reserves notified by the CERC vide order dated 13th October 2015 be implemented at the earliest so that secondary and tertiary reserves as stated in the order are available for frequency control.

8. Secondary Control through Automatic Generation Control (AGC)

- ▶ AGC must be implemented throughout the country at the earliest in line with the Commission's recommendation of treating a region as a balancing area. Performance Metrics for such AGC payments may be introduced once sufficient experience is gained through the pilot project. AGC at the intra state level, particularly for large states, can be implemented in line with directions by the Appropriate Commission(s).

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Commissions order dated 13.10.2015 in Petition No 11/SM/20015– Roadmap to operationalise Reserves in the country

- ▶ For reliable and secure grid operation, to maintain continuous load-generation balance, to counter generation outages as well as unexpected load surges or crashes, and for large scale integration of variable renewable power, it is essential for the grid operators to have access to distributed Spinning Reserves which are dispatched taking due care of transmission constraints whenever required.
- ▶ The Commission reiterates the need for mandating Primary Reserves as well as Automatic Generation Control (AGC) for enabling Secondary Reserves.
- ▶ All generating stations that are regional entities must plan to operationalise AGC along with reliable telemetry and communication by 1st April, 2017. On the other hand, National/Regional/State Load Dispatch Centres (NLDC/RLDCs/SLDCs) would need technical upgrades as well as operational procedures to be able to send automated signals to these generators. NLDC /RLDCs and SLDCs should plan to be ready with requisite software and procedures by the same date.
- ▶ The Central Commission advises the State Commissions to issue orders for intra-state generators in line with this timeline as AGC is essential for reliable operation of India's large inter-connected grid.

1/2/2017

CERC

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Commissions order dated 13.10.2015 in Petition No 11/SM/20015– Roadmap to operationalise Reserves in the country

- ▶ To start with, a regulated framework in line with the Ancillary Services Regulations would need be evolved for identification and utilising of spinning reserves and implemented with effect from 1st April, 2016. This framework may continue till 31st March, 2017. This may only include generating stations regulated by CERC, which could be started off with a manual process for secondary reserves. The NLDC/POSOCO is directed to submit a detailed procedure in this regard for approval by the Commission within one month from the issue of this Order. The amendments required in various Regulations issued by the Commission would also need to be indicated.
- ▶ As the Renewable Energy (RE) penetration levels increase in the coming years, the impact on the quantum of reserves would need to be separately studied and provided for through further amendments.
- ▶ In the long term, however, a market based framework is required for efficient provision of secondary reserves from all generators across the country. For this, NLDC/POSOCO is directed to commission a detailed study through a consultant and suggest a proposal to the Commission for implementation by 1st April, 2017, giving due consideration to the experience gained in the implementation of Spinning Reserves w.e.f. 1st April, 2016.

1/2/2017

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Recommendations of the Expert Group (Contd...)

9. **Slow tertiary control through Reserves Regulation Ancillary Service (RRAS)**
 - a. Expanding the ambit of RRAS at the inter-state level and refinements based on experience so far.
 - b. Introduction of Performance Metrics for mark-up payments for the slow tertiary Ancillary Services.
 - c. Introduction of slow tertiary Ancillary Services at the intra-state level through regulations by Appropriate Commission. This would necessitate implementing the Scheduling, Accounting, Metering and Settlement of Transactions (SAMAST) at the intra state level.

10. **Fast tertiary control at the Inter State level**

Fast tertiary services through RRAS using hydro could be introduced suitably at the interstate level to start with.

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Recommendations of the Expert Group (Contd...)

11. **Monitoring of Area Control Error (ACE)**
 - a. Each State control area, region and the neighbouring countries would work out the Area Control Error (ACE), display, monitor and archive the same. For the purpose of ACE calculation, the bias could be set as 4% of Area load per Hz which can be refined over time. The inter-state and inter-regional tie line values as well as frequency measurements should be treated as Class A telemetry values and updated at a faster rate than ten (10) seconds at SLDCs/RLDCs/NLDC.
 - b. The ACE, worked out as above, should cross zero value and change sign at least once every hour to start with which would be narrowed down to half an hour. Persistent violation of this condition would render the utility liable for penalties.
 - c. The 15-minute deviations from the schedule as worked out through Special Energy Meter (SEM) data and schedules would be closely monitored for all time blocks where average frequency is below 49.95 Hz and above 50.05 Hz. On a monthly basis, the 90th percentile value of overdrawals below 49.95 Hz and underdrawals above 50.05 Hz would be monitored. This should not exceed 150 MW. Any violation could render the utility liable for penalties.

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Recommendations of the Expert Group (Contd...)

12. Time Error

Time error is the difference between the time reported by a synchronous clock, compared to the time reported by a reference synchronous clock. This error signifies the deviation of average frequency from reference frequency. Time error on daily basis (0000-2400 hours) would also be recorded at NLDC level. Standards for cumulative time error would be notified separately by CERC, at an appropriate time based on the experience gained and considering cross border interconnections.



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Thank you



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*A Presentation on
"Fourth Amendment to CERC DSM Regulations"*

Central Advisory Committee Meeting

6.7.2018

1

In this presentation



- **Introduction**
- **Drivers for Review of DSM Price Vector**
- **Limitations in the present DSM framework**
- **Recommendations of the Expert Group**
- **Draft Amendments to DSM Regulations**

2

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- CERC constituted an Expert Group (EG) under the Chairmanship of Shri AS Bakshi, Member, CERC
- Representatives from CEA, POSOCO, CTU, CERC included in EG

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Mandate

To review the experience of grid operation in India, review international experience and practices on grid operation including standards/requirement of reference frequency, review the existing operational band of frequency with due regard to the need for safe, secure and reliable operation of the grid and review the principles of deviation settlement mechanism (DSM) rates, including their linkage with frequency in the light of the emerging market realities

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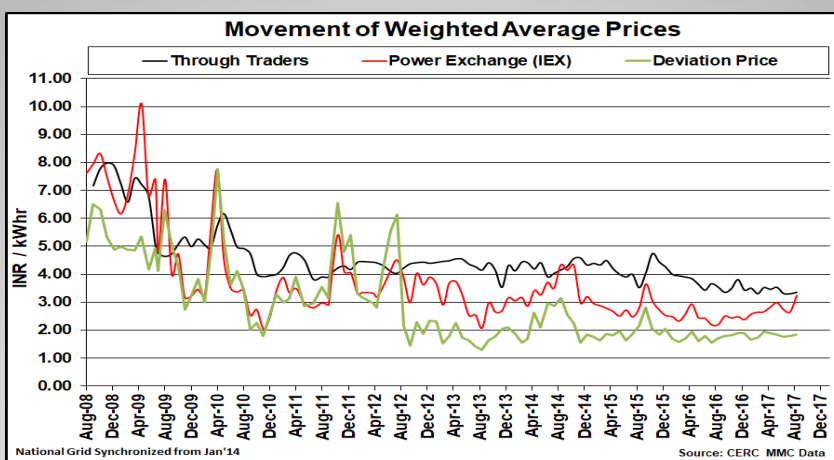
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- **Report Vol – I** : “Review and suggestive measures for bringing power system operation closer to National Reference Frequency”
- **Report Vol – II** : “Review of the Principles of Deviation Settlement Mechanism(DSM), Including Linkage with Frequency, in the Light of Emerging Markets”

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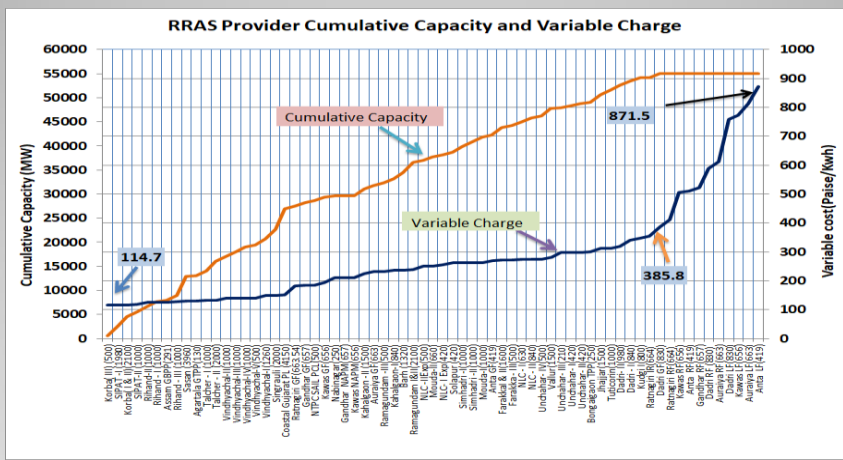
Drivers for Review of DSM Price Vector



DSM Prices are lowest of PX, Bilateral / Trader, DSM prices

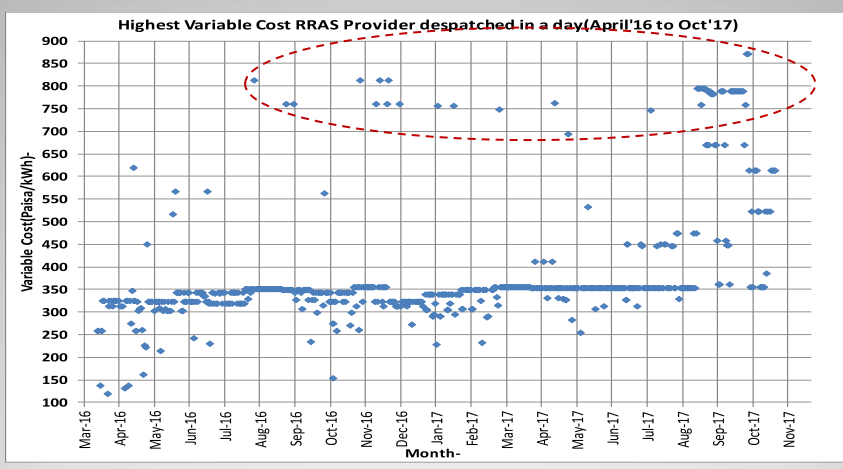
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Drivers for Review of DSM Price Vector



DSM Price lower than average Ancillary Services Price (Rs. 4.75 p.u.) & average Variable Cost (Rs. 2.82 p.u.) [ref. March-April, 2018]

Drivers for Review of DSM Price Vector



Variable Cost of RRAS providers exceeded Rs.8.00 p.u., (more than DSM Price)

Drivers for Review of DSM Price Vector



- **Deviation Price is the lowest of**
 - **Bilateral, Power Exchange (DAM), DSM Prices and the Ancillary Services.**
- **This leaves room for arbitrage for**
 - **participants to lean on grid and disrupt grid security**
- **Deviation Prices -**
 - **real real-time prices**
 - **should incentive to plan & procure power in advance.**
- **Need to review the present DSM Rates**

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Limitations in the Present System



- **Presently, DSM administratively determined**
 - **DSM rate at 50 Hz (178 paise/unit)**
 - - (V.C. of a pit-head thermal (coal fired) station)
 - **Highest DSM rate (824 paise/unit)**
 - - (V.C. of the costliest generator (liquid fired)).
 - **Time-lag in revision**
- **DSM prices**
 - **Do not capture the VoLL***
 - **Do not capture dimensions of time and space**
 - **Do not factor in transmission congestion**
 - **Do not provide adequate price signal**

VoLL is the loss in consumer surplus
as a result of lost load

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Broad Recommendations of EG



- Real Time deviation be priced to encourage participant's behavior to move towards organized markets.
- DSM mechanism to capture the VoLL / time value of electricity / factor transmission congestion.
- DSM prices be indexed to DAM price (Average Area Clearing Price)
- More iterations to facilitate balancing of the power system.
- Gate closure concept be introduced to facilitate better optimization of scheduled dispatches & real time ancillary dispatch.
- Improved forecasting and planning for procurement by the utilities.
- Reserves be created as CERC order on roadmap for reserves.

The Central Commission accepted the Recommendations & Proposed Amendments to DSM Regulations

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Proposed Amendments



- Revision of DSM Price Vector by linking it (the price at 50 Hz) to the daily average Area Clearing Price
- Revision of reference frequency band (viz. 49.85 Hz to 50.05 Hz) for DSM Price Vector
- DSM price vector to have a dynamic slope determined by joining the identified price points at 50 Hz. (daily average ACP), low frequency of 49.85 Hz (Rs. 8 per unit) and 50.05 Hz (zero) on a daily basis.
- The max. ceiling limit for average Daily ACP discovered in the DAM segment of Power Exchange at 50.00 Hz to be Rs. 8/- p.u..
- The DAM price (of PX market share of 80% or more) on a daily basis to be linked to the DSM price vector.

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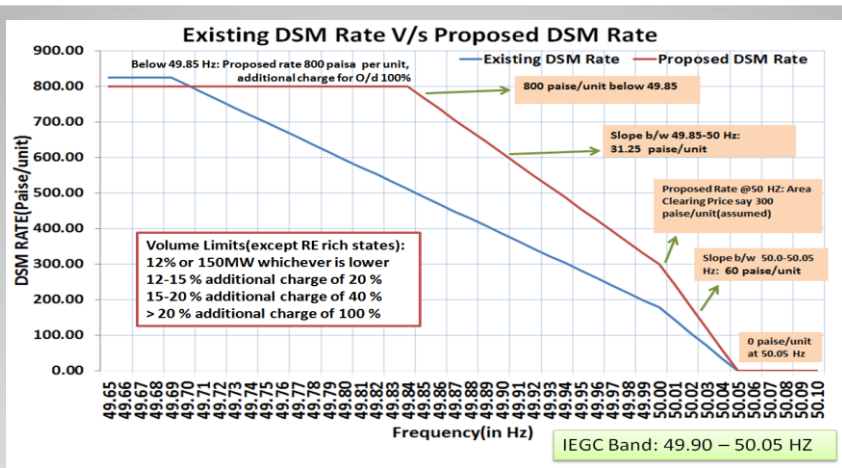
Proposed Amendments



- Linking the cap rates for generators using coal / lignite / APM gas to the energy charges as billed for previous month
- Reduction in number of time blocks (from 12 to 6 time blocks) for change of sign in case of sustained deviation in one direction
- Levy of an additional sur-charge of 20% on the daily base DSM payable / receivable in case of violation of the stipulation regarding change in sign
- Total deviation from schedule during a day not to be in excess of 3% of the total schedule for the drawee entities & 1% for the generators. Violators to be levied 20% of the daily base DSM payable / receivable

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Comparison of Existing and Proposed DSM Price Vectors



Comparison of existing and proposed DSM Price Vectors indicate movement of DSM price closer to real-time market price

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Thank you