

Extracts from the Detailed Procedure for relieving congestion in real time operation framed under Regulation 4 (2) of the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009

2. Transfer Capability

2.1. "Total Transfer Capability (TTC)" means the amount of electric power that can be transferred reliably over the inter-control area transmission system under a given set of operating conditions considering the effect of occurrence of the worst credible contingency.

2.2. "Transmission Reliability Margin (TRM)" means the amount of margin kept in the total transfer capability necessary to ensure that the interconnected transmission network is secure under a reasonable range of uncertainties in system conditions.

2.3. "Available Transfer Capability (ATC)" means the transfer capability of the inter-control area transmission system available for scheduling commercial transactions (through long term access, medium term open access and short term open access) in a specific direction, taking into account the network security. Mathematically ATC is the Total Transfer Capability less Transmission Reliability Margin.

2.4. TTC is dependent upon the network topology, point and quantum of injection/ drawal and power flows in other paths of the interconnected network as well as prevailing voltage profile in the network during the assessment period.

2.5. TTC is directional in nature and the transfer capability for import of power in a region or control area from another region or control area may be different from the transfer capability for export of power from that region or control area to the other region or control area.

2.6. Total Transfer Capability is time variant and there could be different figures for different time of the day/ month/ season/ year.

2.7. Transfer Capability shall be mentioned in MW.

3. Methodology for assessment of TTC, TRM and ATC

3.1. The methodology shall be in harmony with the detailed procedure of the Central Transmission Utility (CTU) prepared under 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 so as not to have different methodology for determination of TTC, TRM and ATC by the CTU in respect of long-term access and medium-term open access and NLDC/ RLDCs in respect of short-term open access.

3.2. TTC assessment is required for reliable system operation and to facilitate non discriminatory open access in transmission as per CERC regulations on Open Access and Power Markets.

3.3. TTC and TRM shall be assessed with the help of simulation studies carried out for a representative scenario to arrive at an initial or base case. Simulation studies may require setting up of a power system model and obtaining a power flow solution. The construction of an accurate base case power system model is a key step in the execution of a meaningful study.

3.4. Power System model to be considered for simulation studies

3.4.1. EHV transmission network shall be normally modeled down to 220 kV level with exceptions for generating units connected at 132 kV and for North Eastern Region, it shall be modeled down to 132 kV.

3.4.2. Normally all generating units greater than 50 MW and connected at 132 kV and above shall be modeled. Smaller generating units (particularly hydro units) may be lumped for study purposes.

3.4.3. Load shall be generally lumped at 220 kV or 132 kV, as the case may be. Actual system data wherever available shall be used for power system modeling. In cases where data is not available, standard data as given in the CEA Manual on Transmission Planning Criteria shall be considered.

3.4.4. The requirements at clauses 3.3.1 to 3.3.3 are for use of data for RLDCs and NLDC. The SLDCs may consider lower voltage level and smaller units, if required.

3.5. Separate base cases calculating the export and import capability corresponding to both peak and off- peak load and generation with the likely scenario during the time frame for which transfer capability is to be assessed shall be used in the Simulation Studies for calculation of TTC and TRM of the required transmission corridors.

3.6. Input Data for Base Case Preparation

3.6.1. **Network Topology:** This shall be as per network data obtained from CTU and STUs. New transmission elements shall be considered only after the date of commissioning of that asset and duly considering their reliability during initial period.

3.6.2. **Unit Availability:** This shall be as per the maintenance schedule finalized by RPC. The new generating units expected to be available during the assessment period shall be considered only after commissioning of the new units and duly considering their reliability during initial period.

3.6.3. **Coal Fired Thermal Despatch:** This shall be as per the anticipated exbus generation of the thermal generating units arrived after deducting a normative auxiliary consumption as per the norms specified by Central Commission. and provisioning for partial outage based on experience of system operator from the installed capacity

3.6.4. **Gas/ Nuclear Despatch:** This shall be as per past trend of Plant Load Factor available with Central Electricity Authority (CEA) or as per past trend available at SLDCs/ RLDCs.

3.6.5. **Hydro Despatch:** This shall be as per the past trend available at RLDCs/ SLDCs. The day corresponding to the median value of daily consumption of the same month last year would be chosen. The current inflow pattern shall also be considered.

3.6.6. **Reactive power capability of generating units:** As per the generator capability curve or based on the assumption recommended in CEA's Manual on Transmission Planning Criteria.

3.6.7. **Nodal MW demand :** As per the anticipated load provided by SLDCs or Load Generation Balance Report (LGBR) prepared by CEA or past trend available at RLDCs/ NLDC.

3.6.8. **Nodal MVAR demand:** As per the anticipated power factor provided by SLDCs. In the absence of data from SLDCs, the load power factor at 220kV or 132 kV voltage levels shall be taken as 0.85 lag during peak load condition and 0.9 lag during light load condition except areas feeding predominantly agricultural loads where power factor can be taken as 0.75 and 0.85 for peak load and light load conditions as given in the CEA's Manual on Transmission Planning Criteria. This would be verified, post facto, with actual data, and if different, would be made more accurate for the future.

3.6.9. Permissible Normal and emergency limits for transmission elements shall be as defined in the (CEA Manual on Transmission Planning Criteria).

3.7. In case data from any of the sources mentioned above is unavailable or in case of additional data requirement, reasonable assumptions shall be made.

3.8. Total Transfer Capability between two areas would be assessed by increasing the load in the importing area and increasing the generation in the exporting area or vice versa till the constraints are hit for a credible contingency. The following credible contingencies shall be considered:

3.8.1. Outage of single transmission element (N-1) in the transmission corridor or connected system whose TTC is being determined as defined in IEGC

3.8.2. Outage of a largest unit in the importing control area Station.

3.9. During assessment of Total Transfer Capability it shall be ensured that the conditions specified in CEA Manual on Transmission Planning Criteria are met after credible n-1 and n-1-1 contingencies.

3.10. Assessment of the Total Transfer Capability shall be in line with CEA's Manual on Transmission Planning Criteria (Relevant paragraphs 5 to 8.1 given as **Appendix-I**). Salient points to be considered while assessing TTC shall be:

- 3.10.1. Violation of grid voltage operating range or
- 3.10.2. Violation of transmission element loading limit in n-1 contingency case
or
- 3.10.3. Violation of emergency limit in the n-1 contingency case or
- 3.10.4 Stability under n-1-1 contingency of a temporary single phase to ground fault on a 765 kV line close to the bus or a permanent single phase to ground fault on a 400 kV line close to the bus
- 3.10.5 Angular difference of 30 degrees between adjacent buses under n-1 contingency.

3.11. Transmission Reliability Margin (TRM) shall be kept in the total transfer capability to ensure that the interconnected transmission network is secure under a reasonable range of uncertainties in system conditions. Computation of TRM for a region or control area or group of control areas would be based on the consideration of the following:

- 3.11.1. Two percent (2%) of the total anticipated peak demand met in MW of the control area/group of control area/region (to account for forecasting uncertainties)
- 3.11.2. Size of largest generating unit in the control area/ group of control area/ region

4. Procedure for declaration of TTC, TRM, ATC and anticipated Constraints

4.1. State Load Despatch Centre (SLDC) shall assess the Total Transfer Capability (TTC), Transmission Reliability Margin (TRM) and Available Transfer Capability (ATC) on its inter-State transmission corridor considering the meshed intra State corridors for exchange (import/ export) of power with inter-State Transmission System (ISTS). These figures along with the data considered for assessment of TTC would be forwarded to the respective RLDC for assessment of TTC at the regional level. The details of anticipated transmission constraints in the intra State system shall also be indicated separately.

4.2. Regional Load Despatch Centres shall assess TTC, TRM and ATC for the inter regional corridors at respective ends, intra regional corridors (group of control areas) and for individual control areas within the region (if required) for a period of three months in advance. During assessment of TTC, the RLDCs would duly consider the input provided by the SLDCs. The TTC, TRM and ATC figures for the inter-regional corridors, intra regional corridors (group of control areas) and for individual control areas within the region (if required) along with all the input data considered shall be forwarded to NLDC. The details of anticipated transmission constraints in the intra regional system shall also be indicated separately.

4.3. National Load Despatch Centre (NLDC) shall assess the TTC, TRM and ATC) of inter and intra-regional links/ Corridors respectively for three months in advance for each month up to the fourth month based on :

4.3.1. The inputs received from RLDCs

4.3.2. TTC/ TRM/ ATC notified/ considered by CTU for medium-term open access. Sample format for declaration of TTC/TRM/ATC is enclosed as **Format-I**.

4.4. NLDC shall inform the TTC/ TRM/ ATC figures along with constraints observed in inter-regional/ intra-regional corridors to the RLDCs. These shall be put on the website of RLDCs as well as NLDC.

4.5. NLDC may revise the TTC, TRM and ATC due to change in system conditions (including commissioning of new transmission lines/ generation), vis-à-vis earlier anticipated system conditions which includes change in network topology or change in anticipated active or reactive generation or load, at any of the nodes in the study. Revisions may be done by NLDC based on its own observations or based on inputs received from SLDCs/ RLDCs. Revised TTC, TRM and, ATC shall be published on website of NLDC and RLDCs along with reasons thereof.

4.6 SLDCs / RLDCs / and NLDC shall designate Main and Alternate officers as "Reliability co-coordinator(s)."