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Sub : Views/ suggestions for review of " Indian Electricity Grid Code "

Respected Sir,

Please find enclosed my views on the review of Indian Electricity Grid Code . These views are in line with my submissions given during the meeting of the Expert group held on 17th June, 2019. My views are mainly with reference to balancing requirement and quantification of flexibility by every state utilities while integrating renewable generation. I tried to include the requisite provisions in different codes including definition chapter and planning code, operation code and scheduling and despatch code.

Submitted for your kind considerations please.

With Kind Regards

Yours Faithfully



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Views and Suggestions to Review Indian Electricity Grid code

Indian power system has entered into new regime of generation and power demand with the integration of large quantum of renewable generation in the Indian grid. At present about 70 GW renewable both Wind and solar generation projects are in operation and country has ambitious target of 175 GW by 2022. The Renewable generation besides having variability and intermittency also have mismatch between the incidence of generation and demand.

In addition power demand of different utilities are witnessing huge variation in their intraday demand and also variation in demand in different seasons. Gaps between peak and off peak power is increasing continuously.

Due to above variation and also mismatch in the time instance of Supply and energy source , there is need to establish assets in the grid to provide balancing requirement of energy from the time period when renewable generation is maximum to instances when renewable generation is minimum which happens during peak demand period. Indian grid being thermal generation dominated, there is need to create adequate flexibility in the grid to enable balancing as well as to take care variation in generation and demand.

Keeping this aspect in view, inclusion in different chapters of IEGC are proposed. The proposed amendments are as follows :

In chapter “ Definitions “ , following may be added

- 1.0 Balancing Energy: it is quantum of energy and power in MW required by any grid while shifting from high renewable energy time period to peak hours when renewable generation is low. This need to be quantified both in energy and MW.
- 2.0 Flexibility of Power system : Flexibility of power system refer to the extent to which generation or demand can be increased or reduced over a time scale ranging from few minutes to hours.
- 3.0 Ramp up rate: Ramp up rate of power system is rate in MW/ minute which a power system is required to increase its generation to match its demand at different time intervals.

4.0 Ramp down rate: It is rate in MW/minute which a power system is required to decrease its generation to match the grid demand at different time intervals.

Amendments in Part 1, GENERAL:

Para 1.2: (i) in the last line of first para following may be added :

Regional and state load dispatch centres

And Renewable Energy Management centres.

(ii) In para 1.2 in the end following para may be added :

Facilitation of development of different technology options to create adequate flexibility in the Indian grid and meet balancing power requirement through development of different storage options including pump hydro projects, battery storage or any other suitable technology.

Amendment in Part 2 – Role of Various Organizations and Their Linkages :

In para 2.2 – Role of NLDC

Considering large RE generation target in the country and also keeping in view balancing of RE generation across the states and regions, NLDC shall interact with different RLDCs to collect data and information about grid security issues due to large RE integration in the different regional grids. For this in fact grid security issues at the intra state level also need to be analysed as in the integrated grid both intra state and interstate aspects need to be examined and analysed to plan adequate measures at state and regional level for secure integration of RE power.

In para 2.3 , the role Renewable Energy Management centres at Regional and National level be included including its functions and coordination with RLDCs. To include this, following para may be added:

Role of REMC at Regional level: Forecasting of RE generation on different time scale, Real time tracking of generation from RE sources, interface with multiple parties forecasting service provider systems, prepare day ahead final schedule based on forecast information and proposed RE schedule by RE generators and communication and management of final RE schedule to RE generators and RLDC's main scheduling tools for integrated planning with conventional generation.

(ii) in Para 2.4, Role of RPC, following para may be added in the end .

To undertake planning of adequate measures in the regional grid to provide desired flexibility in the regional grid by planning different technology options

(iii) In para 2.5, Role of CTU , a new para 2.5.6 may be added as follows :

To identify and formulate adequate measures to create flexibility in Indian grid while integrating large quantum of RE generation in different time periods including different energy storage options and development of flexible power sources.

In para 2.6--- Role of CEA ----- in para2.6.1 (1) new para may be added as follows :

(ix) *Keeping in view large RE capacity integration in the country, As a National planner, CEA shall carry out detail studies and analysis to examine grid security and stability issues while integration of large RE at State and regional level so that adequate measures are planned for adoption at state and regional level. For this CEA need to collect past data of operation of different states while operating RE generation and if any grid security issue is effecting RE operation then adequate measures are planned for secure operation of state and regional grids.*

Role of SLDC para 2.7 ----- Following may be added in para 2.7.1 (2)

- For secure and stable operation of regional grid, SLDC shall share the data with RLDC for its operation including RE generation in the state and its curtailment due to grid security issues along with reasons/ data of grid

security issues resulting into RE curtailment so that RLDC can look into this aspect into comprehensive manner for planning of adequate measures to avoid such curtailments.

- SLDC on its website shall furnish all data in regard to its generation both from conventional and RE generation in different time blocks and also power demand data at different time periods.

PART 3 PLANNING CODE FOR INTERSTATE TRANSMISSION SYSTEM

(i) Chapter 3.4, para (a) may be modified and inclusions in red color may be considered

- (a) CEA would formulate perspective transmission plan for inter-State transmission system as well as intra-State transmission system. These perspective transmission plans would be continuously updated to take care of the revisions in load projections and generation scenarios considering the seasonal and the time of the day variations. In formulating perspective transmission plan the transmission requirement for evacuating power from renewable energy sources shall also be taken care of. **While planning power evacuation from renewable generation, measures to create flexibility in power system shall also be planned to address the variable and intermittent nature of renewable and also the balancing power requirement of different states. Accordingly, suitable technologies need to be planned for implementation in National grid like adoption of different storage options and also concept of hybrid of solar and wind with storage to provide round the clock power from renewable and also to provide flexible power on demand to address the variability in generation and demand. Such type of Technogym options will help in addressing the balancing issues in Indian power system.** The transmission system required for open access shall also be taken into account in accordance with National Electricity Policy so that congestion in system operation is minimized.
- (b) Para 3.4 (b) CTU shall.....

Para viii) may be added as follows:

While planning power evacuation system for renewable generation in different time period, CTU shall keep into consideration the impact of RE penetration in

terms of balancing power requirement and also to create adequate flexibility into power system to take care of RE variation during intraday. While estimating the impact of RE penetration, it is required to quantify the minimum level at which thermal generation will be required to operate during high RE generation time period. Based on this there is need to estimate technology options like storage and means of flexible power so that thermal generator could run at optimal level of operation from technical and commercial considerations. Address the variability in generation and demand technologies/ options like round the clock power from renewable generation and storage and also products to provide flexible power on demand need to be adopted in Indian grid.

After Para 3.4)(e), following para may be added:

With the addition of large RE generation in the grid and also keeping in view high RE penetration in the grid, there is need to examine the flexibility requirement of the grid so that adequate measures are planned to create flexibility in the grid for secure and reliable operation of National grid with high Re penetration. Measures like Electric storage of different technology options like pump hydro storage or Battery storage options may be examined for installation in the ISTS transmission system to meet balancing requirement at National level.

Para 3.6 , Planning data, new para

In regard to provision of data by state utilities for planning the ISTS transmission system, Each state utility shall quantify for different time period the requirement of balancing power and ramp up and ramp down requirement keeping in view there different generation sources available and variation in generation due to RE penetration and also variation in demand. *State utilities shall also inform the past date of RE curtailments due to grid security and other issues so that adequate measures are planned to avoid such curtailments in future.*

Based on this data CEA and CTU can look into the issue of balancing power, flexibility and also quantify the ancillary services requirements and addressing the same in more comprehensive manner at ISTS level.

In regard to demand forecast, it is very important now to estimate not only peak and off peak demand but also the intraday and inter season variation in demand. For this advance tools of demand forecast need to be adopted and continuous augmentation in the technologies of demand forecast shall be done to improve the accuracy in planning and actual demand and its variation.

PART 4 CONNECTION CODE

In this code eligibility as included in CERC (Grant of Connectivity, Long term Access and Medium term open Access in inter- state transmission and related matters) (seventh Amendment) Regulations, 2019 including all type of RE generation, hybrid of RE with or without storage and also of RE parks may be incorporated.

In the connection code, new para in regard to operation of Electric storage alone projects to be added as follows:

Electric storage is a grid entity where electric energy is stored during the time when energy is surplus in the grid to utilise it during the time when energy is in demand for operation of electric storage, electric energy is drawn for storage and same is supplied during high demand period. Therefore for connectivity of storage, there is need to inform maximum quantum of Electric power drawn and during delivery time, the maximum quantum of electric power injected to grid. The transmission planner need to study and analyse the grid adequacy both at time of drawl of power and injection of power and strengthening requirement in the grid if any need to be identified considering both the situations of operation.

PART -5, OPERATING CODE

IN para 5.1, operating philosophy, following para may be added:

There is large RE integration target in future in the country both at CTU and STU connected grid. RE generation has variability and intermittency which

require adequate measures to ascertain secure and stable operation of grids. As RE generation addition will be at state and regional level both and due to strong interconnection of state and regional grids, any variation in grid parameters both in state and regional grid will impact both state and regional grids. Therefore, for successful operation of state and regional grid there should be close interaction of data/ information among SLDCs/ RLDCs and NLDC so that and RE curtailment if any due to grid security and stability reasons are analysed in details examining the past operation data so that adequate measures are adopted to avoid any RE curtailment in the state/ regional grids.

In para 5.2 (U) ---- System Security Aspects, Special requirement for solar/ wind generators:

System operator (SLDC/RLDC) shall make all efforts to evacuate the available solar and wind power and treat as must run station. Howeversolar/ wind generator shall comply with the same.Whenever solar/ wind power is curtailed against must run principle, the renewable power will be considered as deemed generation based on forecast provided by generator and will be paid full tarff for such deemed generation.....For thisSLDCand RLDC :

(iii) In case of any curtailment of RE generation at state or regional level detail analysis may be carried out at regional level by RLDCs as many of RE integration issues require support due to integrated operation and balancing of RE at regional and National level . For carrying out this analysis, the SLDC shall share all the information of the respective state Re curtailment and related grid security issues and causes so that remedial measures are planned and implemented at state/ regional/ National level.

(iv)

In para 5.3, Demand estimation for operational purposes, following para may be added;

Each SLDC besides looking peak demand should also look into hourly variation during the day and seasonal variation across the year. This shall be analysed in coordination with generation sources particularly when the states are meeting their part of the demand through variable RE sources. This will help in quantifying the balancing requirement across the year and during intraday in different seasons.

In para 5.4 Demand Management, following new para may be added:

Meeting the demand through flexible RE sources: Each SLDs are presently facing challenge of large variation both in demand and also generation sources. While meeting variability in both generation and demand, SLDC may explore meeting its demand through flexible sources of electric power with hybrid generation of wind and solar with storage. This will help in reducing the variability in generation and would provide adequate flexibility into the state system.

In para 5.5 periodic reports, following may be added in para 5.5.1 b)

A daily report covering This report shall also cover the wind and solar power generation and and injection into grid including the instances of curtailment of solar and wind generation due to grid security issues giving details of grid security issues making the curtailment of RE power.

In para 5.5.2, Other Reports

A new para (c) may be added

(c) Report shall also quantify the balancing requirement while absorbing RE power and also ramp up and ramp down requirement of the grid and capability/ limitations to meet the requirements.

Para 5.6.2 (a), following may be added

The respective RLDCs may also predict likely wind and solar generation scenarios for the month to predict likely variability and uncertainty in the grid

so that adequate measures could be taken up to address these variability and uncertainties.

In para 5.6.2 (b), following may be added

In the near future, since Re generation will have significant penetration in Indian grid and ours is a strong National grid where Re generation located in one region will be required to transfer power to other region, it is very important that different regions share with each other likely estimated variations on the net inter-regional power flows. This will help each of region to plan in advance through various technology options like storage, ancillary services to handle such variations.

Comments on Scheduling and Despatch code Part 6

In para 6.4 Demarcation of Responsibilities, comments are as follows:

After the para 6.4, 8

SLDCs/ STUs shall regularly carry out necessary exercises to estimate the requirement of flexibility and balancing in the respective grid based on their load and generation estimation of peak and off peak power and its variation (2)flexible power need and also storage requirement particularly while integrating large RE power into their grid.

Comments on Scheduling and Despatch code Part -6

In para 6.5 Scheduling and Despatch for long term, Medium term, short term open access , following may be added :

RLDCs and SLDCs shall schedule and despatch power from any generator including RE generators to the extent adequate advance payment security mechanism in the form of letter of credit or other payment security mechanism is made available by the concern DISCOM. In the absence of such payment security mechanism, DISCOM shall be liable to pay full tariff in case of RE generators based on forecast of such RE generators and fixed charges in case of conventional generators.

In addition to above in this chapter for scheduling of RE generators, following may be considered for their scheduling and despatch:

1.0 In case of RE generators, presently responsibility is given to RE generators or by QCA appointed by RE generators. In the present mechanism, there is penalty on each of the generator in case of deviation from the schedule when the deviation of each of the generator is taken care. Whereas if we aggregate at grid pooling station wise or control area wise, the deviation will be less due to diversity of variations among different generators and combined deviation may be less if it is taken on control area wise. In case of state generation and state demand for a particular state, the schedule is given for net injection or net drawl on state basis. Even though there may be variation in individual state load or state generator but combined together as net drawl/ injection, deviation is less. With the same principal RE scheduling/ forecasting and its deviation can be done control area wise. For aggregating the RE generation , QCA may be appointed by SLDCs/ RLDC s and deviation corresponding to total RE may be divided among RE generators based on their declared capacity.

It will also be desirable to appoint QCA by SLDCs/ RLDCs as their selection criteria will be more stringent as compare to individual generator.

2.0 In the present regulation, the rescheduling / revision in RE schedule shall be effective from fourth time block. But in actual operation there are many factors which effect the actual generation like transient clouds or many times states do not give prior information for load restrictions. All these reasons make change in generation dispatch from actual schedule and results into deviation. To address this the revision may be allowed from next time block.