

**CENTRAL ELECTRICITY REGULATORY COMMISSION  
NEW DELHI**

**Coram: Dr. Pramod Deo, Chairperson,  
Shri. S. Jayaraman, Member  
Shri V.S. Verma, Member  
Shri M. Deena Dayalan, Member**

**Date: 18.6.2010**

**In the matter of**

The Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010.

**Statement of Objects and Reasons**

**1. INTRODUCTION**

1.1 The Commission, in exercise of the power under section 79(1)(h) read with section 178(2)(g) and in compliance with the requirement of previous publication under section 178(3) of the Electricity Act, 2003 (the Act), published the draft Central Electricity Regulatory Commission(Indian Electricity Grid Code) Regulations, 2010 (hereinafter referred to as the “draft grid code regulations”) vide public notice No. L-1/18/2010-CERC dated 12.2.2010 to invite suggestions and comments from the stakeholders/public on the draft regulations.

1.2 In all, comments/suggestions were received from 30 stakeholders which included Generators, Beneficiaries, National Load Despatch Centre (NLDC)/PGCIL, Central Electricity Authority (CEA), Regional Power Committees (RPCs), Power Exchanges and State Load Despatch Centres (SLDCs) etc. The list of

stakeholders who submitted their comments is enclosed as Annexure-I. The Commission also heard the stakeholders in a public hearing on 15.3.2010.

1.3 The Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 have been finalized after detailed analysis and due consideration of the various issues raised by the stakeholders and notified in the Gazette of India. The notified regulations have been referred to as “grid code regulations” in this statement of reasons. The comments/suggestions received from various organizations, statutory authorities and stake-holders and the decisions of the Commission thereon have been discussed in the succeeding paragraphs.

## 2. **Glossary and Definitions**

2.1 NLDC and RLDCs have submitted that the definitions of the terms ‘Agency’, ‘Authority’, ‘CEA’, ‘CERC’, ‘BBMB’, and ‘SSP’ may be retained as per the provisions of the Indian Electricity Grid Code, 2006 (hereinafter IEGC 2006). GUVNL has submitted that the definition of ‘Agency’, ‘BBMB’, ‘Constituent’, ‘SSNNL’ etc may be retained.

2.2 It is clarified that definitions of some of the terms which were earlier appearing in IEGC 2006 have been removed because these terms are either defined in the Act or these terms have not been used frequently in draft grid code regulations. Some of the terms like Capacity factor, BPTA etc given in the definition chapter

of the draft grid code regulations have been removed in the grid code regulations as these terms have not been used.

- 2.3 Shri S.K. Bhatnagar and M/s Sub K Power have suggested for modifying the definition of “Black Start Procedure” by adding “in any system or sub system” where such partial black out or black out is under consideration. Considering the suggestion, the definition of the term in Regulation 2(1)(g) of grid code regulations has been modified by adding “in the region” at the end to define the boundary of system.
- 2.4 Shri A. Velayutham, Ex-Member, MERC has submitted that the term “Beneficiary” was used in the pre-Act era and should be replaced with the term “Transmission System User (TSU)” or “Transmission Customer (TC)”. Athena Chhattisgarh Power Pvt. Ltd. has submitted that the term ‘Beneficiary’ has been defined in the draft grid code regulations as a person who has a share in an ISGS. It has been suggested that the definition of the term ‘beneficiaries’ should also include the Procurers from an IPP.
- 2.5 It is clarified that the term ‘Beneficiary’ has been defined as a person who has a share in ISGS. The beneficiary is for the generating station, whereas, Transmission System User (TSU) or Transmission Customer (TC) would be users of the transmission system only. The ‘ISGS’ means a Central Generating Station or other generating station, in which entities of two or more States have

shares. We are of the view that if an IPP is an ISGS, the definition of beneficiary applies to it also.

2.6 WBSEDCL and WBSETCL have submitted that the definition of the 'Bulk consumer' needs to be incorporated in the grid code regulations. We agree with the suggestion and accordingly, this term has been defined in Regulation 2(1)(i) of the grid code regulations.

2.7 ENERCON has suggested to include 'Emergency' and 'Grid Security' in the definitions. In this regard, we are of the view that these words are well understood in grid operation and may include many possible events, which may be repetitive or may be entirely new. It is also not possible to cover all eventualities in the regulations.. It is best left to the judgment of system operator which should be treated as final.

2.8 CSPTCL has submitted that a relevant and often used term 'Gaming' needs to be defined and included in the glossary and definitions. The word Gaming has been elaborately dealt with in Regulation 6.4.1 of the grid code regulations and there is no requirement to define the term.

2.9 GETCO has suggested to include the definition of "Inter-connection Point for renewable generating stations of wind and solar photo-voltaic" for the sake of abundant clarity. In view of the provisions of the grid code regulations, the definition of this term is not required.

- 2.10 SLDC, Gujarat and GUVNL have suggested that in the definition of the term 'Inter State Transmission System' (ISTS) at Regulation 2(1)(44)(ii) of draft grid code regulations, word 'energy' may be replaced by 'electricity'. We agree with the suggestion and definition has been modified accordingly In Regulation 2(1)(qq)(ii) of grid code regulations.
- 2.11 WBSEDCL and WBSETCL have suggested that no new definition of 'IEGC' can be provided by the Commission, as the Act has specifically defined it in terms of grid standards which are to be formulated by Central Electricity Authority only under Clause (d) of Section 73, which is also supported by the sub-section 34 of Section 2 of the Act.
- 2.12 CSPTCL has submitted that as defined in the draft grid code regulations, the definition of the term 'IEGC' does not cover its full functional character. CSPTCL has suggested that the term 'IEGC' may be defined as a "Regulation describing the philosophy, responsibility and broad operational guidelines for Indian Power system with regard to grid standards issued by CEA".
- 2.13 It is clarified that the Act defines "Grid Code" as the Grid Code specified by the Central Commission under clause (h) of sub-section (1) of section 79. As per notified grid code regulations, the term 'IEGC' has been defined to mean 'these regulations specifying the philosophy and the responsibilities for planning and operation of Indian power system'. We are of the view that definition in the grid code regulations is in line with the definition of the term in the Act and does not require any change.

2.14 Shri A. Velayutham has submitted that 'MWh' used in the draft grid code regulations is the unit of 'Energy', which may not be used to define 'Load'. Distribution System Load comprises of consumer loads including domestic, industry, offices, commercial establishments, agricultural loads etc. Hence, the definition of load may be changed as 'Active Power (MW) and Reactive Power (MVAR) delivered to end user (consumer) device. The definition satisfies all end use consumers. We have found the suggestion useful and accordingly, the definition of 'load' has been suitably modified in Regulation 2(1)(ss) of grid code regulations.

2.15 Shri S.K. Bhatnagar and Sub K Power have submitted that the definitions of the terms 'Long –term Access', 'Medium-term Open access' and 'Short-term open access' have incompatible periods. IWTMA and IWPA have suggested that the maximum period for the Short-Term Open Access may be increased from one month to three months as it will help in taking the clearance in one go and reduce the burden of such transmission users. SLDC, Gujarat has suggested that the definition of 'Medium-term customer' may be modified as 'a person who has been granted medium term open access for use of the inter-State transmission system'. GUVNL has suggested that the definition of 'Short-term Open Access' in the draft grid code regulations needs to be modified as "the right to use the inter-state Transmission System for period up to one (1) month at one time".

- 2.16 It is clarified that the definitions of 'long-term access', 'medium-term open access' and 'short-term open access' are in line with the relevant Regulations of the Commission and hence, no change is required in the grid code regulations.
- 2.17 SRPC has suggested to include the definition of 'Protection Sub-Committee' as a Sub-Committee of RPC with Members from all Regional entities which decide on protection aspects of Regional Grid. We agree with the suggestion made by SRPC. Accordingly, the definition has been included In Regulation 2(1)(iii) of grid code regulations.
- 2.18 CEA has suggested that in the definition of the term 'REA', UI Account and Reactive Charge Account have to be excluded. GUVNL has suggested to modify the definition of 'Regional Energy Account' by inserting 'and Certification of Transmission Charges sharing'. We have accepted the suggestions and accordingly the definition has been suitably modified in Regulation 2(1)(nnn) of the grid code regulations.
- 2.19 Athena Chhattisgarh Power Pvt. Ltd. has submitted that the definition of 'Share' may be modified to include share in respect of an IPP. It is clarified that the definition of 'Share' applies to all ISGS which also includes IPPs.
- 2.20 GETCO and GUVNL have requested to include the definitions of 'Wind Farm', 'Wind Farm Operator', 'Wind Farm Pooling Sub-Station' and 'Wind Turbine Generator'. We are of the view that as these terms are not being used in the grid code regulations, there is no need to define them.

- 2.21 RRVPNL, Shri S.K. Bhatnagar and Sub K Power have submitted that the term 'User' may be defined as "a person such as a Generating Company including Captive Generating Plant or Transmission Licensee, Independent Power Producer, Renewable Energy Power Plant, OA consumer (other than the Central Transmission Utility and State Transmission Utility) or Distribution Licensee or Bulk Consumer, whose electrical plant is connected to the ISTS at a voltage level 33 kV and above". WBSEDCL and WBSETCL have suggested to include open access customer in the definition of 'user'.
- 2.22 We are of the view that the definition of 'user' in the draft grid code regulations is comprehensive and, therefore, no modification is required.

### 3. **GENERAL (CHAPTER-1)**

- 3.1 CSPTCL has submitted that two very important aspects which contribute to smooth functioning of the power system may be included namely (a) protection code and (b) metering code. We are of the view that the Protection Codes are covered in the Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulations, 2007 and Metering Codes are covered in the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006. Hence, no modification is required.



#### **4. Power System (Regulation 1.1 of draft grid code regulations)**

4.1 WBSEDCL and WBSETCL have opined that the draft Regulation 1.1 tries to redefine the power system in the first line as a conglomeration of a number of agencies. As the Act had already defined power system, no other definition can be made. WBSETCL has suggested that the first line of the paragraph needs to be deleted.

4.2 It is observed that in the Grid Code, first line of Regulation 1.1 is a general description about Indian Power System and does not define Power System. The definition of Power System begins from second line and is in conformity with provisions in the Act and hence, no modification is called for.

#### **5. Objective ( Regulation 1.2 of draft grid code regulations)**

5.1 NLDC has suggested inclusion of Ancillary services in the Para 3 of the Objective. This suggestion has been accepted and accordingly Regulation 1.2 has been suitably modified in the grid code regulations.

5.2 WBSEDCL and WBSETCL have opined that the Grid Code cannot provide the provision for facilitation of development of power markets or facilitation of the development of renewable energy sources, as the periphery of Grid Code is limited by the Grid Standards under clause (d) of Section 73 of the Act which provides for 'operation and maintenance of transmission lines' only.

- 5.3 It is clarified that as per Section 79 (1)(h) of the Act, Grid Code has to be specified by the Central Commission having regard to Grid Standards. Thus it is not necessary that Grid Code is limited by Grid Standards. Moreover, we are of the view that the power markets operations are part of Power System operations and the regulations framed under Grid Code are to be followed by all participants including power markets. By defining regulations, Grid Code is facilitating functioning of power markets. Therefore, Para 3 of the Objective is modified and phrase “Facilitation for development of power markets” has been replaced with “Facilitation for functioning of power markets and ancillary services”.
- 5.4 It is further clarified that in accordance with the Preamble and Section 61(h) of Electricity Act, 2003, the promotion of co-generation and generation of electricity from renewable sources of energy is the responsibility of the Appropriate Commission. For the inter-State transfer of power from these sources, the regulations are to be specified by the Central Commission. Due to the intermittent nature of generation of electricity from renewable sources, problems are faced in their integration with the Grid. In case of inter-State sale of this power, the scheduling and despatch is challenging because their variability affects the load generation balance of host State, host Region and the buyer State. These issues need to be addressed to increase penetration and optimum utilization of renewable energy resources. Hence these issues have been addressed in the Grid Code. We, therefore, are of the view that no change is required in the Objective.

## **6. Scope( Regulation 1.3 of draft grid code regulations)**

6.1 Shri S.K. Bhatnagar and Sub K Power have suggested to include STU and CTU in Regulation 1.3 (i) of the draft grid code regulations. We have considered this suggestion and Regulation 1.3 has been suitably modified in the grid code regulations.

6.2 WBSEDCL has proposed that Regulation 1.3 (ii) may be substituted as follows:

“For the purpose of the IEGC, the Damodar Valley Corporation (DVC) will be treated similar to an SEB in relation to the inter-State transmission and inter-State generation only in view of the fact that DVC is a vertically integrated deemed licensee like an SEB and has its own generation, transmission and distribution in the identified command area.”

6.3 We have considered the suggestion and accordingly modified this regulation by adding “Accordingly, Central Load Despatch at Maithon shall perform functions of SLDC envisaged in this code for the area of DVC”.

6.4 NLDC has suggested treating each connection from a neighboring country as separate control area in Regulation 1.3 (iv) of draft grid code regulations. This suggestion has not been accepted as each neighbouring country may be treated as a separate control area, but each connection from a neighboring country cannot be treated as a separate control area.

## 7. Non-compliance (Regulation 1.5 of draft grid code regulations)

7.1 The regulation 1.5 of the draft grid code regulations provided as under:

- “(i) The Regional Power Committee (RPC) in the region shall continuously monitor the instances of non-compliance of the provisions of IEGC and deliberate on the ways in which such cases of non-compliance are prevented in future by building consensus.*
- (ii) RLDCs shall report to the Commission, through petition, instances of serious violation of any of the provisions of the IEGC and incidences of persistent non-compliance of the directions of the RLDCs issued in order to exercise supervision and control required for ensuring stability of grid operations and for achieving the maximum economy and efficiency in the operation of the power system in the region under its control.*
- (iii) The Commission may initiate appropriate proceedings upon receipt of report of RLDCs referred to in (ii) above.*
- (iv) In case of non-compliance of any provisions of the IEGC by NLDC, RLDC, SLDC or RPC, the matter may be reported by any person to the CERC through petition.*
- (v) Notwithstanding anything contained in other clauses of this regulation, the Commission may also take suo-motu action against any person, in case of non-compliance of any provisions of the IEGC.”*

7.2 CEA has made following submission on the said draft regulation:

*“The provision in the excising IEGC regarding reporting of non compliance by Member Secretary, RPC may be retained since he is the only person who is aware of operation of the Regional Power System and is neutral in the sense that he is not an active player in day-to-day operation of the Regional Grid. Also, non – compliance of provisions of IEGC can have serious consequences and CERC may be deprived of inputs in this regard, if non-compliances are to be reported in the form of petitions only. However, to avoid frivolous or non-serious matters to be reported to CERC, the existing provision regarding reporting of the matter first to Member Secretary, RPC may be retained. He in turn may verify and report only persistent non-compliances to CERC, which could not be terminated in spite of best efforts. At present, issues of non-compliances are discussed in the RPC fora and attempts are made for continuous*

*improvement. Recently, CEA had advised Member Secretaries of RPCs to lay more emphasis on under-frequency relays in accordance with their role in IEGC.”*

7.3 WBSEDCL has submitted that Regulation 1.5 (i) speaks about preventing non-compliances of IEGC through building consensus in the RPC which would not be very much effective except in some few cases.

7.4 NTPC has submitted that RPC and the Commission may decide differently on the same issue of violation leading to conflict and this situation can be avoided if RLDC is directed to report only those violations unresolved in the RPC to the Commission.

7.5 SRPC has suggested that Regulation (i) of the existing of draft IEGC may be replaced as under:

*“The RPC Secretariat would continuously monitor the instances of non compliance of provisions of IEGC. Member Secretary, RPC may take up the matter with the defaulting agency for expeditious termination of non compliance. In case of inadequate response TCC / RPC meeting could be called upon to deliberate on the ways in which such cases of non compliances are terminated and prevented in future by building consensus.”*

7.6 TNEB has suggested that since the RPCs are also monitoring the instances of any non-compliance of the provisions of IEGC, the matter can be first referred to RPCs for appropriate action, as against SRLDC petitioning the Commission or the Commission taking suo-motu action. The provisions made in the earlier version of IEGC (2006) may be retained with respect to Regulation 1.5 of draft grid code regulations.

7.7 We have considered the views expressed by the various stakeholders. Accordingly, this regulation has been modified. Regulation 1.5 of grid code regulations now stipulates that RLDCs shall report to the Commission instances of serious or repeated violation of any provisions of Grid Code. Further, Member Secretary, RPC may also report to the Commission, any issue that cannot be sorted out at the RPC forum. The decision to modify earlier provisions has been taken based on the past experience and importance of grid discipline in the system operation. As RLDC is System Operator, on day to day basis it experiences and judges the response of other Utilities to its instructions of reduction in overdraw and other matters requiring urgent action. In RPC forum, issue of Grid discipline is always given importance and Utilities resolve to maintain grid discipline. But some States in NEW grid and Southern Region (SR) are regularly violating grid discipline. It was experienced that due to consultative and consensus based deliberations in RPC, the issue of grid discipline could not be addressed effectively and Member Secretary, RPCs in the past have rarely approached the Commission on this important issue. Also meetings of RPCs took place after some interval during which urgent issues of Grid discipline cannot be left unaddressed. Also, some States, due to earlier provisions in the Grid Code objected to the suo-motu proceedings by the Commission on Grid discipline related issue on the ground that RPC had not reported the matter to the Commission. Hence now primary responsibility of reporting the cases of grid discipline violations is assigned to the RLDCs. Member Secretary, RPC may also report to the Commission any issues that cannot be sorted out at the RPC forum.

7.8 SLDC, Gujarat has suggested to modify Regulation 1.5 (ii) as under:

*“RLDCs shall report to the Commission, through petition, after circulating to respective SLDCs, NLDC and RPCs, incidences of serious violation of any of the provisions of the IEGC and the incidences of persistent non-compliance of the directions of RLDC issued in order to exercise supervision and control required for ensuring stability of grid operations and for achieving the maximum economy and efficiency in the operation of the power system in the region under its control.”*

7.9 WBSETCL has suggested to modify Regulation 1.5 (ii) as under:

*“RLDCs shall report to the Commission prior discussion/ information with SLDCs through petition, instances of serious violation of any of the provisions of the IEGC and incidences of persistent non-compliance of the directions of the RLDCs issued in order to exercise supervision and control required for ensuring stability of grid operations and for achieving the maximum economy and efficiency in the operation of the power system in the regions.”*

7.10 It is understood that the RLDCs are interacting with the SLDCs and the Regional entities on the issues of grid operation. Since only the serious and repetitive violations of Grid Code by any Regional entity are to be reported by the RLDC to the Commission, the SLDC and the Regional entity would be well aware about these instances. Further, we feel that the serious and repetitive violations of Grid Code affect grid security and need urgent actions. However, during the proceedings on the reports submitted by the RLDCs, the SLDCs would be given sufficient opportunity to represent their cases. Hence, the suggestions of SLDC, Gujarat and WBSETCL have not been accepted.

7.11 S.K. Bhatnagar and Sub K Power have requested for re-wording of Regulation 1.5 (iv) by replacing word “may” by “shall” to make the clause mandatory instead of mildly suggestive. We have considered the suggestion and feel that replacing

the word “may” by “shall” would result in situation that every single instance of Grid Code violations would come to the Commission. Therefore, the draft regulation has been retained.

## **8. Role of NLDC (Regulation 2.2 of draft grid code regulations)**

8.1 NLDC has proposed the following amendment in Regulation 2.2 of draft grid code regulations:

*“NLDC shall also carry out the following functions*

*(i) NLDC shall be the nodal agency for collective transactions.*

*(ii) NLDC shall be Implementing Agency for estimation of transmission charges and transmission losses.*

*(iii) NLDC would act as the central control room in case of natural and manmade emergency/ disaster.*

*(iv) NLDC shall act as Central Agency for Renewable Energy Certification*

*(v) Operation of national UI pool account, provided that such functions will be undertaken by any entity (ies) other than NLDC if CERC so directs.”*

8.2 We have considered the suggestions of the NLDC and the functions regarding collective transactions and disaster management have been included in the regulation. Regarding suggestions for other functions of NLDC, it is clarified that as per Regulation 2.2.2 (iii) any other function may be assigned to NLDC by the Commission by order or under regulations.



8.3 WBSEDCL proposed that regulation 2.2.1 of may be deleted as this portion is already covered by the National Load Despatch Centre Rules, 2005 and to avoid future complication in case of amendment in the said rules. It is clarified that since IEGC deals with the roles of various organizations, we find appropriate to reproduce the roles of NLDC as per the Act and other functions assigned by the Commission, from time-to time. Therefore the regulation is retained.

8.4 Athena Chhattisgarh Power Pvt. Ltd. submitted that the role of NLDC will include that of Implementation Agency. We are of the opinion that this role would be assigned to the NLDC once the regulations on sharing of inter-State transmission charges and losses is made by the Commission in accordance with Regulation 2.2.2 (iii). In light of this, another suggestion of Athena Chhattisgarh Power Pvt. Ltd. to include the roles of entities that are required to provide data to Implementation Agency (IA) has not been accepted.

## **9. Role of RLDCs (Regulation 2.3 of draft grid code regulations)**

9.1 WBSEDCL has proposed that Regulation 2.3.1 may be substituted as under:

*“All directions given under sub-section (3) of Section 29 of the Act shall also mention the purposes of such directions so that if it is found that on compliance of such direction the purpose are not being achieved then the affected person of such directions can request for appropriate modification of the direction and accordingly RLDC will take necessary action.”*

9.2 It is clarified that in this regulation, the functions of RLDCs have been given as per the Act and therefore the suggestion of WBSEDCL has not been accepted.

9.3 SLDC, Gujarat has suggested to include “under sub-section 29 (1) of IE Act, 2003” in the end of Regulation 2.3 (5). It is clarified that in the first line of the regulation, the reference of the Act has already been given and hence no modification is required.

9.4 WBSETCL has proposed that Regulation 2.3.1 (6) may also incorporate the following:

*“All directions given by RLDC shall also mention the purposes of such directions so that if it is found that on compliance of such direction the purpose are not being achieved then the affected person of such directions can request for appropriate modification of the directions and accordingly RLDC will take necessary action.”*

9.5 It is clarified that the instructions by RLDCs shall be given in accordance with Section 29 of the Act where the purpose is already mentioned as “ for ensuring stability of Grid operation and for achieving the maximum economy and efficiency in the operation of the power system” and hence no modification is required in the Regulation.

9.6 IWPA has submitted that in Regulation 2.3.3, in order to supply power to the consumer/customer the generator has to arrange all the required approvals/ clearances for Short-term Open Access. Therefore, it has been suggested to consider the Regional Load Despatch Centre (of the Region where the Point of Injection is situated) as the nodal agency in case of Short Term Open Access in Inter-State Transmission for the Short Term open Access in place of RLDC of the region (where the point of drawal is situated.)

9.7 The role of RLDCs in the grid code regulations is in accordance with the Electricity Act, 2003 and existing regulations of the Commission; hence the above suggestions were not accepted.

## **10. Role of RPCs ( Regulation 2.4 of draft grid code regulations)**

10.1 Athena Chhattisgarh Power Pvt. Ltd. submitted that as per the Resolution of Government of India, RPC shall include “A representative each of every generating company (other than central generating companies or State Government owned generating companies) having more than 1,000 MW installed capacity in the region.” This would help if this provision is included in this Code.

10.2 It is clarified that the membership of RPC is not in the purview of the Grid Code. Hence no modification is required in the Regulation.

10.3 SRPC suggested that Regulation 2.4.5 may be modified as follows because preparation and issuance of Unscheduled Interchange Account and Reactive Energy Account on weekly basis are also entrusted to RPC:

*“RPC Secretariat or any other person as notified by the Commission from time to time shall prepare Regional Energy Account (REA) on monthly basis, UI and Reactive Energy Account on weekly basis based on date provided by RLDC, for the purpose of billing and payments of various charges.”*

10.4 We have considered the suggestion and accordingly the Regulation has been modified to include monthly Regional Energy Account, Unscheduled Interchange

Account, Reactive Energy Account, Congestion Charge Account, Renewable Regulatory Charge Account and any other accounts specified by the Commission for the purpose of billing and payment of various charges.

## **11. Role of CTU (Regulation 2.5 of draft grid code regulations)**

11.1 IWTMA has suggested to modify Regulation 2.5.3 to make CTU as the Nodal Agency for connectivity, long-term Access and to make RLDC as the Nodal Agency for Medium – term Open Access.

11.2 It is clarified that this Regulation is in line with the Central Electricity Regulatory Commission (Grant of Connectivity, Long – term Access and Medium – term Open Access in inter-State Transmission and related matters) Regulations, 2009. Therefore no change is required in this regulation.

11.3 WBSEDCL and WBSETCL have submitted that a number of areas have been taken from the Electricity Act, 2003. The repetition of the those areas in the regulations will unnecessarily make the regulations heavy and in future may create some legal complicacies in case of any slight deviation due to improper drafting or due to future amendment in the Act. They have proposed deletion of Regulations 2.5.1 and 2.5.2.

11.4 It is clarified that grid code regulations are regulations specifying the philosophy and responsibilities for planning and operation of Indian power system. The role

of CTU is given in this regulation for convenience of users. We, therefore, are of the view that deletion is not required.

## **12. Role of CEA (Regulation 2.6 of draft grid code regulations)**

12.1 Indian Wind Energy Association (InWEA) and SLDC, Gujarat have suggested that CEA should specify the technical standards for connectivity of renewable energy generators to the grid from time to time. It is clarified that as per the Act, the function of CEA is to specify the technical standards for connectivity to the grid and this includes renewable energy generator also, hence Grid Code need not further define the function of CEA. We therefore, feel that no addition is required in the regulation.

12.2 TNEB has suggested that CEA may function as a technical advisory body to guide in all the functions of SRLDC and SRPC. While promoting and assisting of timely completion of projects, the CEA may also apprise the Commission of the delay in completion of projects and consequent deficit caused to the States, so that the Commission may consider relaxing the operating frequency band. While investigating and sanctioning new generating stations, especially wind/solar stations, the imbalance caused to the generation mix between conventional and non conventional sources may be considered. It is clarified that the grid code regulations which are in the nature of subordinate legislation cannot assign new functions to CEA beyond the scope of section 73 of the Act. Hence we are not inclined to accept the suggestion of TNEB .

### **13. Role of SLDC (Regulation 2.7 of draft grid code regulations)**

13.1 SLDC, Gujarat has suggested that the following clause may be inserted after

Clause 2.7.2:

“Transmission licensee has to follow the directions of State Load Dispatch Center under sub section (b) of Section 40 of Act for efficient and economical development & operation of Intra State or inter-State transmission system as the case may be.”

13.2 It is clarified that in accordance with provisions of the Act, transmission licensee has to comply with the instruction of SLDC, hence it need not to be repeated . So suggestion has not been accepted.

13.3 CSPTCL has suggested that the following should be included in Clause 2.7.1(2):

- (f) Checking that there is no gaming in availability declaration by the generator.
- g) Revision of availability declaration and injection schedule.
- h) Switching instruction.
- i) Issuance of UI accounts.
- j) Collection and disbursement of UI payments.
- k) Intra state outage planning

13.4 It is clarified that role of SLDC in Grid Code has been given keeping in view the role of SLDC in Inter State system operation and is in accordance with the provisions of the Act. Hence the suggestion has not been accepted.

13.5 WBSEDCL and WBSETCL have suggested that the following may be added at the end of Clause 2.7.3:

“If any Intra-state asset is involved for the above cases, then in such cases the concurrence/ No objection/ prior standing clearance shall have to be taken as per Open Access regulation of the SERC concerned.”

13.6 Regarding Clause 2.7.3, WBERC, has suggested that in case of inter -State bilateral and collective Short-term Open Access transactions having a State Utility of an intra State entity as a buyer or a seller, SLDC shall accord concurrence or no objection or a prior standing clearance, as the case may be, in accordance with the Central Electricity Regulatory Commission (Open Access in inter-State Transmission) Regulations, 2008, amended from time to time. However, if such transaction involves an intra-State asset, then open access for that part will be governed under specific regulation of the concerned State Electricity Regulatory Commission.

13.7 It is clarified that the Grid Code provisions are for the inter-State flow of power and for which regulations of the Central Commission are applicable. For the intra-State transactions. the regulations of the SERC may be followed. We therefore, are of the view that there is no requirement to add this clause.

#### **14. Introduction (Regulation 3.1 of draft grid code regulations)**

14.1 NTPC has submitted that the standard methodology for computation of the Total Transfer Capability (TTC), Available Transmission Capability (ATC) and Transmission Reliability Margin (TRM) for ensuring optimum utilization of the

available transmission under different operating conditions should be provided. IEX also submitted that the values of TTC and TRM declared by system operator affect the short term market, and requested that a closer look be taken on the optimal values of reliability margins.

- 14.2 We have considered the views of NTPC and IEX. Under the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009, NLDC has to make detailed procedure for application/ removal of congestion charge with the approval of Commission. The detailed procedures would provide the methodology for computation of the Total Transfer Capability (TTC), Available Transmission Capability (ATC) and Transmission Reliability Margin (TRM). This procedure need not be repeated in the grid code regulations.

## **15. Objective (Regulation 3.2 of draft grid code regulations)**

- 15.1 WBSEDCL and WBSETCL have suggested that Regulation 3.2 may be substituted as under:

“The objectives of Planning Code are as follows:

(a) To specify the principles, procedures and criteria, which shall be used in the planning and development of the ISTS and inter regional links *to confer with Grid Standards for operation and maintenance of transmission lines.*

(b) To promote co-ordination amongst all users, STU/ SLDC and CTU/ RLDC and NLC in any proposed development of the ISTS *to confer with Grid Standards for operation and maintenance of transmission lines.*



(c) To provide methodology and information exchange amongst users, STU/ SLDC and CTU/ RLDC and NLDC in the planning and development of the ISTS according to Regulation (a).”

15.2 The modification suggested by WBSEDCL and WBSETECL (In italics) refer to operation and maintenance of the transmission lines. It is clarified that these regulations are related to the development of ISTS. We, therefore, are of the view that the modifications suggested by them are not required. However, in any case the Regulations made by CEA have to be complied with and the reference of these Regulations has been made in the appropriate places in the Grid Code Regulations.

15.3 SLDC, Gujarat and InWEA have submitted that a new clause, namely, clause (d) may be added to Regulation 3.2 as under:

“To specify the principles procedures and criteria which shall be used for planning and development of the transmission system for evacuating wind power and all the other renewable sources of energy.”

15.4 We are of the view that if generation of electricity from renewable sources of energy is connected to the ISTS, then the planning and development of the transmission systems for evacuation these renewable sources should be taken care of. We have considered the views and the same have been covered in Regulation 3.4 (b) (vii) in the grid code regulations.

## **16. Scope (Regulation 3.3 of draft grid code regulations)**

16.1 GETCO and InWEA have submitted that Planning Code should clearly address the requirements of evacuation planning and transmission line augmentation to

facilitate evacuation of Renewable Energy Generating Stations connected at Transmission level (ISTS or InSTS), as the case may be. Our views on these suggestions are covered in Para 15.4, given above.

16.2 SRPC has suggested to include RPCs in Regulation 3.3. It is clarified that RPC is not a licensee nor a user. Therefore, we hold that the Planning Code shall not apply on RPCs.

## **17. Planning Philosophy (Regulation 3.4 of draft grid code regulations)**

17.1 CEA has suggested for removal of word 'major' from Regulation 3.4(b) and suggested that in Regulation 3.4 (c) it does not appear appropriate to specify under a separate Regulation that transmission system shall be planned in accordance with CERC long term and medium term regulations. Therefore it was suggested to delete this aspect as independent Regulation and to cover it under Regulation 3.4 (b) (v). We have considered the submission. Accordingly Regulation 3.4 (c) has been deleted and a new sub-clause (vi) has been added to Regulation 3.4 (b) of grid code regulations.

17.2 RLDCs and NLDC have submitted that Regulation 3.4 (b) may be modified as under:

“The CTU shall carry out planning process from time to time as per the requirement for identification of major inter-state transmission system including inter-regional schemes and communication system required for data and communication facilities which shall fit in with the perspective plan developed by CEA.”

- 17.3 We have considered the suggestion. CTU has informed that the communication system requirement is not planned by CTU in advance and it is planned as and when application for connectivity is received. In view of this, suggestion has not been accepted. Further, since there is a separate Regulation on Data and Communication facilities in Chapter – 4 of these Regulations, there is no need of modification in this Regulation.
- 17.4 SLDC, Gujarat has suggested that Regulation 3.4 (b) (iv) may be modified to include Operational feedback from NLDC, SLDC or RPC. We have considered the submission. Accordingly, Regulation 3.4 (b) (iv) has been modified to include operational feedback from RPCs and Regulation 3.4 (b) (v) has been added for operational feedback from NLDC/RLDC/SLDC in the grid code regulations.
- 17.5 GUVNL,SLDC Gujarat, InWEA and IWTMA have submitted that in Planning Criteria, transmission system requirement for renewable energy may be included in Regulation 3.4 by adding ‘Perspective Plan formulated by MNRE for Capacity addition through renewable sources’.
- 17.6 We have considered the submission. Accordingly, in Regulation 3.4 (a) of grid code regulations, it has been stipulated that “in formulating perspective transmission plan the transmission requirement of evacuating power from renewables shall be taken care of”. Moreover, a new sub-clause, namely, (vii)

has been added to Regulation 3.4 (b) to provide that while planning schemes, the CTU shall consider “Renewable capacity addition plan issued by Ministry of New and Renewable Energy Sources(MNRES), Government of India.”

**18. Planning Criterion (Regulation 3.5 of draft grid code regulations)**

18.1 RLDCs and NLDC have submitted to include ‘the requirement of Data Collection Points (as defined in Model Connection Agreement) shall be finalized by CTU’ in Regulation 3.5.

18.2 Since the issue has already been dealt in Model Connection agreement given in CERC (Grant of Connectivity, Long Term Access and Medium term Open Access in Inter State Transmission and related matters) Regulations, 2009, no modification is required in this Regulation.

18.3 IWTMA and IWPA requested to enumerate the Transmission planning criteria in the grid code regulations as described by CEA. Further this transmission planning criteria does not consider the renewable energy source either for evacuation plan or transmission plans. Further they have suggested modification in Transmission planning like contingency criteria, line loading, Voltage levels for connectivity etc for wind generation. We appreciate the views of the stakeholders and accordingly, Regulation 3.4.a has now been modified to include transmission requirement for evacuating power from renewables. Other technical issues are under the purview of transmission planning by CEA and CTU and hence are not considered here.

18.4 CEA has suggested that in Regulation 3.5 (a) (i) (a), the “Outage of 400 kV S/C line with series compensation” may be added and the last line i.e. “Outage of 765 kV S/C line” may be rephrased as “Outage of 765 kV S/C line without series compensation.”

18.5 We are of the view that the provisions given in this regulation are in the nature of general policy only. The transmission planning shall be as per Transmission Planning Criteria and other guidelines of CEA. This suggestion was not accepted as 3.5(i) (a) is inclusive of this case and no rationale was given for modification.

**19. Planning Data (Regulation 3.6 of draft grid code regulations)**

19.1 Regarding Regulation 3.6 (b) IWTMA and IWPA **have** requested that the data be made available in the public domain by publishing on the web site of CTU. We have considered the view and accordingly Regulation 3.6 has been modified.

**20. Implementation of Transmission Plan( Regulation 3.7 of draft grid code regulations)**

20.1 InWEA has suggested that the implementation of the Transmission Plan should be the responsibility of concerned Transmission Licensee(s) and not that of CTU/ STU who are exercising their planning function as per Section 38/ Section 39 of the Act. It is clarified that as per the Act, the development of ISTS is the responsibility of CTU and development of intra-State transmission system is the responsibility of the STU in coordination with other licensees. Therefore, no modification is required.

## 21. Introduction( Regulation 4.1 of draft grid code regulations)

### 21.1 CEA has made the following suggestions on this Chapter:

“It is noted that this Chapter contains certain technical requirements which are perceived to be important. It may be pointed out that the tactical requirements for connectivity have been specified by CEA in its regulation on “Technical Standards for connectivity to the grid”. Incorporating only selected provisions in this Chapter may not be appropriate. Further, in case certain amendments are carried out by CEA in the “Technical Standards for connectivity to the grid”, it may lead to ambiguity. In view of this, it is suggested that this Chapter may mention only relevant regulations namely Central Electricity Authority (Technical Standards for connectivity to the grid) Regulations, 2007 and Central Electricity Regulatory Commission (Grant of connectivity, long – term access and medium – term open access in inter-state transmission and related matters Regulations), 2009.

Further, CEA is working on amendments to be carried out in the Connectivity Standards to facilitate integration of renewable energy sources. The relevant regulation is almost ready for publications in the form of draft for seeking comments of the stakeholders. In case of any deviation between the amendments finalized by CEA and those proposed in the IEGC, there will be implications on the developers. In view of the above, it is suggested that the provisions regarding connectivity of renewable energy sources to the grid may be omitted from the IEGC.”

21.2 WBSEDCL and WBSETCL have submitted that CERC has no jurisdiction over the asset covered by the SERC, thus the sign and words of proposed regulation 4.1 “which would be the same whether connected to the state power system or” shall be deleted.

21.3 Both the suggestions have been accepted and Regulation 4.1 of grid code regulations has been modified accordingly.

## 22. Procedure for connection (Regulation 4.4 of draft grid code regulations)

22.1 NHPC has submitted that the comments on the draft procedure for grant of connectivity, long term access and medium term access have already been submitted, and these may be incorporated in Grid Code.

22.2 The comments of all the stakeholders have already been considered while finalizing the Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-state Transmission and related matters) Regulations, 2009. These comments need not be incorporated in Grid Code.

**23. Connection Agreement Regulation 4.5 of draft grid code regulations)**

23.1 NTPC has suggested for modifying Regulation 4.5 (iv) so that the connection agreement should exclude payment security mechanism for transmission charges. WBSEDCL and WBSETCL have suggested that to avoid repetition of the same provisions of other regulations, Regulation 4.5 may contain only the first sentence by deleting the rest. We agree with the suggestion of WBSEDCL and WBSETCL and the said regulation has been modified accordingly.

**24. Important technical requirements for Connectivity to the Grid( Regulation - 4.6 of draft grid code regulations) Protection( Regulation 4.6.1 of draft grid code regulations)**

24.1 RLDCs, NLDC, SLDC, Gujarat, S.K. Bhatnagar and Sub K Power have suggested for modifying Regulation 4.6.1. Considering the comments by CEA as discussed in Para 21.1 above, this Regulation has been removed.

**25. Generating Units and Power Station( Regulation 4.6.2 of draft grid code regulations)**

25.1 NTPC, NHPC and Siemens have suggested for modifying Regulation 4.6.2.

Considering the comments by CEA given in Para 21.1 above, this Regulation has been removed.

**26. Responsibilities for safety( Regulation 4.6.6 of draft grid code regulations)**

26.1 Athena Chhattisgarh Power Pvt. Ltd. has suggested that Regulations, 2008 may be corrected as Regulations, 2009. It is clarified that the CEA (Safety Requirements for construction, operation and maintenance of electrical and electric lines) Regulations, 2008 is still at draft stage and the year of the draft is 2008 and hence no correction is required.

**27. Connectivity of renewable energy generating station to the grid(Regulation 4.9 A Of draft grid code regulations)**

27.1 CEA, S.K. Bhatnagar and Sub K Power have submitted that the requirements of connectivity have to be as per CEA (Technical Standards for connectivity to the Grid) Regulations, 2007. Considering the comments by CEA given in Para 21.1 above, this Regulation has been removed.

27.2 NTPC has suggested that in Regulation 4.9, the connection of renewable sources of energy to the inter-State transmission system may also be included. Considering the comments by CEA given in Para 21.1 above, this Regulation has been removed.



27.3 InWEA has submitted that it would be better to connect wind power at transmission interface for better energy accounting. DISCOM connectivity should only be allowed in case it is not possible to connect to transmission system. It is clarified that the draft regulation mentioned that the connectivity may be at the transmission level or distribution level depending upon the policies of the State Electricity Regulatory Commissions. However, considering the comments by CEA given in Para 21.1 above, this Regulation has been removed.

**28. Special Technical Requirements for of Wind Generators connected to the grid (Regulation 4.9.B of draft grid code regulation)**

28.1 TNEB and SLDC, Gujarat have submitted that these requirements should be implemented for all wind turbines, for the existing as well as future installations irrespective of voltage level and capacity. InWEA submitted that these provisions should be made applicable only for new wind power projects with prospective effect.

28.2 Tata Power has suggested that some of the Wind generators which are not capable of ramping up and ramping down may be excluded from this requirement.

28.3 InWEA has submitted that maintenance of power factor is also dependent on the system voltage which is also responsibility of the transmission licensee. It was submitted that the condition of FRT imposes significant technical and financial implications for the wind power project, because the extent of wind energy

penetration is still not very significant, the Commission may consider introduction of such measures after detailed study of electricity markets with high wind penetration at a later stage.

28.4 SLDC, Madhya Pradesh has suggested that time frame of six months from the date IEGC Regulation, 2010 comes into effect may be prescribed for the existing renewable energy generators for providing the telemetry equipment along with necessary speech and data communication facilities up to nearest Sub LDC/SLDC and for the new renewable energy generators should as a prerequisite for connectivity.

28.5 Siemens has submitted that the Fault ride Through (FRT) capabilities will be a standard feature even for PV plants. Siemens submitted that typical PV plants are not so large that it is necessary to have Y scheme at the grid side. At the output of the inverter the transformer can have Y with isolated neutral (not used neutral) or a delta scheme.

28.6 AMSC, India has suggested to modify the regulations on reactive power requirement and FRT for the wind generators.

28.7 IWTMA and IWPA have requested that Wind turbine generator protection should be powered for 220kV and above. IWMTA and TWPA further submitted that there is an extra cost of around Rs 45 Lakhs/MW to Rs 90 Lakhs/MW on installation of LVRT Technology. There will be huge cost implication on the

project viability. Therefore the installation of FRT at each WTG should not be mandated and detailed study may be done by CEA for the requirement of FRT by RE generators and sufficient time may be provided.

28.8 Siemens has submitted that typical values for protection schemes should be written. S.K. Bhatnagar and Sub K Power submitted that all the protection requirements for the Wind turbine generator are subject of CEA (Technical Standards for connectivity to the Grid) Regulations, 2007. An effort to make this provision mandatory through this Code shall be again an unwarranted, unwise and untimely action besides putting a financial burden on already costly RE generation. The Commission may drop this provisions altogether from Code.

28.9 IWTMA and IWPA have requested to amend the regulation to provide data acquisition facility for transfer of information from wind farm to concerned SLDC only. Comments on Regulation 4.9 of Grid Code have also been received from other stakeholders.

28.10 We agree with the views of CEA, S.K. Bhatnagar and Sub K Power on this regulation. Accordingly, Regulation 4.9 has been removed from the grid code regulations. The technical requirements for connectivity of renewable energy sources shall be part of CEA (Technical Standards for connectivity to the grid) Regulations. We emphasize the need of technical standards for integration of renewable with grid in a secure and optimum manner.

28.11 We suggest that the following features may be considered for inclusion in CEA

Technical Standards for the Connectivity to the Grid for connectivity of wind generators if the connection is at 33 kV and above and the collective capacity of the wind generator at the connection point exceeds 10 MW:

- i) Wind farms shall have the ability to limit the active power output at grid connection point as per system operator's request.
- ii) The grid connected wind farms shall have the ramp up/ramp down capability.
- iii) The reactive compensation system of wind farms shall be such that Wind farms shall maintain power factor between 0.95 lagging and 0.95 leading at the connection point.
- iv) The wind generating machines shall be equipped with fault ride through capability.
- v) The Wind generating machines shall have the operating region as shown in Figure given below during system faults. Wind farms can be disconnected if the operating point falls below the line in the Figure

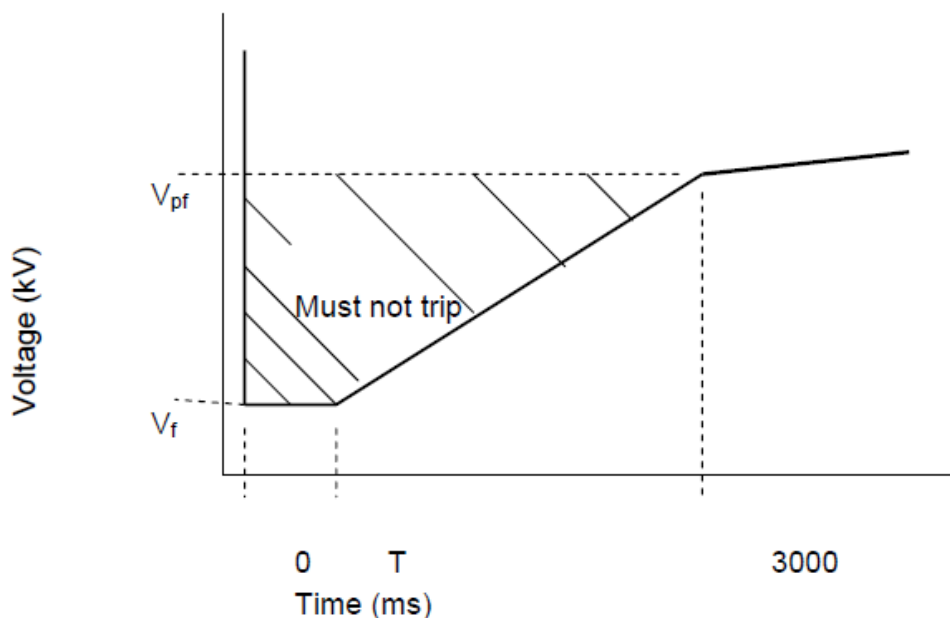


Figure: Fault ride through characteristics

Where,

The fault clearing time for various system nominal voltage levels is given in the following Table

Table: Fault clearing time and voltage limits

| Nominal system voltage (kV) | Fault clearing time, T(ms) | $V_{pf}$ (kV) | $V_f$ (kV) |
|-----------------------------|----------------------------|---------------|------------|
| 400                         | 100                        | 360           | 60.0       |
| 220                         | 160                        | 200           | 33.0       |
| 132                         | 160                        | 120           | 19.8       |
| 110                         | 160                        | 96.25         | 16.5       |
| 66                          | 300                        | 60            | 9.9        |

During fault ride-through, the Wind turbine generators (WTGs) in the wind farm shall have the capability to meet the following requirements:

- a) Shall minimize the reactive power drawl from the grid.
- b) The wind turbine generators shall provide active power in proportion to retained grid voltage as soon as the fault is cleared.

(Explanation: Wind farms connected to high voltage transmission system must stay connected when a voltage dip occurs in the grid, otherwise, the sudden disconnection of a large amount of wind power may contribute to the voltage dip, with adverse consequences. Wind farms must remain connected when the voltage dip profile is above the line shown in the figure. The per unit voltage at the point of connection to the grid is shown in the vertical axis and the duration

(seconds) of the fault in the horizontal axis. This code requires Fault Ride-Through (FRT) capability during voltage drops in Transmission System to 15% of nominal voltage during 300 ms with recovery up to 80% of nominal voltage after 3 sec, with the slope shown in figure given above)

- vi) All the grid connected wind farms must have protection systems to protect the wind farm equipment as well as the grid, such that no part system shall remain unprotected during faults. The protection co-ordination for the wind farms shall be done by the SEB/ STU and RPC.
- vii) The following are the minimum protection schemes that shall be installed for wind farm protection:
  - i) under/over voltage protection
  - ii) under/over frequency protection
  - iii) over current and earth fault protection
  - iv) load unbalance (negative sequence) protection
  - v) differential protection for the grid connecting transformer
  - vi) capacitor bank protection
  - vii) tele-protection channels (for use with distance protection) between the grid connection point circuit breaker and user connection point circuit breaker.
  - vi) Wind farms shall have communication channel which is continuously available to system operator.

- vii) Data Acquisition System facility shall be provided for transfer of information to concerned SLDC and RLDC
  - viii) Lightning protection of WTG system shall be according to IEC TR 61400-24 “Wind turbine generator systems – Part 24: Lightning protection.”
  - ix) Wind turbine grounding systems shall follow the recommendations of IEC TR 61400-24 (section 9).
- viii) The grid connecting transformer configuration shall be designed to provide:
- i) A favorable circuit to block the transmission of harmonic currents.
  - ii) Isolation of transmission system side and wind farm side ground fault current contributions.

The preferred configuration of the grid connecting transformer is delta connection on the wind farm side and grounded wye connection on the transmission system (grid) side. Delta connection on the high voltage side of the grid connecting transformer is not permitted. Alternate transformer configuration including wye-wye or wye-wye with a delta connected tertiary is also acceptable for the grid connecting transformer. If the wind farm is directly getting connected to the existing utility substation, the standard practice of utility shall be followed.

*(Explanation: -*

*The purpose of prohibiting delta connection on the high voltage side of the grid connecting transformer is to block the harmonics current and to detect the earth faults on the grid side. )*

**29. Operating Philosophy ( Regulation 5.1 of draft grid code regulations)**

29.1 SLDC, Gujarat suggested that Regulation 5.1 (b) may be modified by including the word 'SLDC'. We have considered the suggestion and the regulation has been modified accordingly.

**30. System Security Aspects ( Regulation 5.2 of draft grid code regulations)**

30.1 NTPC, WBSEDCL, WBSETCL S.K. Bhatnagar and Sub K Power submitted that all the Governor Action requirements are subject of CEA (Technical Standards for connectivity to the Grid) Regulations, 2007. The Grid code may not prescribe Governor Action setting, specifications, recommendations and detailing, etc. It may be left for the CEA (Technical Standards for connectivity to the Grid) Regulations to incorporate it after suitable amendment.

30.2 NHPC submitted that Regulation 4.6.2 (c) provides that the Generating Unit shall be fitted with a turbine speed governor having an overall droop characteristic as provided in the Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulations, 2007” whereas Regulation 5.2 (e) (iii) provides that all generator shall have a droop setting 3% to 6%. Thus there is a discrepancy in the two Regulations. The Central Electricity Authority (Technical Standards for the connectivity to the Grid) Regulations, 2007 (Part –II Grid Connectivity Standards applicable to the Generating Units) provides that the droop setting for hydro generators shall be 0 to 10%. Therefore, the last line of Regulation 5.2 (e)



(iii) needs to be deleted as it is covered in CEA Regulations, 2007.

30.3 We have considered these submissions. We are of view that CEA (Technical Standards for connectivity to the Grid) Regulations specify broad technical requirements of Governor Action and droop characteristics of the generating units seeking connection at 33 kV and above. While CEA Regulations specifies the capability or range, Grid Code is defining settings within this range. From operational point of view it is essential to provide details on Governor Action characteristics in the Grid Code and therefore the regulation has been retained.

30.4 TNEB has submitted that in between Regulation 5.2 (e) and Governor Action, the following may be added:

*“Implementation of the restricted governor mode of operation can be implemented only with the technical support and supply of the requisite hardware and software of M/s BHEL and can be implemented only if it is technically feasible. However this can be made mandatory for new installations.”*

30.5 This is an implementation issue which needs to be addressed by TNEB themselves. Hence suggestion for modification is not accepted.

30.6 NTPC submitted that machines with mechanical hydraulic governors already exhibit FGMO response. It would not be desirable to deliberately introduce restriction on such machines through retrofit of additional hardware unless

electro hydraulic governors are installed. This would be a major modification involving significant expenses which can be only taken up along with R&M. NTPC suggested to exclude Machines with Mechanical Hydro Governor from restricted FGMO. We agree with the suggestion and the regulation has been modified accordingly.

30.7 SLDC Maharashtra has commented on Regulation 5.2 (h) that due to difference in Inter-State ABT mechanism and Maharashtra State ABT mechanism principle, it is not possible for the Generator to pick up as the UI impact will be on the other utilities. We feel that for integrated grid operation, generators should response according to Grid conditions and their response should not be influenced merely by commercial reasons.

30.8 NHPC has submitted that overload capacity depends on reservoir level, tail race level, tunnel capacity and operating parameters in the running condition. Therefore, it shall not be possible for the hydro generating units to ramp up to 110% of the MCR. The same may be limited to 5% over load capacity. It is clarified that as per the CEA (Technical Standards for connectivity to the Grid) Regulations, 2007, the hydro generating unit shall be capable of generating upto 110% of the rated capacity (subject to rated head available). Hence no modification is required in the regulation.

30.9 Tata Power has commented on Regulation 5.2 (g) and 5.2 (h) of draft grid code regulations as under:

*“Partially loaded generator, for e.g. 500 MW Unit operating at 400 MW and meeting the demand as per the requirements of DISCOMs, if it operates to full capacity for frequency < 49.7, then this will result in flow of 100 MW in the grid.*

*The Governor Control Mode results in additional generation for a drop in frequency. However, such generation over the schedule should be commercially acceptable to the generator which is possible only if the UI rate is higher than the variable cost of generation. A commercial mechanism for recovery of cost of generation, especially when UI rates are lower than generation cost needs to be formulated.*

*Similarly, the mechanism needs to address the case where generator is required to drop generation for frequency > 50.0 Hz. It must be noted that the Intra - State ABT in Maharashtra has kept the generator out of UI mechanism. The generator who contracts with the DISCOM gets paid for only the Actual Generation. Hence any drop in generation results in DISCOM paying for the additional power purchase that it needs to do and that too at the System Marginal Price. Hence, the settlement mechanism in the intra state ABT needs to be in line with the FGMO operation of the generators as System Marginal Price mechanism is followed in Maharashtra.*

*Further, in case of pondage based hydro station which also meets the daily drinking and other water requirements of tail race users, the generation is scheduled to DISCOMs for certain period of time say 10 hours in a day at say 100 MW per hour. The DISCOM would consider this availability of hydro generation for planning power purchases for meeting the full demand. In case frequency remains low continuously, the hydro generation will get picked up due to FGMO and the water quota is exhausted in say 8 hours of operation. In the remaining two hours, DISCOM will have to overdraw from the grid, may be at a higher UI rate as in Maharashtra, the UI of the generator is to be borne by the DISCOM who is contracting the power with such hydro station.*

*Similarly if the frequency remains high and generation gets dropped in certain period of time, it will not be possible to meet the daily tail race users requirement.*

*It is suggested that these hydro generators need to be excluded from FGMO.”*

30.10 We have examined the suggestion of Tata Power. The regulation has been modified and now as per the grid code regulations, the restricted Governor mode

of operation shall start at 50.2 Hz in place of 50 Hz so that no financial loss occurs to the generators in case they participate in Restricted Governor mode of operation. Further, hydro generating stations with pondage upto three hours are exempted from restricted governor mode of operation.

30.11 WBSETCL has suggested that during bad weather conditions, etc. demand falls without any control of users so the word 'except under uncontrollable situation' should be incorporated in Regulation 5.2 (i).

30.12 We appreciate the concern of WBSETCL. However, the grid security is paramount for integrated operation. Any sudden variation beyond a particular limit would jeopardize the grid security. An exception has already been provided for emergency conditions. Hence, the regulation is retained.

30.13 SLDC, Maharashtra has commented on Regulation 5.2 (i) that as the demand of Maharashtra state is around 18,000 MW (1% is equal to 180 MW), hence the quantum of sudden variation in load may be proposed 'in percentage' of demand/ supply of that State.

30.14 We appreciate the concern of SLDC, Maharashtra. However, the grid security is paramount for integrated operation. If the variation limit is defined in terms of the percentage of demand/ supply of the State, then it would become difficult for the RLDC to monitor compliance. Hence, the regulation is retained.

### **31. System Security Aspects (Regulation 5.2 (I) of draft grid code regulations)**

- 31.1 The draft regulation had the following provisions:
- “5.2 (l) All users and SLDC shall make all possible efforts to ensure that the grid frequency always remains within the 49.5 – 50.2 Hz band.”
- 31.2 Shri A. Velayutham has submitted that the tightening of frequency band from 49.2 – 50.3 Hz to 49.5 - 50.2 Hz is a welcome step in the right direction. However, it is necessary to further move very close to 50 Hz operation. Only then it may be possible to adopt full FGMO operation from present restricted FGMO operation. Full FGMO may improve System performance through better Primary Control. Variations in frequency can cause equipment, protection and control malfunction. Also it affects the quality of Industrial product. Internationally the frequency control through Secondary Control is between 20 and 200 mHz. (0.02-0.2Hz).
- 31.3 Shri A. Velayutham has suggested to incorporate the following after sub-regulation (i):
- (a) Regional system has been defined as the ‘Control Area’. It is the responsibility of RLDC to maintain the frequency of the Region within 49.5 - 50.2 Hz band.
- (b) SLDC needs to be told to estimate day ahead demand at 50 Hz. Gap in Supply, if any, have to be managed through load management measures.
- 31.4 HPSEB has submitted on Regulation 5.2 (l) that the existing frequency band of 49.2 - 50.3 Hz as per IEGC Regulations 2006 shall not be changed at least for next two years as the capacity additional are at anvil under State/ Central/

Private Sector otherwise narrowing down the frequency band will give boost to price rise.

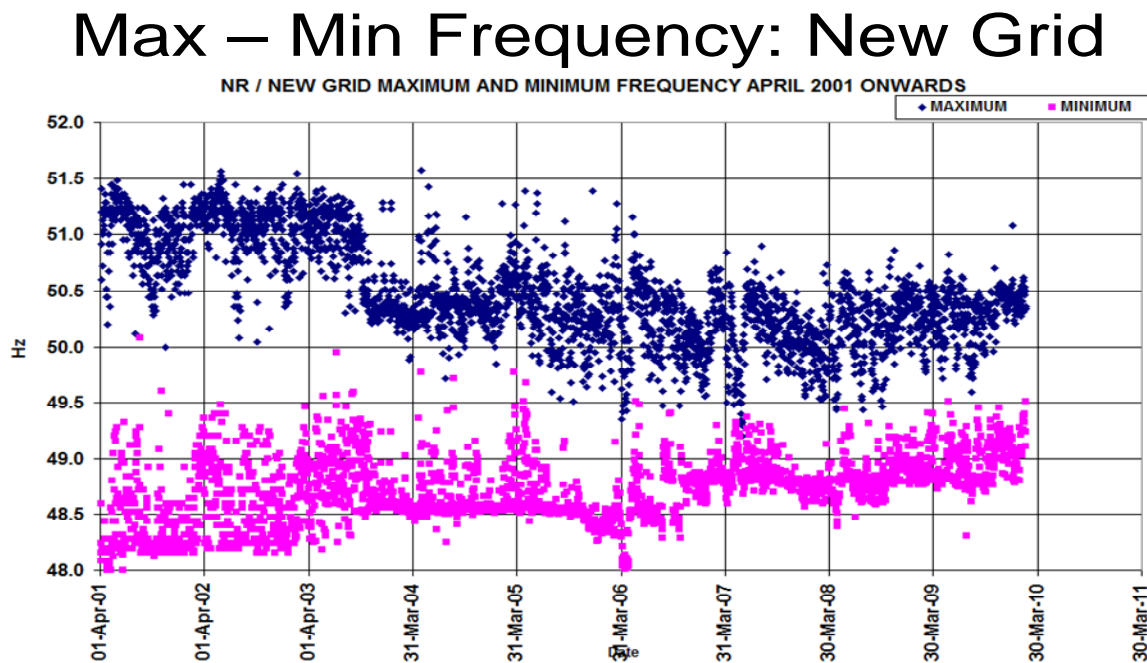
- 31.5 TNEB has submitted that as the country is still under shortage condition and it will take some more time to reach a surplus stage, restricting the frequency band to 49.5Hz-50.2Hz can be postponed. The narrowing down of frequency limits may be considered after integrating NEW grid with Southern Regional Grid.
- 31.6 NLDC and Sh. A. Velayutham have welcome the tightening of frequency band. APTRANSCO, HPSEB, TNEB, OPTCL have requested for deferring of this decision on the ground that due to the prevailing Shortage conditions the narrowing of the frequency band would result in increased load shedding and interruptions of supply as well as increased market rate of power.
- 31.7 We have examined the issue in detail. The frequency profile of the regional grid deteriorate sharply due to over-drawal by the utilities. It is observed that the Power Number of the integrated Northern, Eastern, North-Eastern and Western (NEW) grid is 1800 MW/Hz. This indicates that the required load restriction corresponding to narrowing down frequency band by 0.3 Hz would be about 540 MW in the NEW grid. This quantum of load restriction can easily be managed collectively by the constituents of the new grid. However, this tightening of frequency band will significantly improve the grid security as well as the quality of power supply to the consumers. Further, the reduced fluctuation in frequency would ensure better performance of generating stations and user appliances.

31.8 From the past experience of the narrowing down of frequency band it is learnt that the measure certainly results in improved grid operation. The Commission vide notification dated 30th March, 2009 had reduced the operational range of frequency from 49Hz - 50.5 Hz to 49.2 Hz -50.3 Hz w.e.f. 1st April, 2009. This resulted in improvement in grid discipline and frequency profile of NEW grid as detailed below:

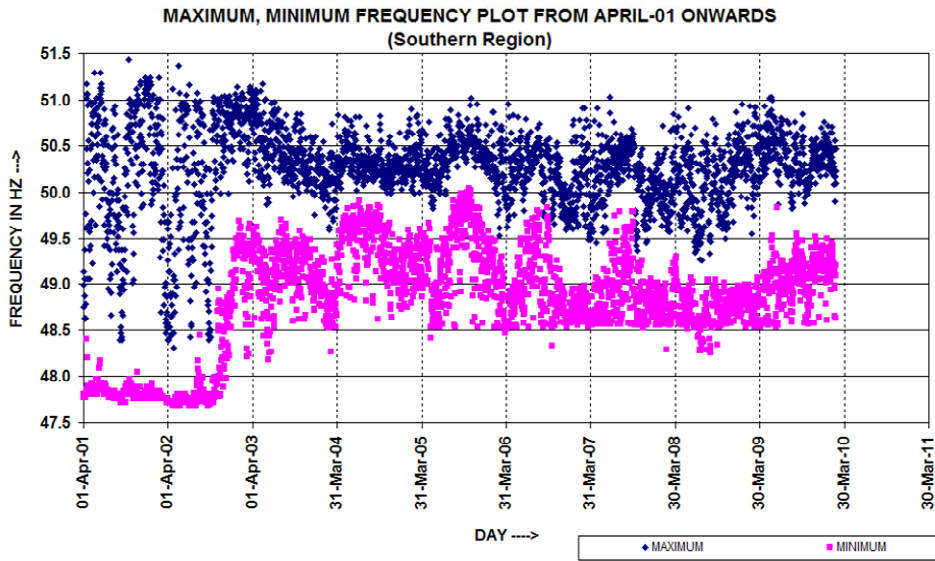
(% of time)

| Frequency     | 2008-09 | 2009-10 |
|---------------|---------|---------|
| 49.0-50.5 Hz  | 91.62   | 96.82   |
| Below 49.0 Hz | 8.25    | 2.75    |
| Below 49.5 Hz | 52.96   | 32.3    |

The graph representing improvement in frequency profile of NEW grid and SR grid are given below:



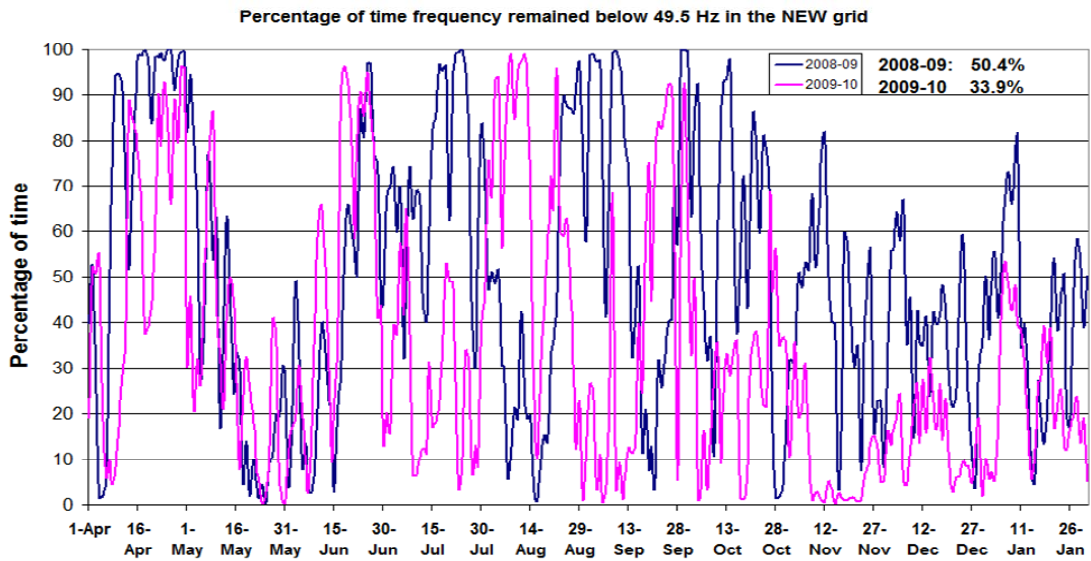
# Max – Min Frequency: SR Grid



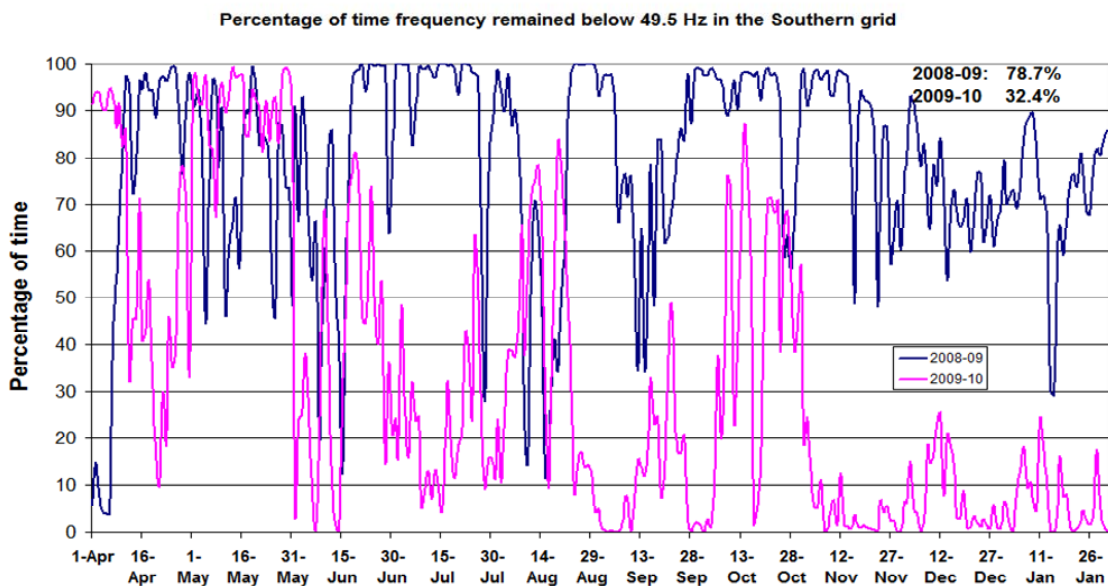
Similarly percentage of time when frequency remained below 49.5 Hz is given below:



## % of Time Freq < 49.5 Hz for NEW Grid



## % of Time Freq < 49.5 Hz for SR Grid



From the data given above, it is evident that despite shortages, the constituents had shown better discipline to keep the frequency within permissible limits after reduction in operating range of frequency.

The improvement in frequency not only makes operation of grid safe and secure but also enhances the life of all grid connected equipments specially the generating machines which are not designed to operate in a wide band of frequency.

We are of the view that the narrowing down of the frequency band along with the restrictions on deviation from the schedule as stipulated in the amended UI Regulations would motivate the constituents States for better planned load management and generation capacity addition.

- 31.9 Sh Velayutam, Ex Member, MERC has suggested modification in draft Regulation 5.2 (m) so as to assign the function to carry out inspection of UF Relays and df/dt Relays to RLDC instead of RPC. WE are of the view that RLDC should be involved in online grid operation of monitoring the relief obtained through UF and df/dt relays and off-line activities like inspection of df/dt should be done by RPC secretariat in coordination with utilities. Therefore, we are of the view that no modification is required.

31.10 HPSEB and TNEB have commented on draft Regulation 5.2 (r) that the minimum voltage range may be kept as per IEGC 2006 for at least one year. GUVNL and InWEA have submitted that in draft Regulation 5.2 (r), 66 kV nominal voltage may be included. We have considered the comments of various stakeholders. We observe that voltage is a critical system parameter for Power System Stability. Under voltage beyond critical level would lead to voltage collapse. We, therefore, decided to continue with the limit of voltage variations as per the draft regulations. However, we have also added voltage variations for lower voltages in the finalized grid code regulations. These voltage limits are as per the CEA (Technical standards for connectivity to the grid) Regulations, 2007.

31.11 SLDC, Gujarat welcomed the step of including Regulation 5.2 (t). GUVNL has suggested for including all renewable sources of energy in Regulation 5.2(t). We agree with the suggestion and the regulation has been modified accordingly.

31.12 NTPC has suggested including the phrase “safety of personnel and equipment is not endangered” in Regulation 5.2(t) (iv). We agree to the suggestion and modification has been made in the final regulation.

**32. Demand Estimation for Operational Purposes( Regulation 5.3 of draft grid code regulations)**

32.1 SRPC has submitted that the demand estimation is to be done on block-wise (15 minutes).

32.2 We feel that if this demand forecast is done daily/ weekly/ monthly/ yearly basis by the SLDC, it would be in a better position to carry out operational planning using demand estimate. We, therefore, have added the word 'yearly' in the regulation. Time - block -wise demand estimation would become a very cumbersome process and may not be practical.

32.3 SLDC, MP and SLDC, Maharashtra have suggested that the demand estimation shall be planned by the respective distribution licensees in the State and given it to SLDC for monitoring and onward submission.

32.4 SLDC, Gujarat has suggested modification in draft Regulation 5.3 (c) as under:

“On the basis of load and demand forecast furnished by distribution licensee, each SLDC shall develop methodologies/ mechanisms for daily/ weekly/ monthly/ yearly demand estimation (MW, MVA<sub>r</sub> and MWh) of State as a whole for operational purposes. Based on this demand estimate and the estimated availability from different sources, SLDC shall plan demand management measures like load shedding, power cuts, etc. SLDCs shall also maintain historical database for demand estimation.”

32.5 After considering the comments of the various stakeholders, Regulation 5.3(c) has been modified and included in the grid code regulations as under:

“Each SLDC shall develop methodologies/ mechanisms for daily/ weekly/ monthly/ yearly demand estimation (MW, MVA<sub>r</sub> and MWh) for operational purposes. Based on this demand estimate and the estimated availability from different sources, SLDC shall plan demand management measures like load shedding, power cuts, etc. and shall ensure that the same is implemented by the SEB/ distribution licensees. All SEBs/ distribution licensees shall abide by the demand management measures of the SLDCs and shall also maintain historical database for demand estimation.”

### **33. Demand Disconnection( Regulation 5.4.2 of draft grid code regulations)**

33.1 NTPC has suggested that the regulation should stipulate that distribution entities are obliged to meet the demand of their customers and the Act casts responsibility on them to take steps to ensure the same. It is clarified that this comes under the purview of SERCs hence this suggestion was not accepted.

33.2 Shri A. Velayutham has submitted that UI mechanism interferes with System Operation and it is difficult to implement sub-Regulation (a) in the context of allowed frequency band 49.5-50.2 Hz under UI. He further submitted that permitting over drawal upto 49.5 Hz under UI, and then abruptly asking the DISCOMs to cut huge chunk of load is not a good System Operation practice. It is clarified that UI mechanism does not interfere with the system operation. UI mechanism is a post facto settlement of deviation and tool for ensuring grid discipline. Action of restricting over drawl should be initiated at frequency 49.7 Hz so as to avoid disrupting huge chunk of load at 49.5 Hz.

33.3 TNEB has requested amendments in draft Regulation 5.4.2(b) suggesting that, action to restrict the drawal from the grid, within the net drawal schedule should begin whenever the system frequency falls to 49.5 Hz instead of 49.7 Hz. It is clarified that as the frequency band has been redefined to 49.5 Hz – 50.2 Hz, we feel it is necessary that the corrective actions should start at 49.7 Hz.

- 33.4 TNEB has commented on draft Regulation 5.4.2 (c) that the Government may have to be consulted for implementation of the state of the art demand management scheme and may take more time for implementation and hence it may be deferred for the time being. We appreciate the views and the time line for implementing the automatic demand management has been extended to 1.1.2011.
- 33.5 WBSEDCL and WBSETCL have submitted that CERC or Grid Code has no jurisdiction over the SLDC in regards to carrying out of real time operations for grid control and despatch of electricity within the state in accordance to sub-section (2) of Section 32 of the Act. WBERC submitted that Demand management schemes for automatic demand management like rotational load shedding, demand response which may include lower tariff for interruptible loads, etc. shall be formulated in the State Grid Code by the concerned SERCs, to reduce over drawal in order to comply with Regulation 5.4.2 (a) and (b).
- 33.6 It is clarified that in integrated grid operations, Load Generation Balance is for the grid as a whole and state grid and regional grid operation cannot be treated separately as any deviation affects all grid connected entities at regional level. As per Electricity Act, 2003 the function of CERC is 79 (c) to regulate the inter – State transmission of Electricity and under 79 (h) to specify Grid Code having regard to Grid Standards. By operating the system at parameters not in line with Grid Standards, State utilities/STU are endangering safe and reliable operation of the grid as a whole, which affects not only state grid but it affect all other entities

connected to grid. To protect the interest of consumers in the control areas of utility which at the same time fully adhere to Grid Discipline, it is necessary for the Commission to provide provisions in the Grid code which promote safe and reliable operation of Grid as a whole. This is in the interest of all grid connected entities to implement these measures in their control areas.

- 33.7 SLDC, Gujarat has suggested that following may be inserted after Regulation 5.4.2 (e):

*“Non compliance of the directives of SLDC by any distribution licensee/ bulk consumer to curtail drawl consequently resulted in non compliance of Indian Electricity Grid Code shall be reported by SLDC to CERC. Unless specified in the IEGC, the SLDC shall report to respective SERCs for any non compliance of directions issued by SLDC for appropriate actions.”*

- 33.8 It is clarified that as this is a subject matter of detailing under the purview of SERCs, this provision may be included in the respective State Grid Codes.

**34. Periodic Reports( Regulation 5.5 of draft grid code regulations)**

- 34.1 IWTMA has requested that such reports shall be available for other stakeholders of the grid/ network. It is clarified that the weekly report would be available on the web-site of RLDCs from where any person can access these reports.

**35. Procedure for Operational Liaison( Regulation 5.6.2 of draft grid code regulations)**

35.1 WBSETCL has suggested that RLDC has to issue directives to STU or any other user under State through the respective SLDC. Hence the Regulation 5.6.2 needs to be redrafted accordingly.

35.2 SLDC, Gujarat has suggested that Regulation 5.6.2 (a) may be modified as under:

*“Before any Operation is carried out on Regional grid, the RLDC will inform each user/STU/SLDC/CTU, whose system may, or will, experience an operational effect, and give details of the operation to be carried out.*

*In the case of any operation carried out in one region is affecting the other adjoining state grid of other region whose system is experiencing operational effect, the such operation shall be carried out in concurrence with those affecting RLDC/SLDC. The respective RLDC may also give specific directions to such transmission licensee to act as above.*

*Immediately following an event on Regional grid, the RLDC will inform each user/STU/SLDC/CTU, whose system may, or will, experience an operational effect following the event, and give details of what has happened in the event [but not the reasons why].*

*Any operation in a region having impact on other region(s) shall be intimated by the concerned RLDC to NLDC.*

*Immediately following an event in the National/ integrated Grid, NLDC would keep all RLDCs informed about such events.”*

35.3 The suggestions of WBSETCL and SLDC Gujarat have been accepted and Regulation 5.6.2(a) and 5.6.2(b) have been modified by including ‘SLDC’ in the appropriate places in the grid code regulations.



**36. Outage Planning: Introduction( Regulation 5.7.1 of draft grid code regulations)**

36.1 NTPC has suggested that Regulation 5.7.1 (c) may be modified to make provision so that any deviation in outage plan may be made with the prior due notice to concerned RPC and RLDC instead of prior permission of concerned RPC and RLDC. We do not accept the suggestion of NTPC because outage plan is formulated in consultation of all the members of RPC and reviewed quarterly. Any sudden change in plan would adversely affect the load generation balance plan of the utility and it would be difficult for the utility to arrange power in short time and frequent deviation must be discouraged. Deviation shall be allowed only after permission of RPC and RLDC. A new Regulation 5.7.4 (j) had been added providing that RPCs shall submit quarterly, half-yearly reports to the Commission indicating deviation in outages from the plan along with reasons. These reports shall also be put up on the RPC website.

36.2 GETCO and InWEA have submitted that in order to extract maximum power from available renewable energy generation capacity, a condition may be added that annual outage plan of Wind Farm or associate transmission lines should be preferably planned during lean wind season, planned outage of solar power should be scheduled during rainy season and planned outage of run-of the hydro power plant in lean water season. It is clarified that this is already covered under Regulation 5.7.1 (c).

**37. Scope( Regulation 5.7.3 of draft grid code regulations)**

37.1 SRPC suggested to include RPCs in Regulation 5.7.3. We agree with the view of SRPC and the regulation has been modified accordingly.

**38. Recovery Procedures( Regulation 5.8 of draft grid code regulations)**

38.1 APTRANSCO has suggested that there is need for self start facility at Gas generating stations in addition to Hydel generating stations. It is clarified that in accordance with CEA (Technical Standards for connectivity to Grid) Regulations, 2007, the requirement of black start facility is required for Hydro generation only. This cannot be made compulsory for Gas based generating station. In case regional operational requirement need this, it can be incorporated in the regional plan and procedures for restoration prepared by RLDCs.

38.2 Athena Chhattisgarh Power Pvt. Ltd. has submitted that in Regulation 5.8 (c), the role and responsibilities of IPPs in this activity may be brought out in the IEGC. It is clarified that the grid code is applicable to all grid connected entity irrespective of ownership. Hence there is no need to specify it separately.

**39. Event Information: Responsibility (Regulation 5.9.4 of draft grid code regulations)**

39.1 SLDC, Gujarat has suggested that Regulation 5.9.4 may be modified as as under:

- a) The RLDC/SLDCs shall be responsible for reporting events to the users, NLDC/RLDC/RPC Secretariat. The same shall be informed to respective STU /CTU as these cases may be.
- b) All users, STU, CTU shall be responsible for collection and reporting of all necessary data to NLDC, RLDC, SLDC and RPC Secretariat for monitoring, reporting and event analysis.

39.2 Suggestion of SLDC Gujarat on 5.9.4 (b) has not been agreed because it will result in absolving SLDC of any responsibility of data collection and reporting. SLDCs are important interface of system operation at State level and aggregation and collection of data at SLDC level is must for checking integrity and usefulness of data. For any event related data, verification through SLDC is must to understand exact sequence of events.

**40. Event Information: Reporting Procedure (Regulation 5.9.6 of draft grid code regulations)**

40.1 WRPC and SRPC have suggested that reporting of events in the grid should also be to RPCs along with the RLDCs. We appreciate the view and it is clarified that the operation at the regional level by RLDC is done in coordination with RPC. Hence the reports of important events in the grid shall continue to be sent by RLDCs to RPCs and CEA as per the prevailing practices. For analysis of important events all users shall also provide necessary reports and data to RPCs.

**41. Demarcation of responsibilities( Regulation 6.4 of draft grid code regulations)**

41.1 GUVNL has appreciated the revised Regulation 6.4 on 'Demarcation of Responsibilities' and praised the initiative of the Commission to decide the

jurisdiction of RLDC/ SLDC for units put under commercial operation. The provision for switching between RLDC and SLDC pursuant to commercial operation of units/ stages of the project depending on the share of power outside or inside the host State is exemplary.

41.2 RLDCs and NLDC have submitted that it would be preferable to retain the present limit of 1,000 MW capacity in line with earlier order of the Commission in Petition 58/2008 and IEGC, 2006. However, in view of Regulations on Connectivity etc., it would be appropriate that thermal power stations of 500 MW and above capacity and hydro power stations of 250 MW and above capacity should come under scheduling jurisdiction of RLDC if major share from such power stations is outside the host state. The timeline by which the above capacity is achieved is also important. It has been proposed in the draft IEGC that there would be changeover from one control area jurisdiction to other based on share to host state / other states. Such toggling of control area jurisdiction would lead to the following issues:

- Metering system: Different states follow different metering/ meter data processing system, and sometimes they are at variance with practice followed at regional level. With change in control area jurisdiction, it would be difficult to change the metering system and should be avoided.
- It would lead to problem in scheduling and UI accounting

Implementation of loss when the station is with SLDC/ RLDC totally varies. STOA also will have a major impact since scheduling agency changes.

41.3 RLDCs and NLDC have submitted that Regulations 6.4.2 to 6.4.4 may be modified as under:

“The RLDC shall coordinate the scheduling, metering etc of the following generating stations which accordingly shall be treated as Regional Entity/Control Area:

- (i) All Central generating stations (excluding stations where full share is allocated to host state)
- (ii) Generating stations only directly connected to ISTS/ CTU network and fulfilling following conditions:
  - (a) Station Capacity is above 500 MW and above in case of a thermal Generating station
  - (b) Station Capacity is 250 MW and above on case of hydro generating stations
  - (c) The Capacity as above shall be reckoned based on the Engineering Procurement and Commissioning (EPC) contract given by the plant developer or based on approved Long Term Access.
  - (d) More than one Regional Entity / control area has share in it and share of other regional entities is more than host regional Entity/Control Area.
- (iii) Generating stations connected with both Regional Transmission System and State Transmission System and fulfilling following conditions:
  - (a) Station Capacity is above 500 MW and above in case of a thermal Generating Stations
  - (b) Station Capacity is 250 MW and above on case of hydro Generating Stations
  - (c) The Capacity as above shall be reckoned based on the Engineering Procurement and Commissioning (EPC) contract given by the plant developer or based on approved Long Term Access.
  - (d) More than one Regional Entity/ Control Area has share in it and share of other regional entities is more than host regional Entity/ Control Area.

- (iv) In case, a thermal generating stations of 500 MW and above and hydro generating stations of 250MW and above has connection to both CTU and STU network, scheduling and other functions performed by the system operator of a control area will be done by the RLDC or SLDC, depending on whether the share of power in a generating station's installed capacity or likely capacity after one year. (i.e. where long-term access has been granted) is more for outside the host state or inside the host state. (Explanation: If the share for the host state is 30% and that outside the host state is 40% then the RLDC shall coordinate the scheduling; if on the other hand share for the host State is 40% and outside the host State, it is 30% then the SLDC shall coordinate the scheduling).
- (v) RLDC shall coordinate the scheduling of power stations satisfying the above criteria, if the share inside and outside the host State is the same
- (vi) All generating plants desirous of coming into ISTS jurisdiction area would need to follow the registration and commencement of scheduling procedure to be formulated separately by NLDC/RLDCs.
- (vii) In case commissioning of a plant is done in stages the decision regarding scheduling and other functions performed by the system operator of a control area would be taken on the basis of financial closure of the project. However, further scrutiny of the application may be done by NLDC/ RLDCs as per the registration and commencement of scheduling procedure.
- (viii) For all cases other than above, scheduling will be done by the concerned SLDCs. The role of the concerned RLDC in such case shall be limited to consideration of the schedule for inter-State exchange of power on account of this generating station while determining the net drawal schedules of the respective control area.
- (ix) There may be exceptions with respect to above provisions, for reasons of operational expediency, subject to approval of CERC.
- (x) The geographically fragmentation of Control Areas shall be avoided. Thus a generating Company having two or more power stations shall not be treated as a single Regional Entity/control area. However Control Areas already in existence shall not be disturbed. A similar treatment would be applicable for control area for drawing power. A drawee control area would be eligible to become Regional Entity/Control Area and come under the direct

jurisdiction of RLDC only if (i) it is directly connected to the ISTS (ii) has long term - access portion of its power from outside the state.”

41.4 SLDC, Gujarat has suggested modification in draft Regulation as under:

“The national interconnected grid is divided into control areas, like Regional ISTS, States, DVC, etc. where the load dispatch centre or system operator of the respective control area controls **directly** its generation and/or load to maintain its interchange schedule with other control areas whenever required to do so and contributes to frequency regulation of the synchronously operating system and **exercise the operational actions effectively**.”

Further, while determining the control area, we suggest that ideally the control area should be defined on the basis of notional periphery covering territorial jurisdiction and all the generation stations, distribution licensee, bulk power customers etc. shall be within jurisdiction of that control area of respective State.”

41.5 SLDC, Maharashtra has submitted that if the state is having predominant share then scheduling and energy accounting of the generator will have to be carried out by SLDC and subsequently if the share of host state reduces then energy accounting of the generator will have to be carried out by RLDC. During such changeover of control the issues related to metering may arise in view of different ABT mechanism in state and central. In this scenario the procedure of energy accounting may be specified.

41.6 SLDC, Gujarat has suggested in draft Regulation 6.4 (2) (c) (iii) the sentence ‘(i.e. where long-term access has been granted)’ may be replaced by ‘(i.e. where Power Purchase Agreement executed)’. SLDC, Gujarat further suggested in draft Regulation 6.4 (2) (c) (iv) the word ‘RLDC’ may be replaced by ‘SLDC’.

41.7 SLDC, Gujarat has fully endorsed the proposal of this order. However, in case any difficulty is raised and if the Commission considers to revise above provision, the switchover proposed from next billing period can be extended from the next financial year.

41.8 CSPTCL has submitted that in Regulation 6.4 (2) (iii), it has been mentioned that the control area of SLDC and RLDC would be according to the share of power of the host State and the share of the power of the customer outside the host State. The situation may render the change of control area very frequently. In Regulation 6.4 (2) (v) reference have been made for expeditious changeover of the control area. Here sufficient time needs to be permitted for change over of control area as this requires modification in billing software and other formats.

41.9 WRPC has submitted under Regulation 6.4 (2) (c) (v) of the draft IEGC Regulations, 2010 that linking the decision for deciding the control area depending upon the commercial operation of the generating units as and when added will result in frequent shifting of control area from SLDC to RLDC or as case may be.

41.10 CEA in Regulation 6.4. 2(c) (iii) has proposed the following:

“If a generating station is connected to both ISTS and the State network, scheduling, despatch, energy accounting etc shall be done by RLDC or SLDC and could be changed from time to time. This does not appear to be a practical proposition. In this context it would also be pertinent to add that for the purpose of startup power many generating stations get connected to the State network. Further, it is to be noted that a generating stations may not be able to tie up long term PPA within the home state or even



with outside states and may operate as a merchant plant supplying power on medium term and short term contracts. Such a station is essentially an inter-state generation stations and should fall in the control area of RLDC. From a legal perspective any generating station which is connected to ISTS only or both to ISTS and STU system can be brought under the control jurisdiction of RLDC. From a practical perspective it may be kept in view that SLDC's still lack independence and institutional capacity for doing real time energy accounting, installing special energy meters, etc. and in most of the states intra state ABT mechanism has not been put in place. If the proposal is implemented many new inter-State generating stations of IPPs may face hurdles in obtaining open access from the SLDCs. Therefore, it would not be desirable to push inter-State generating stations having connectivity with ISTS as well as STU in to the control jurisdiction of SLDC for the sake of reducing the work load of RLDCs.”

41.11 We have considered the submissions of CEA, NLDC, RPCs and the stakeholders. Divergent views were expressed by the stakeholders on various issues related to demarcation of responsibilities. Generally, the concept of control area given the draft regulation has been accepted. However, certain issues were raised by the stakeholders. We have given thoughtful consideration to the suggestions/ comments. We are of the view that in future, there may be a number of generators, developed by the private sector, having various types of contracts. They could also switch from one type of contract to the other. Some IPPs may have a contract with the host State for a part of the generating capacity and multiple separate contracts with the States outside the host State. Therefore, control area jurisdiction is very important. The control area jurisdiction has been defined based on twin principles of connectivity with CTU/ STU and percentage share of beneficiaries within and/ or outside the host State.

The case of generating station connected to both ISTS and STU needs careful consideration both from both operational and commercial point of views. The draft Regulation 6.4.2 (iii) – (v) related to this case are as under:

*“(iii) If a generating station is connected both to ISTS and the State network, scheduling and other functions performed by the system operator of a control area will be done by the RLDC or SLDC, depending on whether the share of power in a generating station (i.e. where long-term access has been granted) is more for outside the host state or inside the host state.*

*(Explanation: If the share for the host state is 30% and that outside the host state is 40% then the RLDC shall do the scheduling; if on the other hand share for the host State is 40% and outside the host State, it is 30% then the SLDC shall coordinate the scheduling).*

*(iv) RLDC shall coordinate the scheduling if the share inside and outside the host State is the same.”*

*(v) In case commissioning of a plant is done in stages the decision regarding scheduling and other functions performed by the system operator of a control area would be taken on the basis of above criteria depending on generating capacity put into commercial operation at that point of time. Therefore it could happen that the plant may be in one control area (i.e. SLDC) at one point of time and another control area (i.e. RLDC) at another point of time, if the higher share is earlier within the state and later outside the state. The switch over of control area would be done expeditiously after the change, w.e.f. the next billing period.”*

41.12 Considering the suggestions, Regulation 6.4.2 has been modified by substituting sub-clauses (iii) to (v) by sub-clauses (iii) and (iv) in the grid code regulations as under:

*“(iii) If a generating station is connected both to ISTS and the State network, scheduling and other functions performed by the system operator of a control area will be done by SLDC only .If state has more than 50% Share of power, The role of concerned RLDC, in such a case, shall be limited to consideration of the schedule for inter-State exchange of power on account of this ISGS while determining the net drawal schedules of the respective states. If the State has a Share of 50% or less, the scheduling and other functions shall be performed by RLDC.*

*(iv) In case commissioning of a plant is done in stages the decision regarding scheduling and other functions performed by the system operator of a control area would be taken on the basis of above criteria depending on generating capacity put into commercial operation at that point of time. Therefore it could happen that the plant may be in one control area (i.e. SLDC) at one point of time and another control area (i.e. RLDC) at another point of time. The switch over of control area would be done expeditiously after the change, w.e.f. the next billing period.”*

41.13 This has been done to ensure certainty in the demarcation of responsibilities.

The IPP with their business strategy would decide quantum of power to be sold through long term, Medium term and short terms. The connectivity to ISTS and STU system indicates that generator wants to avail this flexibility. As the customer of this type of generator would be in more than one region, RLDC through its communication system would be able to coordinate with more than one regions and also RLDC would be aware of system operating conditions like transmission constraints, Voltage conditions etc and would be in better position to ensure that scheduling to various consumers of the IPP is done optimally on day to day basis. Hence, we have decided that if the host State has more than 50% share of power, then that generating station shall be under the jurisdiction of SLDC, else it shall be under RLDC. Regarding the apprehension of some stakeholders on frequent toggling of control area jurisdiction, it is clarified that the control area jurisdiction is decided on the basis of permanent share of the host State, which will not change frequently, hence frequent toggling would not

be there. Moreover, initially when one or two units/ stages of the project will come under commercial operation, the jurisdiction would be more likely with SLDC depending on the share of the host State. On the progressive commissioning of units/ stages, it is more likely that the share of the host State would decrease and become equal to or less than 50%, resulting in shifting of control area jurisdiction from SLDC to RLDC. In future also, when more units are commissioned, it is more likely that the control area jurisdiction will remain with RLDC and there would not be frequent toggling. Regarding the apprehension of some stakeholders about the problem in metering during due to this toggling, it is clarified that the interface meters at CTU and STU interfaces shall be installed as per the CEA regulations on metering. It is further clarified that as switchover of control area would be done expeditiously after the change w.e.f. the next billing period i.e. next week UI accounting there shall not be any problem in energy accounting as anticipated by SLDC, Maharashtra. For inter-State energy accounting, it shall be as per CERC ABT mechanism.

**42. Automatic load management (Regulation 6.4.7 of draft grid code regulations)**

42.1 HPSEB has submitted that the automatic load management scheme is so far not fully commissioned. However, manual load shedding is being resorted to. Narrowing down of frequency band i.e. 49.5 Hz to 49.7 Hz shall result in indiscriminate load shedding and shall have adverse impact on the life of EHV/

HV switchgears. These issues raised by HPSEB have already been dealt with while dealing with comments on Regulation 5.4.2 (a) & (b).

42.2 NTPC in Regulations 6.4.7 and 6.4.8 has suggested that the reference to STU may be deleted from these Sections. The suggestion has been accepted and the regulation has been modified accordingly.

42.3 TNEB in Regulation 6.4.10 has suggested that under deficit condition, the generators may be permitted to generate beyond the permissible limits as specified under the UI Regulations 2009. However, for generation beyond 105% in a time block and 101% for the day, the variable charges only need to be paid to the generator. It is clarified that this issue has been dealt in amended UI Regulations.

42.4 NTPC has requested to amend Regulation 6.4.14 that there may not be any necessity to file agreements containing details of tariffs and payment terms with RLDC and RPC for scheduling and regional energy accounting. It is clarified that this regulation was part of earlier Grid code also. The suggestion of NTPC was not accepted as it shall be applicable to all and a special dispensation for Central Generating Stations cannot be made.

42.5 NTPC in Regulation 6.4.16 has suggested that under fuel shortage condition, thermal generators have the option of making declaration specifying minimum MW, maximum MW and MWh capability. It is submitted that during the past there have been instances when generator has been scheduled for the full MWh

capability declared but certified for DC less than its declared MWH capability. To eliminate such aberration, it is suggested that procedure for declaration and certification under fuel shortage conditions may be issued by RLDCs/ NLDC for approval of the Commission. This is imperative to prevent abuse of the provision of scheduling under fuel shortage condition. It is clarified that the issue is related Tariff Regulation and needs be addressed suitably in accordance with these regulations.

42.6 Regarding Regulation 6.4.25, NTPC has suggested to modify the draft regulation by deleting the second sentence of this Regulation. The suggestion has been accepted and the provisions of sub-clause (25) in Regulation 6.4 in the draft grid code regulations has been deleted.

**43. Scheduling and Despatch procedure( Regulation 6.5 of the draft grid code regulations)**

43.1 WBSETCL has submitted that, in Regulation 6.5.5, provisions should be made to check the intra-State congestion during preparation of schedule, whenever any intra-State entity is engaged in collective transactions. It is clarified that this has to be considered by SLDC while giving its concurrence.

43.2 On draft Regulation 6.5.5, TNEB has submitted that whenever there is a steep change in the cleared quantum in the power exchange, the deviation in the drawal schedule of the regional entities as a result may be permitted without

being deemed to have violated the IEGC provisions. The suggestion cannot be accepted from the point of view of grid security.

43.3 NHPC on the illustration in draft Regulation 6.5.13 has commented as under:

“The quantum of energy which could not be dispatched by the hydro station due to transmission constraints shall also be adjusted in the 4<sup>th</sup> day schedule of the generating station” is not logical because if there will be spillage of water due to Transmission Constraint the Hydro Generator will not be able to produce generation on day 4 equal to spillage occurred on day 1 as the availability of water is not under the control of Hydro Generator. Thus the actual generation during day 1 when there is Transmission Constraint should be treated as Scheduled Generation and no UI should be applicable on day 1. Hence no compensation is required to be given in day 4 schedule regarding under generation due to transmission constraint. Accordingly the illustrations should be modified and C1, C2, C3 C4-----should be eliminated and made equal to zero.”

43.4 We have considered the suggestion of NHPC and have withdrawn the proposed change regarding transmission constraint.

43.5 On draft Regulation 6.5.17, NTPC has proposed that NLDC/ RLDC may prepare a procedure for determining and declaring grid disturbance. The procedure when approved by the Commission shall become a part of the IEGC. It is clarified that the classification of the grid disturbances shall as per CEA (Grid Standards) Regulations.

43.6 WBSETCL has submitted that Regulation 6.5.17 should be made applicable for all regions as any grid disturbance in any region has also consequential impact in other region also. We are not inclined to accept this suggestion as the grid disturbance in a part of a region may not always affect other regions.

43.7 On draft Regulation 6.5.18, SLDC, Gujarat has submitted that since fuel related problem can be anticipated in advance and can be taken into account while declaring capability, RLDC may allow revision of declared capability by the ISGS(s) only for four times in case of fuel related problem. In this regard, we are of the view that for the sake of operational flexibility, the revision of declared capability should be allowed.

43.8 NHPC on draft Regulation 6.5.18 has suggested the following:

“In case of pure ROR power stations like Salal, Tanakpur and Uri, where virtually no variation in water level is possible since FRL and MDDL is same, in case of sudden increase in variation in inflow, these power stations may lead to an unwanted situation where power station can neither spill their water nor revise their schedule. This situation even may arrive in storage power stations. Therefore, in view of above it is proposed that revisions of  $\pm 10\%$  of the DC be allowed after every six hours.”

43.9 We appreciate the problem faced by the hydro generators. Therefore, we have allowed the revisions in Declared Capability every six hours and accordingly, Regulation 6.5.18 has been suitably modified in the grid code regulations

43.10 On draft Regulation 6.5.19, CEA has suggested the following:

“In case of a forced outage all generating stations irrespective of their nature of PPA, whether long term, medium term or short term, should be allowed to revise their schedule with the exception of schedules for day ahead collective transactions cleared through a power exchange. If large number of generating stations supplying power under long term, medium term and short term bilateral contracts are not allowed to revise their schedule under forced outage, it may result in serious grid imbalances.

CEA also submitted that in the UI Regulations, 2010, a limit has been put on under injection by the generator. To do so, the generators must have facility to revise their declaration in case of forced outages. However, this



Regulation of proposed IEGC allows only generator with two part tariff and long term contract to revise their schedule in case of forced outage. Therefore to have a level playing field and to enable generators to generate close to their schedule, generators supplying through bilateral transactions under open access should be given right to revise declaration in case of forced outages. Since such events are not so common in a well maintained generating station, a limit say once per day may also be specified for this purpose.”

43.11 We are in agreement with the views of CEA. The issue of handling Grid imbalance is important and Regulation 6.5.19 has been modified to allow revision of schedules to a generator of capacity of 100 MW or more, in case of short term bilateral transactions, in case of forced outage, with the objective of not affecting the existing contracts, the revision of schedule shall be with the consent of the buyer till 31.07.2010. Thereafter, consent of the buyer shall not be a pre-requisite for such revision of schedule.

43.12 NTPC has suggested modification in draft Regulation 6.5.21 which proposed that DC offered by a generating station, under fuel constraint conditions, cannot be revised except in the case of a Forced Outage. However, such revisions may become necessary on account of improved fuel availability particularly in gas stations outage at one station can enable diversion of same gas to other station where it can be utilized. After considering the suggestion the Regulation 6.5.21 has been modified by adding a proviso thereto as under:

“Provided that in case of gas based ISGS, for optimum utilization of gas, this shall be permitted, i.e. in case of tripping of a unit, this gas may be diverted to another unit using the same gas.”

43.13 On Regulation 6.5.21 SLDC, Gujarat submitted as below:

### **Comments**

*In regard to discourage frivolous revision, RLDC may, at its sole discretion, refuse to accept schedule/ capability changes of less than five (5) percent of previous schedule/ capability.*

#### **Rational**

*Since over injection up to 5% of declared capability is allowed and not construed as gaming, the generator can inject such power without declaration. Therefore, the limit of frivolous revision may be considered up to 5%.*

43.14 It is clarified that the provision in draft Regulation 6.5.21 for the refusal to accept schedule revision request for less than 2% variation was based on the reason that it may not be practicable to revise schedule for less than 2% which in a generating unit may be due to normal variations in fuel quality etc. The purpose of this regulation is to avoid frequent changes in schedules. This is not related to gaming possibility by the generator. Hence, the suggestion of SLDC, Gujarat has not been accepted.

#### **44. Special dispensation for scheduling of wind and solar generation (Regulation 6.5.23 of the draft grid code regulations)**

44.1 SLDC, Gujarat and GETCO have submitted that Regulation 6.5.23 may be modified to include existing wind generators. CEA has submitted that the wind forecasting tools are independent of the generating plant of the wind farms and therefore, there appears to be no technology related reason for proposal to exempt wind farms for which PPAs have already been signed from the requirement of wind forecasting. This exemption appears to have been made on the consideration that it will upset existing commercial agreements. In this regard, it needs no emphasis that new regulatory initiatives can always override prevailing contracts, like when ABT was implemented it altered the agreed

commercial arrangement between existing generating stations and their beneficiaries.

44.2 We are of the view that the existing contracts between the wind generators and the transmission/ distribution utilities should not be disturbed. In the final regulations, the provision has been made for old wind farms (A wind farm is collection of wind turbine generators that are connected to a common connection point) that it could be mutually decided between the Wind Generator and the transmission or distribution utility, as the case may be, if there is no existing contractual agreement to the contrary.

44.3 TNEB has submitted that Regulation 6.5.23 of draft grid code regulations may be modified as below:

“Scheduling of wind and solar power generation plants (existing and future plants) would have to be done where the sum of the generating capacity of such plants connected at the connection point to the transmission or distribution system is greater than one MW and the connection point is irrespective of the voltage level.”

44.4 We are of the view that in case of very small wind generators with a capacity of one MW, the forecasting would not be technically and commercially feasible and therefore the provision for scheduling of such generators should not be required.

44.5 On Regulation 6.5.23 of draft grid code regulations, APTRANSCO has submitted that the provision for revision of schedules by wind and solar power generating stations supplying inter-State power under LTA, MTOA and STOA may be

deferred for the time being. Considering the suggestion, the effective date for requirement of scheduling for wind generators has been specified 1.1.2011.

44.6 IWTMA and IWPA have suggested for making provisions for “Centralized wind forecasting facility in an area with an aggregated capacity of 200 MW and above. They also suggested that for implementing Wind energy forecasting system around 5 years of time may be specified by the concerned authority with due consideration of penetration level, cost and tariff. Once the forecasting methods proves the desired results, then the cap of 200 MW can be reduced by taking due account of statistical data available at that time.

44.7 We have considered the suggestion. Taking into view the current state of forecasting technologies, Regulation 6.2.23(ii) of grid code regulations now provides that the schedule of solar generation shall be given by the generator based on availability of the generator, weather forecasting, solar insolation, season and normal solar generation curve and shall be vetted by the RLDC in which the generator is located and incorporated in the inter-state schedule. If RLDC is of the opinion that the schedule is not realistic, it may ask the solar generator to modify the schedule.

44.8 On Regulation 6.5.35, NTPC has submitted that since URS power is available in a very short window, the step proposed in the draft grid code regulations is a welcome step which would facilitate utilization of URS power. It has been suggested that short-term open access application procedure may be simplified so that concerned RLDC can easily process the application and implement the

transaction after seller and buyer mutually agree. NLDC suggested removal of this Regulation as RLDC is not to assist in locating a buyer/ seller. IEX also stated that this is the function of market platforms and participants. We agree with the suggestion of NLDC and IEX. The Regulation 6.5.35 has been deleted.

**45. Reactive Power and Voltage Control (Regulation 6.6 of draft grid code regulations)**

45.1 Shri A. Velayutham, TNEB, S.K. Bhatnagar and Sub K Power have submitted that in a regulatory environment, Generators should also be included in the framework of Reactive Power Pricing. We are of the view that it is not technically correct to include Generators in commercial mechanism of reactive power. They can provide reactive support only as per limiting curve and beyond that reactive power generation is only possible by sacrificing active power output. Internationally also generator are kept out of these type of schemes.

45.2 TNEB, IWTMA and NTPC have submitted that the proposed reactive charge in Regulation 6.6.2 was very high. OPTCL submitted that sudden increase in reactive charges from 6 p/ kVArh to 25p/ kVArh in one go would result in over-compensation and redundant investment in power sector as distribution utilities, STU and the industries will rush to install capacitors. Since reactive compensation is ideally placed at the receiving end, this charge may be fixed at 10 p/ kVArh for users with effect from 1.4.2010 and can be raised by 1 paise every year till it reaches 15 paise.

45.3 WBSETCL and WBSEDCL have submitted that the basis of charge for reactive power as mentioned in Regulation 6.6.2 is not mentioned. CERC should first come out with a regulation for determination of such charges where principles and methodology of such determination shall be first prepared on the basis of the stakeholder's comments. Thus, such charges shall be maintained at present level only.

It is clarified that the reactive energy charge of 25 paise/kVARh with escalation rate at 0.25 paise/kVARh was proposed to incentivize the capacitor addition in State Transmission network. It has been experienced that even after concerted efforts at RPC level, the progress of capacitor installation programme was slow and voltage profile in certain pockets of the grid, during particular seasons was not good and lot of reactive energy transaction at inter-State points occurred. The proposal of 25 paise/ kVARh was aimed at the collection of these reactive charges in Reactive Pool Account for using this for installation of capacitors. Also high reactive energy charge would have forced States to install capacitor in their transmission and distribution system and avoid reactive energy drawl. During the public hearing apprehensions were expressed that this charge may result in over compensation. A comparative cost benefit analysis of investment in capacitor installation and reactive power drawl was undertaken by staff of the Commission based on recent purchase orders for capacitor installation by the STUs. We have concluded that 10 paise/ kVARh would be sufficient. Keeping in view the present cost of capacitors, investment in capacitor installation would give positive Net Present Value (NPV). An annual escalation rate of 0.5 paise/ kVARh will now be applied.

**46. Complementary Commercial Mechanism (CCM) (Annexure – 1 of the draft grid code regulations)**

46.1 APTRANSCO and SLDC, Maharashtra have suggested that the provision for a regulatory charge known as the Renewable Regulatory charge” may be deleted as it will unnecessarily burden the other States with no fault and ultimately burdened their consumers.

46.2 WBSEDCL and WBSETCL have submitted the followings on Regulation 6.1 (d):

“The differentiation of UI charges as provided under paragraph 5 & 6 of Annexure-I [referring to Sec.6.1 (d)] is not permissible under the Act. In spite of scope of revising the schedule 8 times in a day the dispensation provided to wind and solar has no merit at all. The liability arising out of UI charges of a state or solar/ wind generation has been distributed to other states or all over the country is a form of introduction of cross-subsidy in generation segment in contradiction to clause (g) of section 61 of the Act which in turn is a cross-subsidization between two sets of consumers of two different states. The blanket application of the said provision at 33kV and above is the intrusion by CERC over the jurisdiction of SERC. Thus both the provision 5 and 6 may be withdrawn.”

46.3 Shri S.K. Bhatnagar and Sub K Power have submitted that the introduction of levy of Renewable Regulatory charge under Regulation 6.1(d) is not justified because under the Section 86(e) of the Act, the State Commission has been vested with the function to promote co-generation and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. Therefore, the Central Commission has no purview to interfere in the functions of the State Commission as far as sale and purchase of the

electricity from Renewable Energy is concerned. The matter of sale and purchase of electricity also includes affecting a commercial mechanism on Renewable Energy Generation. Besides this, section 79 of the Act under is silent about the Central Commission's functions towards Renewable Energy (RE) Generation and it has no direct function on the subject. Levy of RRC shall be an over enthusiastic effort to develop a commercial mechanism at the cost of development/growth of the RE Generation which has basic and prime priority /importance and while enabling levies in the commercial mechanism are of minor importance and significance. Levy of RRC shall only hamper, barricade and discourage the growth of RE generation. It is unreasonable to expect a highly demanding, precise and real time job of wind/ solar energy forecasting system (working within 5-6 block periods on hour to hour or 7X24 basis) by individual developer or joint basis in the present scenario of unpredictable climate changes. Levying of Renewable Regulatory Charge on RE generators may not be in precedence and consequence of the success and results of imposing a UI on conventional generation and drawals since last few years and the Commission may not base its decision on this success story of UI. As such it shall be wise to withdraw from over emphasis on UI in phases by relying more and developing a feasible technical mechanism through Regulatory measures by utilizing cutting edge technology.

46.4 It is clarified that for inter-State transmission/ sale of power, the Central Commission can specify the regulation for promotion of renewable sources of energy. The RRF is a commercial mechanism to facilitate inter-State transfer of



the power and to ensure optimum utilization. This can be done by insulating such generators from UI charges upto certain level and to make provisions to avoid operational and commercial problems of the host State. The CCM for the renewable has been made keeping in view the national perspective. Our views on the issue have also been given in Para 5.4 of this order.

46.5 TNEB has suggested that in Regulation 6.1(d) of the Complementary Commercial Mechanism the Renewable Regulatory Charges on monthly basis may be adopted in real time basis also for the existing as well as future wind and solar installations irrespective of the voltage level. UI mechanism should reflect only the difference in load and generation of the given control area. In case of TNEB the variation of wind generation is also embedded in UI.

46.6 PricewaterhouseCoopers has submitted to exempt renewable sources of energy from UI charges.

46.7 NTPC has submitted that Sections 3, 4, 5 & 6 of Complimentary Commercial Mechanism have enumerated the methodology to be followed for scheduling of wind and solar generators. Section 4 (ii) of the Draft IEGC has proposed the following:

*“The schedule by such wind and solar power generating stations supplying inter-State power under long-term access and medium-term open access and short-term open access may be revised by giving advance notice to RLDC. Such revisions by wind and solar power generating stations shall be effective from 6<sup>th</sup> time-block, the first being the time -block in which notice was given. There may be maximum of 8 revisions for each 3 hour time slot starting from 00:00 hours during the day.”*

It would appear that wind and solar generators supplying inter-State power have been allowed a maximum of 8 revisions per day while no such cap is applicable to other generators supplying power under long-term access that could theoretically have as many revisions as required. Since the idea is to facilitate scheduling of renewable where day-ahead estimation and declaration of capacity may not be possible, the provision of only 8 revisions may be deleted.

Further, the draft IEGC has proposed the following scheduling process and associated UI settlement for wind and solar generators as under:

*"5. The wind and solar generators shall be responsible for forecasting their generation up to accuracy of 70%. Therefore, if the actual generation is beyond +/- 30% of the schedule, wind or solar generator would have to bear the UI charges. For actual generation within +/- 30% of the schedule, no UI would be payable/receivable by Generator, The state which purchases power from the wind generators, shall bear the UI charges for this variation, i.e. within +/- 30%. However, the UI charges borne by the State/s due to the wind/Solar generation, shall be shared among all the States of the country in the ratio of their peak demands on a monthly basis, in the form of a regulatory charge known as the Renewable Regulatory charge for wind/solar energy. This provision shall be applicable for new wind/solar farms with collective capacity of 10 MW and above connected at connection point of 33 KV level and above, who have yet to sign a PPA with states or others."*

The objective would appear to be to introduce frequency linked despatch and grid discipline into scheduling for renewables, at the same time giving some allowance for the unpredictable nature of supply from renewables.

These renewables have a single part tariff. In case the settlement will be at scheduled energy, the scope for earning upto 30% extra on account of scheduled (but not delivered energy) would motivate renewable generators to **always declare 30% higher than their assessed availability**. In case of solar based generators, this would be even more perverse as their scheduled energy rates are much in excess of maximum UI rates and they would **gladly pay for any UI in excess of 30%**. This would vitiate the scheduling process.

On the contrary, if the settlement is on actual injected energy basis, any inability to forecast availability within 30% of actual availability would result in penal UI charges being levied on the difference, **irrespective of the frequency at which it occurs, even 50.1 Hz**. Unlike other generators who have a marginal cost, since renewables are zero marginal cost supplies, they would **not have any frequency linked dispatch**.

It is submitted that solar and wind energy is of infirm nature and day ahead (or 3-hour ahead) forecasting of such generation for every 15 minute interval even with 70% accuracy would be difficult. Presently, there is very little expertise and experience available for such forecasting. Renewable energy is free whenever available and needs to be absorbed by the grid for ensuring complete utilization of such energy. Merit order would not apply to such generation. "Must run" plants would be scheduled to their full declared capacity (DC), except under backing down instructions from the system operator due to adverse system conditions. The proposed scheduling mechanism does induce any frequency linked discipline on the renewable generators as illustrated

above. Therefore, these generators should be treated as *Must run with post-facto SG=AG and paid for only their actual injection into the grid. Any UI liability on this account can be socialized through the Renewable Regulatory Charge.*

Section 6 of Annexure 1 stipulates that the maximum acceptable deviation from schedule is 50% for wind and solar generators. It would appear that a deviation in excess of 50% would be a violation of Commission's regulations with appropriate penal actions as provided in law. This would amount to pulling up a generator for breaking the law for his failure to reasonably forecast his availability and appears to be unfair and too harsh. It is submitted that this may be deleted.

46.8 NTPC has raised following issues in its comments as extracted above:

- (a) There should not be any limit on number of schedule revisions.
- (b) suggestion on payment based on actual energy.
- (c) Treatment of deviation in excess of 50%.

It is clarified that limit on number of schedule revisions is kept to encourage wind generators to forecast responsibly. Frequent change in schedule of wind generator may impact load – generation balance of the host State, host region and purchasing State. It is clarified that as per the finalized regulation, wind generators shall be compensated for actual generation if the deviations are within the reasonable band. We feel that the amount to be received for the energy generated beyond 150% of the schedule should be kept small i.e. UI rate applicable for frequency interval below 50.02 and not below 50.00 Hz, as this will encourage wind generator to forecast more responsibly.

46.9 Tata Power has submitted that in Regulation 6.1 (d), it is not clear upto what quantum would the Wind Generator be compensated, whether at scheduled generation or actual generation. Tata Power has further opined that the Wind Generator should be compensated for actual generation. Keeping in view the suggestion, the final regulations have been modified with principal that wind generators should be compensated for actual generation if the deviations are within the reasonable band. The methodology is explained through sample calculation in Appendix.

46.10 On Regulation 6 SLDC, Gujarat suggested that the maximum deviation may be reduced to 20-30 %. We have considered the comments and we are of the view as the amount to be received for the energy generated beyond 150% of the schedule has been kept small i.e. UI rate applicable for frequency interval below 50.02 and not below 50.00 Hz, this will encourage wind generator to forecast more responsibly.

46.11 CEA has made the following submissions:

*“To bring in more clarity, it is suggested that Commercial Mechanism regarding renewable sources should be made part of a separate Annexure.*

*From Regulation 1 and 2 of the Annexure, it appears that this mechanism is applicable to ISGS only as no mention has been made about transactions made using access to ISTS. However, in Regulation 4*

*regarding Renewable sources, it appears that these provisions are applicable to renewable ISGS as well as to renewable energy sources supplying power using access to ISTS. This aspect may be looked into while finalizing the IEGC.*

*From Regulation 5, it appears that in some cases, Renewable Regulatory charge would be payable while in some other cases, it would be receivable. Therefore, it is suggested that there should be a provision for creation of a Renewable Energy Charge pool on the lines of UI pool.*

*Also, it is suggested that there is need to relook into sharing of UI charges between buying state and wind/solar generator particularly for over-injection exceeding 30%. In shortage conditions, when frequency may be low (and hence UI rate will be high), the proposed provision may provide perverted incentive for the wind/solar generator to under-declare capability and get lower schedules. Thereafter, he may over-inject beyond schedule in excess of 30% to earn undue money. This is particularly true since no check is proposed on the forecasting tool of the wind/solar generator. One way out could be to specify the requirement for forecasting tool that it will be free from manual intervention and forecasting results should be recorded in such a manner that they cannot be tampered with. If such technological requirement is not feasible, the proposed commercial mechanism may be re-casted to avoid such gaming.*

*In Regulation 6, it is proposed that for wind/solar generators, a maximum deviation of 50% will be allowed in a time block. However, consequences*

*of deviations beyond 50% are not clear. Generally, grid security may be endangered only in case of over-injection. Such provision, without additional financial implications may not serve the desired purpose”.*

46.12 It is clarified that to explain the Complementary Commercial Mechanism (CCM) for generation from renewable sources of energy, a separate Appendix has been included with illustrative examples. Further, the suggestion of CEA on the Regulatory Charge Fund has been accepted and provision 9 in CCM has been made in the final Grid Code as given below:

“NLDC shall prepare, within one month of notification of these regulations, a detailed procedure for implementation of the mechanism of Renewable Regulatory Fund and submit the same for approval by the Commission.”

On the issue of energy generated beyond 150% of the schedule, we have already expressed our views at Para 46.10. Hence, danger to grid security in case of over injection by the wind generator should not be there.

46.13 GUVNL has submitted that as per draft Regulation 6, maximum deviation of upto 50% in a time block for injection by wind / solar generators is allowed. It is submitted that no provision is provided as to what has to be done in such cases of deviation exceeds one time block. It is clarified that Maximum deviation is kept at 50 %, but amount received for the energy generated beyond 150% is kept small i.e UI rate applicable for frequency interval below 50.02 and not below 50.00 Hz, this will encourage wind generator to forecast more responsibly.

46.14 InWEA has submitted that that forecasting may be made mandatory for all new Wind Energy projects (above certain threshold capacity limit) with clear identification of responsibility for forecasting.

The degree of error in forecasting reduces with collective system forecasts due to wider spread of wind farms over the project area. Accordingly, it is preferred that a Sub-Load Despatch Centre dedicated for forecasting/ despatch/ co-ordination activities for non-firm RE sources is constituted at each State level. Every SLDC can then co-ordinate with such sub-Load despatch centre from all activities related to forecasts, scheduling, despatch, monitoring, records keeping and energy accounting of non-firm RE sources such as Wind Energy, Solar Energy etc.

Further, the limit of 10 MW needs to be enhanced and increased to about 25 to 30 MW, and forecasting to be made compulsory.

46.15 RLDCs and NLDC submitted that in line with the proposal of the Hon'ble Commission to shift detailed provisions on UI from IEGC to the CERC (Unscheduled Interchange Charges and related matters) Regulations, 2009, treatment of UI of wind/ solar generation may be removed from the draft IEGC regulations and included in UI Regulations. The following comments were submitted:

In the draft IEGC regulations, it has been proposed that for actual generation within +/- 30% of the schedule, no UI would be



payable/receivable by Generator. This provision would encourage gaming by wind / solar generation (RE generator) as explained below:

The RE generator would be immune from any UI charges for deviation by 30%. Thus if a generator has sold 10 MW through open access, it would get paid for 10 MW by the buyer at the agreed rate. However, even if it generates 7 MW only, there would be no charges for deviations and it would get payment for 10 MW including 3 MW not delivered. Similarly, even if it generates 13 MW, it would get payment for 10 MW only and extra 3 MW would be delivered free. Apparently, intent of this regulation is to provide for nullifying impact of deviations on both sides. However, this mechanism would encourage gaming e.g. even if a generator assesses availability of 7 MW, it would sell 10 MW to take undue benefit out of the proposed treatment of UI. Deviations would deliberately be kept on the negative side i.e. under-injection and even if the deviation becomes positive in a block, the generator has the option to get the schedule revised to ensure under-injection. It would not provide any incentive for correct forecasting and planned deviation of 30% by a large number of renewable generators would be a threat to grid security.

It is suggested that even if no UI charges are applied on deviation by 30% in a block, a limit, say 5% may be put on total deviation over a day. Further the deviation of 30% in a block or 5% over a day should be on both sides (i.e. positive and negative). The SLDC concerned may verify for gaming if any, based on pattern of deviation, and if gaming is detected,

benefit of the above provision may be denied to the concerned wind farm for a period of one month.

46.16 It is clarified that the above concern of RLDCs and NLDC has been now dealt in Appendix to the Grid Code Regulations. Illustrative examples of payments to be made to the renewable generators in all possible cases of under generation or over injection have been given.

46.17 SRPC has submitted that the sharing of UI charges on account renewable generation among the States in the country could be done on energy consumption (average demand) of the State for the month as peak demand could be one maximum figure which may be quite high compared to peak demand of other days. It is clarified that this is as per methodology followed in other regulations. Hence the suggestion has not been accepted.

46.18 SLDC, Maharashtra on Para 5 of Complementary Commercial Mechanism at Annexure 1, has suggested that the provisions of UI charge applicability and deviation of generation, there can be possibility of gaming while giving the despatch schedule by the wind and solar generators. The deviation margin may be reduced to +/-10%.

46.19 On para 5 of Annexure 1, SLDC, Gujarat has submitted that while proposing accuracy up to 70%, remaining portion will increase the uncertainty in balancing function of power system. Consequently, this will further cause the volume of

interchange energy and may also cause congestion in the power system. Therefore, it may be increased to the accuracy of 80% or more. However, at present to start with scheduling, accuracy up to 70% may be allowed but later on it may be increased based on experiences.

46.20 InWEA on para 5 of Complementary Commercial Mechanism, made the following submissions:

“The Forecasting of Wind power and operational measure to address variations from forecasts are two distinct aspects. Forecasts should facilitate System Operator (SLDCs/RLDCs) in undertaking efficient and planned Grid operations. Such “deviations” should be addressed through ancillary support services/spinning reserve/back-up generators etc. rather than through commercial mechanism such as UI mechanism.

Based on limited trial operations carried out by InWEA, it is understood that the degree of volatility in forecasts is much higher (in percentage terms) during non-windy season as compared to percentage variation during windy season. However, implication of +/-50% variation (in absolute terms MW) during non-windy season is even lower than +/-30% variation (in absolute terms in MW) during windy season, since average MW during non-Windy season is much lower than average MW during Windy season. Thus, seasonal variation aspect needs to be addressed under the IEGC rather than keeping fixed range of variation of +/-30%.

Grid Code may provide for the variation band of +/-50%. The exercise for forecasting can be initiated with effect from April 1, 2010. However, a trial operation period/transition period should be extended before the variation can be subjected to UI mechanism which has commercial implications. In this context, it is also observed that ABT mechanism with UI features was introduced in phases with sufficient time period extended for all participants to operationalise or get accustomed to new mechanism.

Accordingly, it is submitted that forecasting mechanism with commercial linkage to UI mechanism may be introduced after pilot operations for at least 1 year i.e. from April 1, 2011.”.

46.21 IWTMA and IWPA have submitted that the accuracy of forecasting is affected by various factors (size of wind farm, location of wind farm, season, time of forecasting i.e. week ahead day ahead-hourly basis etc.). The time period of 1 hour should be considered for maximum deviation of 50% in place of 15 min time block. It is clarified that it not possible to consider separate time block of 1 hour as it would create accounting difficulty, also existing scheduling mechanism cannot be change for large RE generator as there is no rationale to do so. On this issue of CCM, we would like to clarify the larger perspective. Government of India through the National Action Plan on Climate Change has the objective of promoting renewable sources of energy, in line with the Electricity Act 2003. However, some of the renewable sources of energy namely wind energy, solar energy etc., depends on nature and hence cannot be predicted with

accuracy. This causes problem of scheduling of this power by the Regional Load Despatch Centers and State Load Despatch Center.

#### 46.22 Integration of Renewable

There are two major attributes of variable generation that notably impact the bulk power system planning and operations:

- **Variability:** The output of variable generation changes according to the availability of the primary fuel (wind, sunlight and moving water) resulting in fluctuations in the plant output on all time scales.
- **Uncertainty:** The magnitude and timing of variable generation output is less predictable than for conventional generation.

The impact of large wind generation portfolio in total generation capacity of a utility is already started impacting grid operation in case of Tamil Nadu and in future likely to affect Rajasthan and Gujarat. The uncertainty and variability of these resources create challenge for system operator in load generation balance. Due to persisting shortage conditions any negative deviation in expected generation from these sources push utility towards grid indiscipline. This also discourages utility to add more renewable in their control area. The present scheduling mechanism, UI mechanism and regulatory restrictions on quantity of overdrawl impose adverse commercial impacts on renewable rich state. If these operational and commercial issues are not resolved quickly through Regulatory framework, it may impact future growth of renewable.

46.23 The Central Commission vide OM No 20/4(30)/2009-CERC dated 10<sup>th</sup> September, 2009 constituted a Task Force with representation of Engineering Wing of the Commission Staff, CEA, System Operator, C-WET, WISE and State Commissions/ Utilities/ SLDCs of Tamil Nadu, Rajasthan, Gujarat and Karnataka for integration of renewable sources energy into the Grid. The Task Force also co-opted eminent experts in the field. It also taken into account the efforts made by the technical group constituted by Ministry of Renewable Energy (MNRE) for formulating guidelines in addressing the technical issues/ problems of power evacuation and grid synchronization related wind power projects. Industry representatives and experts from MNRE were also invited to fully understand the technology and Grid integrations issues.

46.24 The Task Force was assigned the responsibility to evolve recommendations applicable to all types of infirm electricity from renewable sources and to deal comprehensively with issues related to forecasting, grid operations, settlement of imbalance and technical standards for grid connectivity to renewable based generations.

#### **RECOMMENDATION OF THE TASK FORCE**

Three meetings of the committees were held on 13.11.2009, 15.12.2009 and 18.01.2010. After extensive discussion considering Wind Grid code prepared by the technical group constituted by Ministry of Renewable Energy (MNRE), international

practices in renewable rich nations and CIGRE Report No. 293 and 322, California ISO Document, following decisions were taken by the task Force:

- On the issue of connectivity, it was decided that connectivity should be allowed with transmission system or distribution system, in line with the CERC regulations on Renewable Energy tariff in this regard.
- It was decided that forecasting of wind generation shall be made compulsory and so also provision of SCADA for all future wind generators. For existing wind Farms, some time would be given for implementation of the same.
- Fault ride through would be made compulsory for new wind generation machine. For old machines some time would be given for retro fitting of the same.
- Scheduling of wind and solar power generation plants would be mandated for all wind and solar plants where the sum of generation capacity of such plants connected at the connection point to the transmission or distribution system is greater than 10 MW and connection point is 33 kV and above, where PPA has not yet been signed with the State or others. For capacity and voltage level below this, as well as for old wind farms, it could be mutually decided between the Wind Generator and the transmission or distribution utility, as the case may be. Where a group of wind farms or solar plants are connected at a connection point, they could either forecast individually or jointly. Rescheduling of wind or solar generation would be allowed for every time blocks of 3 hours starting from 00.00 hrs. at a notice for 1.5 hours. Therefore scheduling based on forecast would be for 1.5 hours in advance (nearest) and 4.5 hours in advance (farthest) i.e. 3.0 hours on average. The wind or solar generators have to be responsible for

forecasting upto the accuracy of 70% and bear UI charges if they deviate from this. SLDC shall do the UI calculation and segregate the 30% explicitly. For the remaining deviation, the state which purchases power from the wind or solar generators, have to bear the UI charges. However, the UI charges borne by the State/s due to the wind or solar generation would be socialized among all the States of the country in the ratio of their peak demands, in the form of a regulatory charge known as the ancillary service charge for wind/solar energy from the pool.

- For solar generation and for biomass, other than the issue of scheduling, there is no other specific issue/problem in integration of these renewable sources to the grid.

46.25 In view of the national policy of encouraging renewable sources of energy, it was felt necessary that provisions regarding this be integrated into the IEGC, taking into account the variable nature of sources such as wind and solar energy. Therefore, an appropriate mechanism for dealing with unscheduled inter-change (UI) due to these sources has been included in the IEGC, keeping in view also other technical requirements related to such integration. The UI impact on renewable is proposed to be dealt with in a manner that solar and wind generators are not financially burdened for the variations in generation, which cannot be reasonably forecast. The Commission is committed to ensure that the renewable energy generators should get the returns as specified in the renewable energy regulations. The proposals in IEGC have been formulated with this spirit, while at the same time addressing the load management needs of the



states where large quantities of wind/solar based generation is expected to come up in future.

46.26 To facilitate implementation of National Action Plan on Climate Change which calls for significantly increasing the share of electricity generated from renewable energy, we have decided that the financial burden of all the fluctuations from schedule in case of new solar energy plants and the fluctuations within  $\pm 30\%$  of schedule in case of new wind energy plants will be borne by all the users of inter-State grid. These project developers and the host states will not be at disadvantage from such fluctuations. New wind energy generators will be able to fine tune their schedules (based on forecasting) as close as three hours before actual generation.

46.27 In the Annexure -1, provisions regarding conventional generating station are same as previous grid code. Special commercial mechanism has been formulated for renewable like wind and solar power generation. These issue are vital importance and clarity on their commercial arrangement is necessary for their integration with the grid. Due to concentration of these resources in some pockets of the country, and renewable purchase obligations of state utilities, it is certain that their power generated through these renewable had to travel across the host states and region on ISTS network. Present UI mechanism, tariff structure of wind and solar power, intermittent output of these resources which purely depend on nature with almost zero variable cost present a challenge in their integration , both commercial and technically. Presence of these sources in

the generation portfolio make load generation balance complex. During the past years many instances came into notice of the Commission, where sudden change in output from these sources not only impacted host State but overall grid discipline was affected as host state overdrawn heavily from the grid violating Grid code and prevailing UI regulations. Also at Coordination Forum meeting Tamil Nadu and Rajasthan aired their views on this issue. If remain unaddressed, these issues may hamper the growth of Renewable Generation in the country .This would have been counteracting to international commitments and National Solar Mission of Government of India. To resolve these issue, CERC constituted a Task Force and based on intense discussion with all stake holders including Wind Generators, State utilities and MNRES these commercial mechanism were evolved after detailed deliberation and efforts were made to balance interest of Renewable developers, host State and grid operator at State and regional level.

46.28 SRPC submitted that Talcher STPS Stage II Station of Southern Region is located in Eastern Region and IEGC provides metering at ER and WR ends for metering Inter Regional Exchanges, the following Regulation may please be inserted in Regulation 15 of CCM:

UI accounting of Talcher STPS Stage II would be carried with reference to ER frequency. Inter Regional UI between WR & SR, ER & SR would be at NEW Grid frequencies.

It is clarified that the matter shall be dealt in accordance with the UI Regulations.

## **47. Explanation of Appendix: I**

- 47.1 As most of the comments received on draft IEGC (Grid Code) regulations indicate that the procedure for commercial settlement for renewable is not clear to the stakeholder because it is not mentioned whether billing was done on Schedule energy or actual energy. To clarify the issue it was decided to include illustrative examples of various possible scenarios so that commercial mechanism given in Annexure-I may be clearly explained.
- 47.2 These examples are self explanatory and it clearly indicate payments to be made and received by Generator, purchaser and host states. It is clear that no single entity is adversely affected commercially due to renewable generators deviation from schedule.
- 47.3 Government of India under National Solar Mission had decided a target of addition of 1000 MW grid connected solar power capacity. After detailed analysis it was decided that no UI shall be imposed on Solar Power because at present Solar energy cost is very high and in case UI is imposed on it, there will be possibility of gaming due to large difference in UI price and solar energy cost. Also , UI imposition on solar will hamper implementation of Govt of India scheme of bundling solar power with NTPC power as it would be difficult to account for UI liability in case of failure of either component of bundle i.e solar power or thermal power.

Also as the present penetration level of solar power is small, any deviation from schedule is not going to affect load generation balance adversely in a large integrated grid.

47.4 In case of actual solar generation more than schedule, the buyer state should not be affected adversely by paying for actual energy on contracted rate, hence it has been decided that purchaser, because he had drawn as per schedule, shall receive back the payment for this excess power at the contracted rate.

|                                      |                                |                                  |   |
|--------------------------------------|--------------------------------|----------------------------------|---|
| Sd/-                                 | Sd/-                           | Sd/-                             | Sd/-                                    |
| <b>M. DEENA DAYALAN<br/>(MEMBER)</b> | <b>V.S. VERMA<br/>(MEMBER)</b> | <b>S. JAYARAMAN<br/>(MEMBER)</b> | <b>DR. PRAMOD DEO<br/>(CHAIRPERSON)</b> |

**The following stakeholders have submitted written submissions on the draft IEGC Regulations, 2010:**

1. American Superconductor
2. Andhra Pradesh Transmission Company Ltd. (APTRANSCO)
3. Shri A. Velayutham, Ex-Member, MERC
4. Athena Chhattisgarh Power Pvt. Ltd.
5. Central Electricity Authority (CEA)
6. Chhattisgarh State Power Transmission Company Ltd. (CSPTCL)
7. ENERCON (India) Ltd.
8. Gujarat Energy Transmission Corporation Ltd. (GETCO)
9. Gujarat Urja Vikas Nigam Ltd. (GUVNL)
10. Himachal Pradesh State Electricity Board (HPSEB)
11. India Energy Exchange Ltd. (IEX)
12. Indian Wind Energy Association (InWEA)
13. Indian Wind Power Association (IWPA)
14. Indian Wind Turbine Manufacturer Association (IWTMA)
15. NHPC Ltd.
16. NTPC Ltd.
17. PricewaterhouseCoopers
18. Rajasthan Rajya Vidyut Prasaran Nigam Ltd. (RRVPL)
19. RLDCs and NLDC
20. SLDC, Gujarat
21. SLDC, Maharashtra

22. Shri Subodh K. Bhatnagar, Individual Expert
23. M/s Sub K Power
24. M/s Siemens
25. Southern Regional Power Committee (SRPC)
26. Tamil Nadu Electricity Board (TNEB)
27. West Bengal State Electricity Distribution Company Ltd. (WBSEDCL)
28. West Bengal State Electricity Transmission Company Ltd. (WBSETCL)
29. West Bengal Electricity Regulatory Commission (WBERC)
30. Western Regional Power Committee (WRPC)