

PROCEDURE FOR PLANNING OF INTER-STATE TRANSMISSION SYSTEM (ISTS)

Central Transmission Utility of India Ltd.

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PROCEDURE FOR PLANNING OF INTER-STATE TRANSMISSION SYSTEM

1. Outline

- 1.1. This procedure has been prepared by Central Transmission Utility of India Ltd. (CTUIL), hereinafter referred to as CTU, in discharge of its functions under Section 38(2)(b) of the Act for the purpose of planning and co-ordination relating to Inter-State Transmission System in accordance with Electricity (Transmission System Planning, Development and Recovery of Inter-State Transmission Charges) Rules, 2021.

2. Applicability

- 2.1. This procedure shall be applicable to stakeholders such as Central Government, State Governments, Central Transmission Utility (CTU), Central Electricity Authority (CEA), Regional Power Committees (RPCs), State Transmission Utilities (STUs), Generation companies, System Operators (National, Regional, and State), Licensees, and any other person notified by the Central Government in this behalf.
- 2.2. This Procedure shall come into effect from the date it is published on CTU website.

3. Planning Philosophy and Cycle

- 3.1. A robust, strong and flexible ISTS network acts as an enabler for seamless transfer of power from any generator to demand centres anywhere in the country in an efficient, reliable and economic manner. Such a network shall facilitate the ease of interconnection of generators to the ISTS and also the end consumers to purchase power at competitive rates along with promoting the development of vibrant power market. An adequate ISTS network is essential for ensuring continuity of power supply to state utilities and distribution companies under various emergency situations including disaster management.
- 3.2. The CTU shall draw up plan for Inter-State Transmission System (ISTS) for upto next five years on rolling basis every year identifying specific transmission projects which are required to be taken up along with their implementation timelines, after considering the plans made by Central Electricity Authority (CEA) and studying the progress in generation capacity

and demand in different parts of the country as well as taking note of General Network Access (GNA) requests made by Designated Inter-state Customers (DICs), any signals of any congestion in any part of the ISTS and difficulties in obtaining right of way for development of transmission corridors.

- 3.3. Towards this, the entire process for transmission planning shall be undertaken on continuous basis, twice a year, as detailed below. Hereinafter, this shall be referred to as “**ISTS Planning Cycle**”:

Table 1: ISTS Planning Cycle

Sl. No.	Activities	Responsibility*	Timeline	
			(Apr- Sep)	(Oct-Mar)
1.	Data Collection: - Inputs regarding plans made by CEA (short term & perspective plans for next ten years) - Open Access / General Network Access / Cross border transaction requests made by Designated Inter-state Customers / other entities - Data to be submitted by the STUs (to be facilitated - by RPCs) - Transmission constraints along with operational data to be submitted by System Operators to CTU - RE related inputs to be provided by MNRE	MNRE, CTU, CEA, STUs, RPCs, and POSOCO	01 st to 30 th Apr	01 st to 31 st Oct
2.	Data validation and preparation of Load-Generation Balances (LGBs) at All India level for different scenarios through joint consultation in separate regional meetings	CTU, CEA, STUs, RPCs, and POSOCO	15 th Jun	15 th Dec
3.	Preparation of base case files for identified LGB(s) at All India level	CTU	30 th Jun	31 st Dec
4.	Single or Multi Regional Joint System studies for evolution of new ISTS schemes and / or augmentation of existing system	CTU, CEA, POSOCO, and concerned RPC(s) & STU(s)	31 st Jul	31 st Jan
5.	Preliminary proposal along with assumptions on CTU website for stakeholders' comments	CTU	15 th Aug	15 th Feb

Sl. No.	Activities	Responsibility*	Timeline	
			(Apr- Sep)	(Oct-Mar)
6.	Stakeholders' comments on the preliminary proposal	Stakeholders	31 st Aug	28 th Feb
7.	Finalisation of transmission schemes considering comments / suggestions of stakeholders and uploading of the final proposal on CTU website	CTU	30 th Sep	31 st Mar

**Inputs from transmission licensees may also be taken at various stages regarding RoW, new technologies, etc.*

- 3.4. The details of finalized schemes along with their implementation timelines and status of approval shall be made part of the ISTS Rolling Plan for upto next five years and the same shall be published and reviewed as per ISTS Planning Cycle mentioned above.

4. Data requirement from all stakeholders

- 4.1. CTU shall be the nodal agency for compilation of data required for formulation of basic network data file (base case files) for the purpose of ISTS planning.
- 4.2. Stakeholders shall provide requisite data in the form and manner specified under para 4.4 below, on bi-annual basis as per para 3.3.
- 4.3. Stakeholders shall also provide details related to expected timelines for commissioning of under construction and planned generation(s) / transmission elements.
- 4.4. Following type of data shall be required by CTU in PSSE as well as MS-Excel format (**Annexure-I**) from all stakeholders for preparing and updating planning files:
 - **Substation (List-1):** Consists of buses represented in the file along with name and voltage level, availability of load and injection by generator
 - **Transmission lines (List-2):** Consists of lines along with names of the substations interconnected by them with line parameter (positive and zero sequence), line length, line reactors, conductor configuration, etc.
 - **Generator connected (List-3):** Various generating stations of the states modelled in the file along with parameters are given in the list with values

like P_{max} , P_{min} , Q_{max} , Q_{min} , MVA base, X_s , X_d' , X_d'' , X_{tran} (% impedance of GT) etc.

- **Loads (List-4):** Loads considered, both P and Q
 - **Shunt (List-5):** If fixed bus shunt includes shunt capacitor or bus reactors, reactors may be shown with negative sign
 - **Transformer (List-6):** Substation name, From and To bus voltage, Tap Position, number of Transformers, Rated MVA, % Impedance, connection code, zero impedance etc.
 - **LCC HVDC (List-7):** Rectifier Bus, Inverter bus, Control mode, Set val, maximum firing angle, minimum firing angle, scheduled voltage, commutating resistance etc.
 - **VSC HVDC (List-8):** Converter bus1, Converter bus 2, Control mode, Set val, Rdc, scheduled voltage, ac current rating etc.
 - **STATCOM (List-9):** Bus number, Control mode, P set point, Q set point, V send setpoint, shunt max etc.
 - **Switched Shunt (List-10):** Bus number, Control mode, Vhi, Vlo, Binit, Blk1 steps, Blk1 step (MVar) etc.
- 4.5. CTU would circulate the last updated load flow file for planning horizon amongst all stakeholders as per requirement. STUs would indicate changes in network topology, load, generation, etc. in PSSE format (python or iddev files) supported by data indicating the above changes in formats given at **Annexure-I**. RPCs shall facilitate CTU in this process.
- 4.6. Following common bus number nomenclature to be followed by all the stakeholders for creation of new bus numbers in PSSE after examining the next available unique bus nos. in the given series –

Zone / State		Voltage	Unique Bus Number		
D1	D2	D3	D4	D5	D6

Example: In bus number 542001, 54 represents Tamil Nadu zone, 2 represents 230 kV and 001 is the bus number.

Detailed nomenclature for bus numbering, zone and area allocation is attached as **Annexure-II**.

Regarding owner assignments for identification of type of generators based on source of fuel & sector nomenclature **Annexure-III** may be referred.

- 4.7. Stakeholders shall also be responsible for submission of electro-mechanical and electro-magnetic data models to CTU in desired simulation software such as PSSE, PSCAD, etc. of various network elements like Generators (all types), FACTS devices, HVDCs etc. The data shall preferably be provided using the standard models available in the simulation software.
- 4.8. In absence of receipt of data from Generator / Transmission utilities, data of similar size & type existing generator / transmission element shall be considered as per generic models with generic parameters available with CTU / POSOCO.
- 4.9. In case, stakeholders do not submit data within prescribed time-lines as specified in para 3.3, suitable assumptions would be made for the studies. However, data submitted after the time-lines shall be considered in the next cycle.

5. Data and information to be provided by STUs

- 5.1. STUs shall nominate two or more nodal officers for coordination with CTU & RPC in regard to planning studies including submission of requisite power system data within 15 days of publication of this procedure. Subsequent change in nomination, if any, may also be intimated to CTU & RPC well in advance.
- 5.2. STUs shall intimate modifications of following data in the last updated base case file circulated by CTU in PSSE format (idev or python) supported by data indicating the above changes in formats given at **Annexure-I** on bi-annual basis as per timeline specified in ISTS Planning Cycle:
 - Modifications of basic network data (as per Lists-1, 2, 5 & 6 of para 4.4) corresponding to Intra-State Transmission System (In-STs)
 - Intra-state generation addition/phasing out data (List-3)
 - Steady state and dynamic data pertaining to In-STs transmission line, substation equipment, generation, HVDC, FACTS/STATCOMs etc. (as per Lists – 7, 8, 9 & 10)
 - Demand data changes (List-4). The overall demand data of states with proposed changes shall be submitted by respective STUs in due consideration of the EPS published by CEA. In case of any deviations

same shall have to be appropriately justified. STUs shall consult their respective Distribution companies and / or SLDCs for submission of demand data, if required, for demand assessment.

- 5.3. STUs shall be responsible for submission of all the planning related data and models to CTU in desired formats in respect of In-STS generation and transmission elements.
- 5.4. STUs in coordination with SLDCs shall submit the forecasted drawl from ISTS grid considering historical data & future generation capacity augmentation along with operational feedback, if any.

6. Data and information to be provided by ISTS connected Generators

- 6.1. Generators connected or intending to connect to ISTS shall submit their technical data (electro-mechanical and electro-magnetic) to CTU in comprehensive manner in the form of equivalent PSSE, PSCAD and/or any other software standard models.
- 6.2. Generators are required to validate their data models with their respective machines before submission of the same to CTU.
- 6.3. Generators already connected to ISTS or to whom connectivity has been granted but are yet to be connected to grid shall be required to submit the data models within six months of publication of this Procedure. Further, till submission of requisite data, the data for planning studies of a similar sized machines as available in CEA manual on Transmission Planning Criteria shall be utilized.
- 6.4. Generators connected to ISTS Grid shall revise their data models or parameters of already supplied model, on regular intervals based on actual response or in case any change are carried out by them
- 6.5. Generators which are getting phased out in next five years shall be required to intimate to CTU in advance so that same is considered during planning stage.

7. Data and information to be provided by ISTS Transmission Licensees

- 7.1. ISTS Transmission licensees shall provide following inputs :
 - Difficulties in obtaining Right of Way (Row) for development of transmission corridors

- New Technologies, Conductors, etc.
- Steady state and dynamic data pertaining to transmission line, substation equipment, HVDC, FACTS etc.
- Tentative cost of transmission equipment (on per unit basis), etc.

8. Data and information to be provided by ISTS Grid Operator (POSOCO)

- 8.1. POSOCO shall furnish information regarding signals of any congestion in any part of the ISTS in respect of ICT & Line loadings, over-voltages, short circuit issues, stability issues, etc. to CTU.
- 8.2. POSOCO shall facilitate CTU with historical data of ICT & Lines loading, bus voltages, generation and demand profile etc. for the purpose of study and analysis.
- 8.3. POSOCO shall facilitate CTU in preparation of dynamic / transient stability study files by sharing data models of existing generating and transmission elements available with them.
- 8.4. After interconnection with ISTS Grid, POSOCO shall be responsible for model validation (within two months of first-time charging). The same shall be updated on annual basis or as prescribed by CERC from time to time thereafter. Model validation refers to a process to improve the models used in simulations so as to make the simulation results as close to the actual responses of the power system as possible. Such validation effort mainly applies to data models, such as
 - Generator including conventional, wind, and solar units
 - Excitation system
 - Governor
 - PSS
 - FACTS
 - HVDC, etc.

Upon validation, the final models shall be submitted to CTU for use in the planning base cases.

9. Data and information to be provided by RPCs

- 9.1. RPCs shall facilitate CTU in respect of data collection from STUs; validation & preparation of study files; and joint studies for evolution of new ISTS schemes.
- 9.2. RPCs shall facilitate CTU in obtaining requisite details from STUs pertaining to In-STS including steady state and electro-mechanical & electro-magnetic data models of generating & transmission elements.

10. Data and information to be provided by CEA

- 10.1. CEA shall share relevant inputs for planning studies based on short term plan prepared every year on rolling basis for upto next five years and perspective plan every alternate year on rolling basis for next ten years for development of the ISTS.
- 10.2. CEA shall facilitate CTU in data collection, validation, joint studies, tentative costing as well as finalization of ISTS schemes before they are taken up for approval in relevant forums.

11. Data and information to be provided by MNRE

- 11.1. Following inputs shall be required from MNRE for evolving transmission system for potential RE zones (REZs):
 - Location of the RE potential (preferably district-wise) along-with quantum of the potential
 - Type of the above RE Potential (Wind/Solar/Hybrid)
 - Time-frame in which the above potential is expected to materialize so that the planned transmission system can be phased in to match with corresponding RE generation
 - Any other data as may be required for planning of ISTS system

12. Data Validation

- 12.1. Based on the inputs from various stakeholders as per various provisions above, CTU shall prepare the basic network base case file and same shall be validated through joint consultation amongst CTU, CEA, STUs, RPCs & POSOCO bi-annually as per time-line specified under para 3.3. Based on the inputs from the stakeholders, after necessary modifications network data shall be finalised.

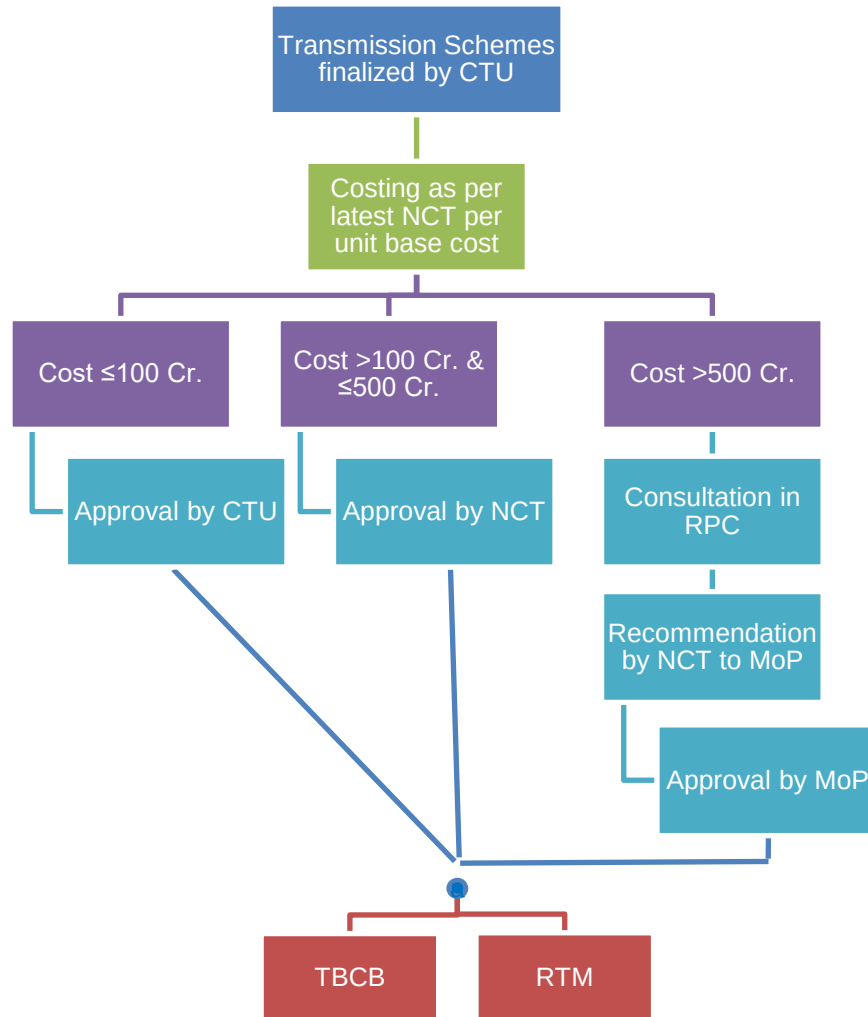
- 12.2. Based on the validated network data, details of generation (as provided by STUs/ISTS connected generators) and details of demand (as provided by STUs in coordination with respective state distribution licensees), etc. CTU shall prepare the base case files bi-annually as per time-line specified under para 3.3.

13. Preparation of Transmission Plan for new ISTS

- 13.1. Load-generation scenarios shall be worked out as per the requirements so as to reflect the daily and seasonal variations in load demand and generation availability (such as cases for peak, off-peak and other than peak / off-peak hours for different seasons considering low, moderate and high renewable/other generation capacity).
- 13.2. In addition to this, varying import/export requirements of each state and scheduling of various generating stations under economic dispatch for which variable cost of existing and upcoming generating stations may also be considered.
- 13.3. While planning the transmission system, options of upgrading the existing ISTS in place of building new transmission lines (such as increasing line loading through use of compensation, reconductoring, etc.) shall be explored for optimally utilizing the existing assets.
- 13.4. To avoid bottling up of power, STUs shall also plan/strengthen their downstream networks based on the evolved inter-state transmission system in similar time-frame. Based on progress of implementation of generating stations and upstream/ downstream systems, mid-course correction for transmission system to the extent possible should be made in terms of (i) Re-configuration of planned transmission system, (ii) Phasing of transmission elements and (iii) Rescheduling of some of the transmission elements.
- 13.5. CTU shall carry out joint studies in consultation with CEA, POSOCO, RPCs, and STUs for evolution of new transmission system as per time-line specified under para 3.3.
- 13.6. Based on the outcome of joint studies, CTU shall prepare the preliminary plan for proposed ISTS with following details:
- a) Assumptions made in system studies and inputs received from stakeholders
 - b) Results of system studies

- c) Detailed justification for the scheme along with details of the complete scheme
 - d) Recommendations regarding matching In-STS network system strengthening (as required)
 - e) Estimated cost of schemes
- 13.7. The preliminary plan shall be published on CTU website for inviting observations from stakeholders on the proposed transmission schemes bi-annually as per time-line specified under para 3.3. Thereafter, stakeholders shall be required to submit their comments on the evolved ISTS plan, if any, bi-annually as per time-line specified under para 3.3 (viz. within 15 days of uploading). In case of non-receipt of comments by any stakeholder by the stipulated date, it shall be construed that stakeholders are in agreement with the plan and have no observations on the same.
- 13.8. The transmission plan shall be prepared considering observations from stakeholders and CTU shall publish the plan on its website bi-annually as per time-line specified under para 3.3.
- 13.9. The approval of planned schemes shall be as per relevant notification(s) of the Ministry of Power. The details of finalized schemes along with their implementation time lines and status of approval shall be made part of the annual rolling plan for ISTS for upto next five years and the same shall be reviewed bi-annually as per details at para 3.3.
- 14. Consultation and Approval of planned ISTS scheme**
- 14.1. The meeting for consultation on transmission planning with participation from CEA, CTU, POSOCO, RPCs and STUs for respective region would be held on monthly basis or more frequently as may be required, wherein the discussions taken in the joint study meetings would also be included. During the meeting, deliberations would be held for processing of Open Access / General Network Access applications, assessment of transmission system augmentation requirements in ISTS, any other matter pertaining to planning of ISTS, etc.
- 14.2. The approval of planned ISTS schemes shall be as per relevant notification(s) of the Ministry of Power (MoP). MoP vide its office order no. 15/3/2018-Trans-Pt(5) dated 28-10-2021 regarding reconstitution of National Committee on Transmission (NCT), has made following process for approval of ISTS schemes. As per said office order, approval shall include identification of mode

of implementation viz. TBCB or RTM and also commissioning schedule. Further, cost estimation of the project is to be done by NCT.



14.3. The above process may undergo changes as per directions of MoP from time to time.