DECEMBER 12, 2023

Northern Ontario Voltage Study Public Information Session

IESO Transmission Planning

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Agenda

- Introduction
- Technical Landscape & Challenges
- Reactive Power & Voltage Control
- Study Objectives & System Changes
- Analysis Criteria & Proposed Solutions
- Financial Aspects & Implementation
- Next Steps

Purpose of Today's Information Session:

- Provide a brief overview of Northern Ontario's bulk planning
- Share key findings and recommendations from the recent Voltage Study
- Outline next steps

Different Levels of Electricity Planning in Ontario

Background

- Maintaining transmission system voltages below maximum voltage ranges is challenging in northern Ontario today.
- There are several transmission reinforcement projects that are underway or planned to start over the next few years, which can worsen the operational challenges in managing high voltages.
- The IESO conducted this study to provide a comprehensive and co-ordinated approach to assess the reactive power requirements of the northern Ontario bulk power system given expected system development.

Reactive Power Compensation

- Reactive power compensation is used to control voltage variations and to increase the power transfer capability of the transmission system
  - Many loads (such as motors) consume reactive power, which must be supplied from the system.
  - Transmission lines both consume and generate reactive power, the net reactive effect of a transmission line is determined by its loading.
  - Voltage variations occur under the normal daily and seasonal changes in load level, whereas abnormal system conditions can lead to more severe variations.
- Reactive power compensation, using capacitors and reactors, or dynamic reactive compensation devices such as Static Var Compensator (SVC) and STATic synchronous COMpensator (STATCOM) can be an economical way to augment a transmission system.

Importance of Voltage Control

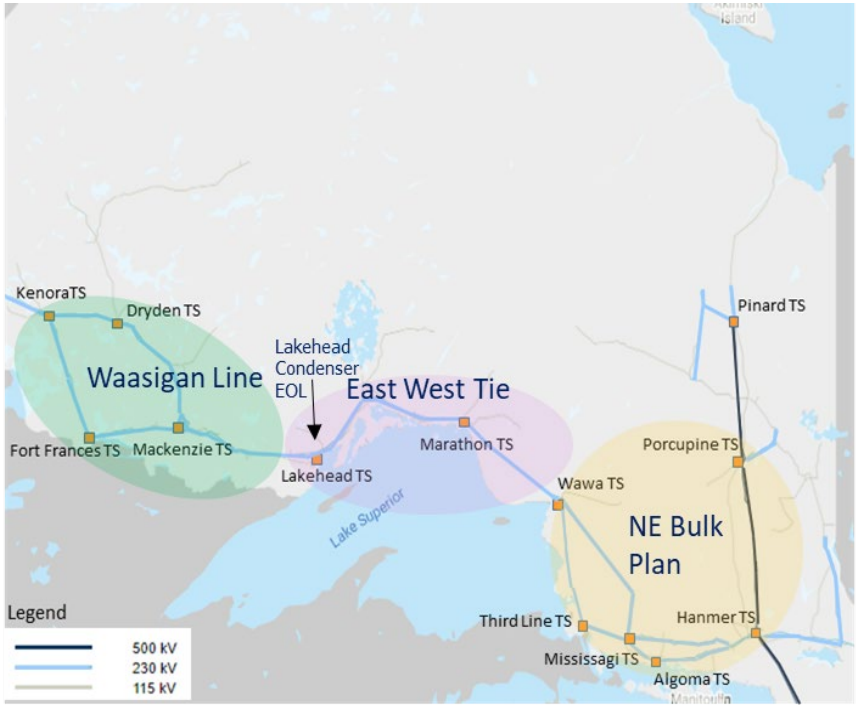
- Voltage control is performed to maintain the voltage level on the system within acceptable limits.
- Voltages must remain within a specified range for proper equipment operations and to avoid equipment damage.
- Maintain good power factor and transfer capability on the transmission system.
- Prevent voltage collapse and widespread power loss.

Objectives of the Study

- The objectives of this study are to:
  - Address operational challenges in managing high voltages that exist today;
  - Identify reactive power requirements to support the integration of several planned new transmission lines, acknowledging that they will provide additional capacitive injection to the bulk transmission system when they are lightly loaded; and
  - Confirm the capacitive requirements to support the Northeast Bulk Plan, which identified a need for dynamic reactive support but did not make a recommendation on size and locations.

Major Changes in the Northern Ontario Bulk System

- The East West Tie expansion came into service in 2022.
- The Lakehead C8 condenser is approaching End of Life (EOL) and is planned for replacement with a similar sized STATCOM.
- The Waasigan transmission project Phase 1 is targeted to be completed at the end of 2025 and Phase 2 is expected to be in service by the end of 2027.
- The Northeast Bulk Plan recommended transmission lines between Sudbury and Sault Ste. Marie (targeted to be in service by 2029), and a line between Wawa and Porcupine (targeted to be in service by 2030).



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Planning Criteria

- This study was conducted in accordance with the following planning criteria:
  - North American Electric Reliability Corporation (NERC) TPL-001 "Transmission System Planning Performance Requirements",
  - Northeast Power Coordinating Council (NPCC) Regional Reliability Reference Directory #1 "Design and Operation of the Bulk Power System" where applicable, and
  - IESO Ontario Resource and Transmission Assessment Criteria (ORTAC).
- Operating practices and challenges were also considered in this study.

Methodology

- Pre-contingency and post-contingency analysis were performed to ensure compliance with the planning criteria.
- All-in-service (AIS) and outage conditions were considered in the assessment.
  - Recognizing that there are limited actions that can be taken to manage high voltages, and that operating above maximum allowable voltages can pose a risk to transmission and customer equipment, the IESO took a conservative approach by considering an additional critical reactive compensation device to be on planned outage in contingency assessment for the high voltage cases.

Needs Identification

- The following needs were identified through this study:
  - High voltage issues in the Northwest and Northeast systems today under outage conditions.
  - High voltage issues under light load/low transfer conditions following the incorporation of new transmission lines through the Waasigan project and the Northeast Bulk plan recommendations.
  - Low voltage and voltage drop in the Northeast system following the loss of the new transmission line from Sudbury to Mississagi with forecast demand growth.

Option Evaluation

- To address the identified issues, this study explored options including static and dynamic reactive devices and assessed various locations for these devices based on technical performance, cost and physical feasibility.
- The study also explored the option of enhancing existing nearby generation facilities to expand their reactive capabilities to provide additional voltage support.

Recommended Solutions

- The study recommended the following solutions:
  - Install shunt reactors at Lakehead TS, Porcupine TS, Mackenzie TS and Mississagi TS to manage high voltages.
  - Install STATCOM devices at Mississagi TS and Algoma TS to provide dynamic reactive support and enhance operability.

Estimated Cost and Implementation

- The total estimated capital cost of the proposed reactive power devices is approximately $190 million.
- The recommended reactive power devices will be implemented "within the fence" at existing stations and are expected to come in service between 2025 and 2029.

Next Steps

- Publish Northern Ontario Voltage Study Report – December 2023.
- Support the implementation of the recommended solutions.
- Continue to monitor demand growth and system development in Northern Ontario and recommend additional reactive support as needed.
- Continue discussions through Northwest and Northeast Regional Electricity Networks.

Thank You

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