

LS Power Grid New York Transmission Planning Criteria

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Revision History

Date	Version	Description	Sponsor
04/30/2021	-	Initial document to establish Transmission Planning Criteria for LS Power Grid New York	Tim Cook
06/20/2022	2.0	Added Breaker Fault Duty, Extreme Contingency and GMD sections	R. Nagarajan; T. Cook

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1. Purpose

This document describes LS Power Grid New York's (LSPG-NY) Transmission Planning Criteria for assessing the reliability of its existing and future transmission system under reasonably anticipated operating conditions.

2. Introduction

LSPG-NY has developed the planning criteria described in this document in compliance with North American Electric Reliability Corporation (NERC) planning standards. The transmission planning criteria documented herein is intended to serve as a guide for LSPG-NY to reliably operate its transmission system facilities under normal operating and contingency conditions.

Planning guidelines and criteria detailed in this document is intended to act as a supplement to those established by NERC, Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC).

LSPG-NY adheres to

- NYSRC's Reliability Rules & Compliance Manual Section B.1 - Transmission System Planning Performance Requirements.
- New York Independent System Operator's (NYISO) transmission planning criteria and guidelines as specified in Section 4 of Manual 23 - "Transmission Expansion and Interconnection Manual".

3. Transmission Planning & Operation Standards

All LSPG-NY transmission system design, planning and operational activities are subject to the NERC Standard TPL-001-4 performance standards and those that the NYISO adhere to. The following aspects need to be taken into account when applying the standard/performance criteria for transmission planning activities:

i. Treatment of Switched Shunt and/or Load Tap Changer (LTC) devices

- a. Switched shunt reactive devices (capacitors and reactors) are shown as fixed devices with either an "ON" or "OFF" status;
- b. Load Tap Changers (LTC) on auto-transformers and generator step-up transformers are locked.

ii. Transmission Planning Performance Planning Events

- a. LSPG-NY will demonstrate via appropriate assessments that all of its interconnected transmission system is planned such that its portion of the transmission system can be operated reliably to supply projected demands at all levels within the range of forecasted demands under the performance criteria set by NERC Standard TPL-001-4 and those that the NYISO adhere to. The demonstration of such an effort would include but not be limited to ensuring:
 1. Transmission planning efforts span both near and long-term planning horizons as defined in the NERC TPL Standard (TPL-001-4)
 2. All normal operating procedures are established
 3. All projected firm transfers, if applicable, are modeled and the assessment spans varying demand levels across the entire range of forecasted system demands
 4. Assessment includes existing and planned facilities taking into account lead times especially that associated with long-lead time equipment as defined in NERC TPL-001-4
 5. Ensure system performance meets criteria outlined in the NERC Standard TPL-001-4 and other NPCC/NYSRC planning rules from a transmission system capacity and reactive resource adequacy standpoint
 6. NYSRC Transmission Planning Reliability Rules are applied

4. Transmission System Ratings – Normal Operating & Contingency Conditions

i. Bus Voltages

- a. The LSPG-NY transmission system is planned at nominal voltage levels of 345 kilovolts (kV), 230 kV and 115 kV.
- b. For 345 kV and 230 kV the transmission system voltages shall not exceed 1.05 per unit or fall below 0.98 per unit of nominal voltage during P0 event (no contingency – normal system). The voltage range during post contingency shall not exceed 1.05 per unit or fall below 0.95 per unit (see Table 1).
- c. For 115 kV the transmission system voltage shall not exceed 1.05 per unit or fall below 0.95 per unit of nominal voltage during P0 event (no contingency – normal system). The voltage range during post contingency shall not exceed 1.05 per unit or fall below 0.90 per unit (see Table 1).
- d. It is to be noted that for BPS equipment NYISO's operating limits, if found to

be more stringent, will be applicable. More details in NYISO's Emergency Operations can be found in Manual 15 and a list of BPS equipment voltage limits are specified in Table A2 of this manual.

- e. The maximum percent voltage variation from per-contingency to post-contingency is 5.0 for 345 kV and 230 kV and 10.0 for 115 kV.
- f. LSPG-NY will follow the NYISO Voltage Limit Guideline – Refer to Attachment G, NYISO Transmission Planning Guideline #2-1, of the NYISO “Transmission Expansion and Interconnection Manual.”

Table 1: Voltage Range

Voltage kV	System Normal		Post Contingency	
	p.u.	kV	p.u.	kV
345	1.05 – 0.98	362 – 338	1.05 – 0.95	362 – 328
230	1.05 – 0.98	242 – 225	1.05 – 0.95	242 – 219
115	1.05 – 0.95	121 – 109	1.05 – 0.90	121 – 104

Note: System studies may require that the low voltage value be higher than indicated in the table under System Normal conditions.

ii. Facility Ratings

- a. LSPG-NY Facility Rating Methodology is utilized to develop the Facility Ratings for LSPG-NY owned portion of the Bulk Electric System (BES). The methodology applied is in pursuant to the NERC Reliability Standard FAC-008.
- b. Based on the LSPG-NY Facility Rating Methodology, LSPG-NY will develop the Facility Ratings for its transmission lines and transformers utilizing the principle that the applicable thermal rating corresponds to the maximum current carrying capability of the Most Limiting Series Element (MLSE) between its two end points.

iii. Substation Bus Design Criteria

The following will serve as general guidelines to determine the ultimate layout for all new 345kV, 230 kV and 115 kV stations:

- a. The ultimate layout for all new 345 kV and 230 kV stations shall fall under one of the following configurations:
 - Ring Bus Arrangement
 - Breaker-and-a-half Scheme
 - Double bus-double breaker Arrangement.
- b. The ultimate layout for all new 115 kV switching stations (i.e. stations with more than two circuits) should allow for an improved bus arrangement where possible.

- c. The type of improved bus arrangement or configuration shall be consistent with ultimate plans or potential growth of the substation. Based on the number of transmission elements connected to the substation, the following improved bus arrangements would be considered adequate:
 - Five (5) transmission system elements or less – Ring Bus
 - Between Six (6) and Nine (9) transmission system elements – Breaker-and-a-half
 - Ten (10) transmission system elements or greater – Double bus-double breaker
- d. The most economically justifiable improved bus arrangement shall be selected based on system reliability needs and future expansion considerations.

5. System Stability

- a. System transient stability shall be maintained after a disturbance event defined by any of the following system phenomena:
 - Three-Phase Fault
 - Single-Line-to-ground (S-L-G) Fault
 - Line-to-Line (L-L) fault
 - Line-to-Line-Ground (L-L-G) fault
- b. The transient voltage response criterion is a recovery of 0.90 per unit by five seconds after the fault has cleared
- c. System rotor angle and voltage stability shall be maintained at all key generation and/or other stations.
- d. For a stability simulation to be deemed stable, oscillation in angle and voltage must exhibit positive damping within ten seconds after initiation of the disturbance.

6. Breaker Fault Duty

Circuit breaker fault (three phase, phase-to-phase-to-ground, and single line-to-ground) duty studies shall be conducted annually. All resulting breaker duties are required to be within their rated interrupting capability. Fault duty is calculated by following the NYISO Transmission Expansion and Interconnection Manual, Attachment I, NYISO Planning Guideline #4-1, Guideline for Fault Current Assessment.

All circuit breaker capacitive and inductive interrupting duties shall be within rated capability.

7. Extreme Events/Contingencies

Studies shall be performed to assess the impact of the extreme events outlined in the NERC Transmission Planning Reliability Standard (Transmission System Planning Performance Requirements; TPL-001-4) Table A, NPCC Directory 1 and NYSRC Reliability Rules which are expected to produce more severe system impacts. Assessment of the extreme events shall examine post-contingency steady state conditions as well as stability, overload, cascading outages and voltage collapse. If the analysis concludes there is cascading caused by the occurrence of extreme events, an evaluation of possible actions designed to reduce the likelihood or mitigate the consequences and adverse impacts of the event(s) shall be conducted.

Criteria/methodology used in the analysis to identify system instability for conditions such as cascading, voltage instability, or uncontrolled islanding shall consider the following:

- Per the NERC Transmission Planning Reliability Standard, the evaluation of extreme events will identify the possibility of cascading. Cascading is defined as the uncontrolled successive loss of system elements triggered by an incident at any location. Cascading results in widespread electric service interruption that cannot be restrained from sequentially spreading beyond an area predetermined by studies. For extreme event assessments, BES elements are evaluated against their STE rating.
- The NYISO Transmission Expansion and Interconnection Manual, NYISO Transmission Planning Guideline #3-1, Guideline for Stability Analysis and Determination of Stability Based Transfer Limits addresses system stability, including dynamic voltage stability.
- Uncontrolled islanding would occur when generation is isolated with load due to some system condition that is not planned. Uncontrolled islanding will be assessed as part of NYISO / NPCC SS-38 Working Group UFLS studies.

8. Geomagnetic Disturbance Vulnerability Assessments

Per NERC TPL-007-4 R3, each responsible entity is required to have criteria for acceptable System steady state voltage performance for its System during the Geomagnetic Disturbance (GMD) events. NYISO in collaboration with the Transmission Owners developed a criteria document for use in the vulnerability assessments.

LSPGNY will follow this NYISO voltage criteria document for its system performance during GMD events.

9. Reactive Power Planning

- a. The transmission planning criteria ensures adequate reactive power reserve available for system voltage support under varying operational conditions, including expected transfers.

- b. The reactive power reserve would comprise of the reactive capability of the generation resources connected to the transmission system and the static and/or dynamic shunt reactive compensation devices.

10. References

1. NERC TPL-001-4 Reliability Standards, Transmission System Planning Performance Requirements
2. NERC TPL-007-3 Transmission System Planned Performance for Geomagnetic Disturbance Events
3. LSPG-NY Facilities Rating Methodology
4. Attachment G, NYISO Transmission Planning Guideline #2-1, of the NYISO “Transmission Expansion and Interconnection Manual.”
5. NYSRC’s Reliability Rules & Compliance Manual Section B.1 - Transmission System Planning Performance Requirements.
6. New York Independent System Operator’s (NYISO) transmission planning criteria and guidelines as specified in Section 4 of Manual 23 - “Transmission Expansion and Interconnection Manual”.
7. NPCC Directory #1, Design and Operation of the Bulk Power System
8. NYISO Manual 15 Emergency Operations.
9. NYISO’s GMDVA voltage criteria document - “TPL-007-4 R3 Criteria 2022 GMD Vulnerability Assessment”