Northeast Texas Electric Cooperative, Inc.

Transmission Planning Reliability Criteria

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Purpose

This document presents the Northeast Texas Electric cooperative, Inc. ("NTEC") transmission planning criteria meant to assess transmission system reliability and determine when conversion of radial facilities to closed loop operation should be considered.

Nominal Voltage Levels

Nominal 345 kV and 138 kV voltage levels will normally be used for most new transmission circuits. Some interconnection circuits may be constructed at 115 kV, or 230 kV to align with neighboring utilities' operating voltage. Nominal 69 kV circuits may be considered appropriate in some situations and facilities may be constructed rated 138 kV to allow future voltage conversion if needed.

Voltage Limits

Transmission voltage should not exceed 105% nor fall below 95% of nominal voltage under normal (pre-contingency) conditions. Transmission voltage should not exceed 105% nor fall below 92% of nominal voltage during emergencies (Appendix 1). Transmission voltages during emergencies should not result voltages at the point of delimitation with NTEC customer facilities exceeding or falling below prescribed limits at distribution substations, and voltages at generating stations below minimum acceptable levels established to prevent tripping of the generating units. Capacitor banks, reactors, and LTC auto-transformers are used in transmission substations to hold voltage levels within acceptable ranges during normal and emergency conditions.

Facility Ratings

Facility ratings define transmission facility loading limits. Normal ratings are generally based upon no abnormal loss of facility life or equipment damage. Emergency ratings may accept some loss of life or strength, over a defined time limit for operation at the rated loading level. The facility rating for a transmission circuit is defined by the most limiting facility element driven by either conductor capability, sag clearance, terminal equipment rating or other factors, including public safety requirements. Normal and emergency transmission equipment ratings are documented by the NTEC Facility Ratings Methodology.

In particular, transmission line loadings should not exceed 100% of the applicable normal rating during normal conditions, or 100% of the applicable emergency rating during emergency conditions.

Contingency Testing Criteria

Contingency are selected for evaluation in accordance with applicable NERC Reliability Standards for transmission planning. Appendix 1 documents the testing criteria for NTEC transmission facilities under normal and contingency conditions.

For facilities, not subject to the NERC standards for transmission planning, system performance is evaluated based on single contingency events. Single contingencies include the forced outage of generating units, transmission circuits, transformers, and/or other equipment. In general, a single contingency is defined as the outage of any one of these facilities. Due to the interconnected nature of power systems, testing may include outages of facilities in neighboring systems. A single facility is defined by the arrangement of automatic protective devices and disconnecting equipment (i.e. circuit breakers, relays, etc.). Generally, double circuit tower outages, breaker failures, station outages, common right-of-way outages, and other common mode failures have substantially lower probabilities of occurrence than the outage of a single transmission facility and are, therefore, not considered single contingencies.

NTEC considers less probable/extreme contingency testing and could investigate the following situations:

- Loss of any combination of related facilities, a critical transmission circuit when a 345 kV auto-transformer is out of service, or a generating unit when another generating unit is out of service.
- Sudden outage of any multi-circuit transmission corridor at a time when any other single circuit is out of service.
- Sudden outage of any single, or double-circuit transmission tower corridor at a time when two generating units are out of service.
- Sudden outage of any generating unit at a time when any two other generating units are out of service.

The identified equipment above could be NTEC, NTEC member, or neighboring utility owned.

The purpose of testing the NTEC system for less probable/extreme contingencies is to evaluate the risk of uncontrolled islanding, or uncontrolled loss of large amounts of load.

Short Circuit Testing Criteria

Short circuit analysis is performed periodically to ensure the proper circuit interrupting capability during system fault conditions. Short circuit analysis is performed assuming 1.05 per unit voltage at all NTEC and NTEC member system buses.

Stability Testing Criteria

NTEC test system stability under the planning events specified in the NERC Reliability Standards for transmission planning. Testing with disturbance events other than those specified in NERC Reliability Standards for transmission planning may be performed in planning and operational planning studies where applicable.

The NTEC system is considered stable when meets the system performance specified in SPP's Disturbance Performance Requirements document.

Radial-to-Loop Conversion Criteria

The following criteria shall serve as the basis for planning for the NTEC system when evaluating potential conversion of radial facilities to closed loop operation:

If the NTEC load at a Point of Delivery (POD) multiplied by the length of the radial facility exceeds 300 MW-miles, then conversion of the facility to closed loop operation shall be considered.

Appendix 1

Table 1 – Steady State & Stability Performance Planning Events

Steady State & Stability:

a. The System shall remain stable. Cascading and uncontrolled islanding shall not occur.
b. Consequential Load Loss as well as generation loss is acceptable as a consequence of any event excluding P0.
c. Simulate the removal of all elements that Protection Systems and other controls are expected to automatically disconnect for each event.
d. Simulate Normal Clearing unless otherwise specified.
e. Planned System adjustments such as Transmission configuration changes and re-dispatch of generation are allowed if such adjustments are executable within the time duration applicable to the Facility Ratings.

Steady State Only:

f. Applicable Facility Ratings shall not be exceeded.
g. System steady state voltages and post-Contingency voltage deviations shall be within acceptable limits as established by the Planning Coordinator and the Transmission Planner.
h. Planning event P0 is applicable to steady state only.
i. The response of voltage sensitive Load that is disconnected from the System by end-user equipment associated with an event shall not be used to meet steady state performance requirements.

Stability Only:

j. Transient voltage response shall be within acceptable limits established by the Planning Coordinator and the Transmission Planner.

Category	Initial Condition	Event [1]	Fault Type [2]	BES Level [3]	Interruption of Firm Transmission Service Allowed [4]	Non-Consequential Load Loss Allowed
P0 No Contingency	Normal System	None	N/A	EHV, HV	No	No
P1 Single Contingency	Normal System	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer [5] 4. Shunt Device [6]	3Ø	EHV, HV	No[9]	No[12]
		5. Single Pole of a DC line	SLG			
P2 Single Contingency	Normal System	1. Opening of a line section w/o a fault [7]	N/A	EHV, HV	No[9]	No[12]
		2. Bus Section Fault	SLG	EHV	No[9]	No
				HV	Yes	Yes
		3. Internal Breaker Fault [8] (non-Bus-tie Breaker)	SLG	EHV	No[9]	No
				HV	Yes	Yes
		4. Internal Breaker Fault (Bus-tie Breaker) [8]	SLG	EHV, HV	Yes	Yes

Appendix 1

Category	Initial Condition	Event [1]	Fault Type [2]	BES Level [3]	Interruption of Firm Transmission Service Allowed [4]	Non-Consequential Load Loss Allowed
P3 Multiple Contingency	Loss of generator unit followed by System adjustments[9]	Loss of one of the following: 1. Generator 2. Transmission Circuit 3. Transformer [5] 4. Shunt Device [6]	3Ø	EHV, HV	No[9]	No[12]
		5. Single pole of a DC line	SLG			
P4 Multiple Contingency *(Fault plus stuck breaker[10])*	Normal System	Loss of multiple elements caused by a stuck breaker [10](non-Bus-tie Breaker) attempting to clear a Fault on one of the following: 1. Generator 2. Transmission Circuit 3. Transformer [5] 4. Shunt Device [6] 5. Bus Section	SLG	EHV	No[9]	No
				HV	Yes	Yes
		6. Loss of multiple elements caused by a stuck breaker[10] (Bus-tie Breaker) attempting to clear a Fault on the associated bus	SLG	EHV, HV	Yes	Yes
P5 Multiple Contingency *(Fault plus relay failure to operate)*	Normal System	Delayed Fault Clearing due to the failure of a non-redundant relay[13] protecting the Faulted element to operate as designed, for one of the following: 1. Generator 2. Transmission Circuit 3. Transformer [5] 4. Shunt Device [6] 5. Bus Section	SLG	EHV	No[9]	No
				HV	Yes	Yes
P6 Multiple Contingency *(Two overlapping singles)*	Loss of one of the following followed by System adjustments.[9] 1. Transmission Circuit 2. Transformer [5] 3. Shunt Device[6] 4. Single pole of a DC line	Loss of one of the following: 1. Transmission Circuit 2. Transformer [5] 3. Shunt Device [6]	3Ø	EHV, HV	Yes	Yes
		4. Single pole of a DC line	SLG	EHV, HV	Yes	Yes

Appendix 1

Category	Initial Condition	Event [1]	Fault Type [2]	BES Level [3]	Interruption of Firm Transmission Service Allowed [4]	Non-Consequential Load Loss Allowed
P7 Multiple Contingency *(Common Structure)*	Normal System	The loss of: 1. Any two adjacent (vertically or horizontally) circuits on common structure [11] 2. Loss of a bipolar DC line	SLG	EHV, HV	Yes	Yes