

Gist of Discussion during Interactive Session held on 01.05.2024 regarding Submission of Technical Connection Data for RE

Interactive Session was held on 01.05.2024 with RE developers at CTUIL Office w.r.t various issues related to submission of technical connection data, wherein following was discussed:

(i) Important Standards/Regulations/Procedures/documents:

- 1) Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 with (Amendment) Regulations, 2013 & 2019 including CEA clarification dated 06-01-2023.
- 2) Detailed Procedure for CERC Connectivity and GNA Regulations 2022.
- 3) Report of the Working Group in respect of Data Submission Procedure and Verification of Compliance to CEA Regulations on Technical Standards for Connectivity to the Grid by RE Generators.
- 4) Procedure for assessment of the Design Temperature for RE Plants in compliance with CEA (Technical Standards for Connectivity to the Grid) Regulations.

(ii) Timelines for submission of technical connection by RE entity(ies) on NSWS portal.

The timelines for submission of technical connection data in line with CERC GNA Regulations, 2022 was elaborated. It was re-iterated to submit the data well in time so as to avoid any delay in physical interconnection process. Although the GNA Regulation mandates submission of data atleast 1 year prior to anticipated date of connectivity, applications are accepted with lesser time-period also. It has been observed that a minimum time period of at least about 3-4 months is required to process the applications in case where no additional equipment's such as filters, Inverters, SVG/STATCOM etc. are required to meet compliances at the POI w.r.t CEA Technical standards, as per the outcome of the detailed study. It may be noted that such installation by RE developer typically requires 4-5 months. Therefore, in order to take care of time for installations of additional equipment, if required to meet the compliances of CEA Technical Standards at POI, application should be made about 8-10 months prior to physical connection so that RE developers get sufficient implementation time before physical connection.

Therefore, timely submission of technical connection data is of paramount importance.

Keeping above in view, RE entity(ies) were emphasized to submit the technical connection data atleast about 8-10 months prior to anticipated physical connection so that the Connection details could be issued in time.

(iii) Compliance requirements w.r.t RE:

The broad compliance requirements w.r.t CEA Technical Standards for Connectivity to grid to be met by RE developers were discussed which include the following.

- 1) Power Quality requirements
- 2) Dynamic reactive power requirements

- 3) Voltage ride through requirements (LVRT & HVRT)
- 4) Frequency Response and operational capability
- 5) Control capability.
- 6) Active power ramping capability

(iv) Methodology for compliance assessment - RE:

The methodology for evaluating the compliance fulfilments by RE entities was presented which inter-alia includes submission of following IBR/plant level mathematical models/study reports towards compliance of CEA Technical Standards:

A. Mathematical Model submission requirements (IBR):

- 1) RMS (Root mean square): PSS/E
- 2) EMT (Electromagnetic transient): PSCAD

B. Certification of Individual IBR Unit (SoC/Test reports/evaluation reports)

C. IBR/PPC- Benchmarking reports

D. Plant level model development & compliance evaluation.

- 1) RMS (PSS/E): Detailed & Equivalent plant model
- 2) EMT (PSCAD): Equivalent (Dynamic studies) & Detailed (Power Quality)

A few sample simulation cases depicting in-consistent RE plant performance were discussed w.r.t various provisions of CEA Technical Standards.

(v) Suggestion and Way forward & frequently asked queries:

Based on the experiences in context of data submission, various suggestions were conveyed including improvements in modelling accuracy, voltage ride through performance, adequacy of generation evacuation infrastructure, dynamic reactive capability, equipment for meeting power quality norms. Further, modelling issues were discussed, and it was emphasized to avoid them in the early stage by entity(ies) itself so as to reduce the iterations being done. It was suggested that rigorous data checking may be done by entity(ies) itself before submission of data to CTU to enable smooth integration process. Based on the discussions, following will be taken forward:

- A.** Prior data checking by entity(ies) before submission to CTU so that the errors/mismatches in data submission are minimized. The data will be submitted to CTU well in time.
- B.** Frequently asked questions and queries will be uploaded on the CTU website.

Frequently faced issues (Submission of Technical Connection Data- RE)

Following deficiencies have been commonly observed in the submitted applications from RE entities for connection data (CONN TD-1) on NSW portal. Applicants are requested to ensure that issues may be taken care before submission of data to CTU.

A. Plant-level models:

1. Non-submission of data in plant-level PSS/E and PSCAD models:
 - In some cases, the data including the **length of branch, and Rate-A/B of the branch/transformer**, is not filled in the PSS/E plant level model.
 - Since the short circuit behavior of IBR can't be expressed in terms of X" and therefore NCFSC characteristics are required. Seq file for **NCFSC characteristics** are not forwarded in some of the cases.
 - Signed FORMAT-CONN-TD-1 not uploaded during the submission in NSW portal.
2. Representation of **Swing bus** with design fault current values i.e 50/63kA.
3. Non-representation of actual plant topology in plant-level PSSE/PSCAD models.
 - In some of the cases, it has been observed that the position of bus couplers in 33kV level is not matching with the actuals.
4. Use of inappropriate branch **R,X,B parameters** in plant level models.
 - In some of the cases, it has been observed that branch R,X,B parameters are quite unreasonable considering the tower geometry. The circuit R,X,B parameters should approximately match with the typical values mentioned in **CEA Transmission Planning Criteria, 2023**.
5. Load flow results in PSS/E detail and equivalent models are different.
6. Rating of equipment(s) are different between detailed, equivalent models & actuals.
7. User defined models are incorporated in models.
 - It may be noted that entities are required to submit the plant level PSS/E models based on Generic models available in PSS/E library.
8. Non-consideration of additional reactive compensation device(s) in the plant level PSSE & PSCAD dynamic models (in cases they are actually being implemented).
9. Not considering harmonic spectrum of additional reactive compensation device in the PSCAD power quality model.
10. In case where the dedicated transmission line is getting shared between multiple plants, while calculating required dynamic reactive compensation of one plant, rating of other plants should also be considered.

B. Unit IBR details/reports:

1. Non-submission of applicable IBR PQ characteristics
 - In some of the cases, it has been observed that the IBR PQ characteristics are submitted pertaining to different ambient temperature. They are required to submit the PQ & QV characteristics for the applicable temperature along with temperature derating curve.
2. Non-submission of **unit IBR Test reports/SoC/Assessment/Evaluation reports**
 - In some of the cases, the unit IBR test report is not submitted for the complete range of applicable tests. While in some cases, the SoCs was not submitted for particular tests.
3. Non-submission of **unit IBR benchmarking reports**
 - It has been observed that in some of the cases, unit IBR benchmarking reports are submitted for balanced ride-through cases only. Entity(ies) are required to submit the unit benchmarking reports for all applicable tests including balanced and un-balanced faults.

4. Transferability of test results

- Entity(ies) are required to submit the IBR Unit test report which is being/has been installed at the site. However, in some of cases, OEMs test one variant (which is not being installed) and submit its report. The case of transferability of test results is permitted in exceptional circumstances within the boundaries of corresponding IEC/IEEE Standards.

C. Un-desired response of plant in PSS/E and PSCAD:

- Fluctuations in reactive power during LVRT conditions:

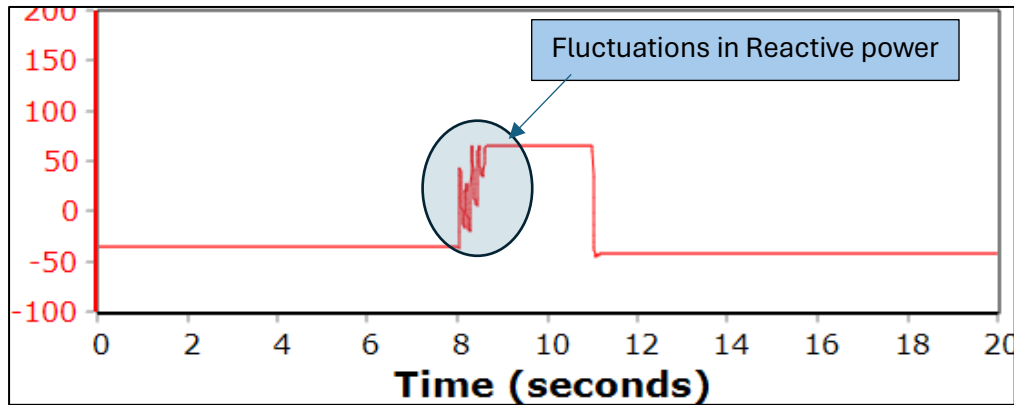


Figure 1 Plant reactive power response during LVRT condition LVRT-0.85pu in PSS/E

- Fluctuations in reactive power during voltage response test:

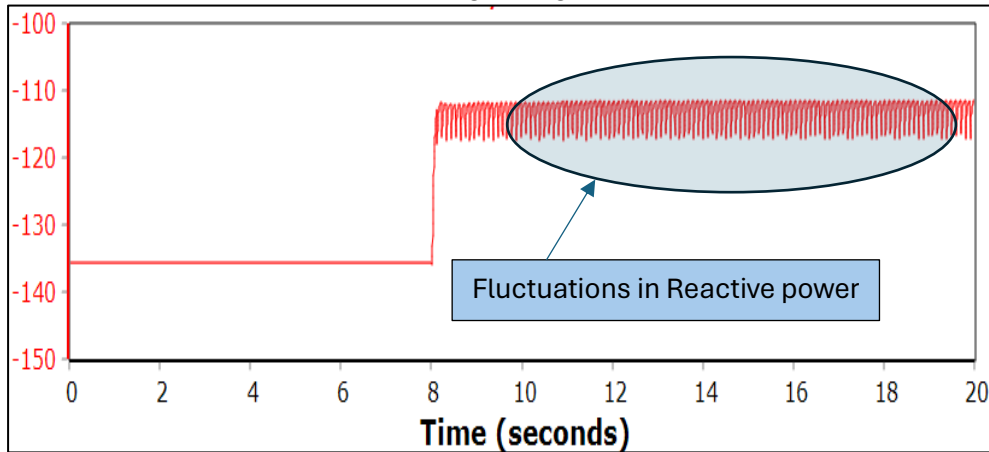


Figure 2 Plant reactive power response during VRT-1-0.95pu in PSS/E

3. Reduction in active power during HVRT conditions:

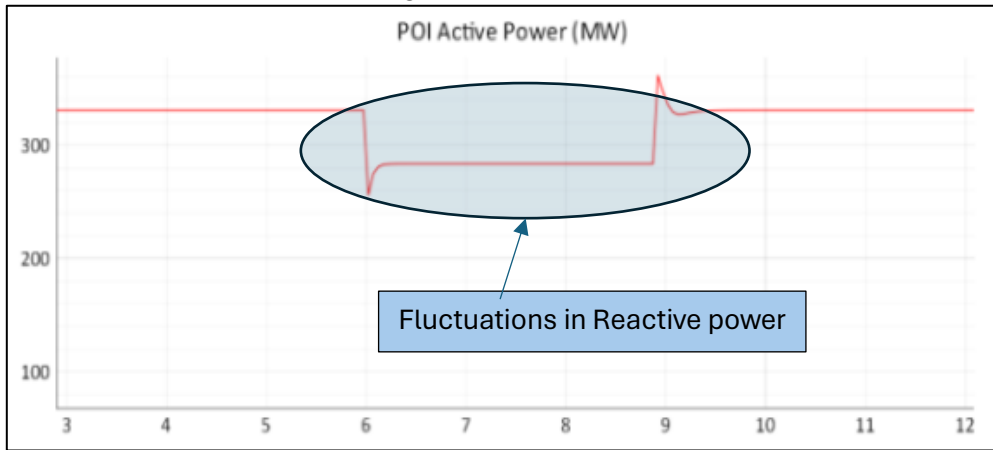


Figure 3 Plant active power response during HVRT (1.15pu case) in PSS/E

4. Delay in active power recovery during LVRT conditions:

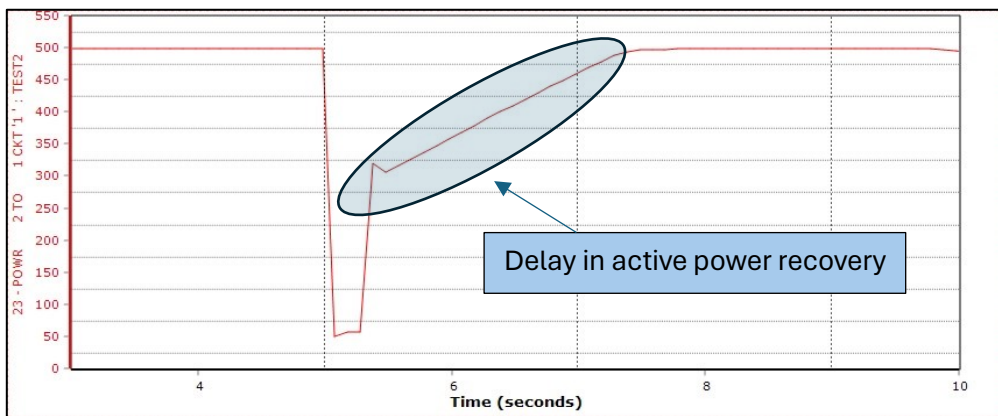


Figure 4 Plant active power response during LVRT (0.15pu case) PSS/E