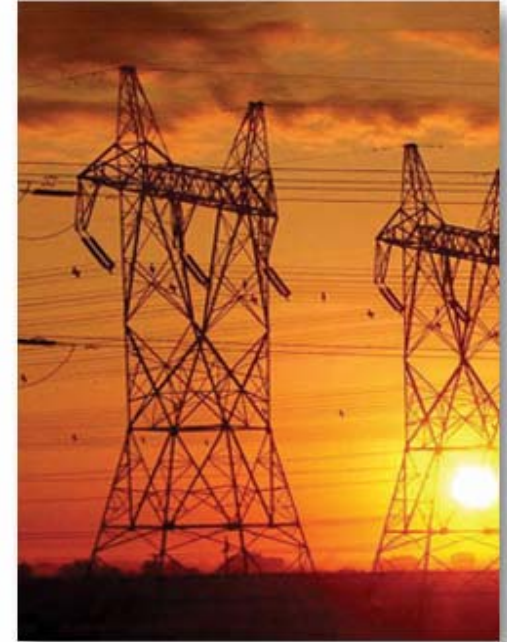


# Hydro One's Transmission Development Plans



Naren Pattani  
Manager,  
Transmission System  
Development



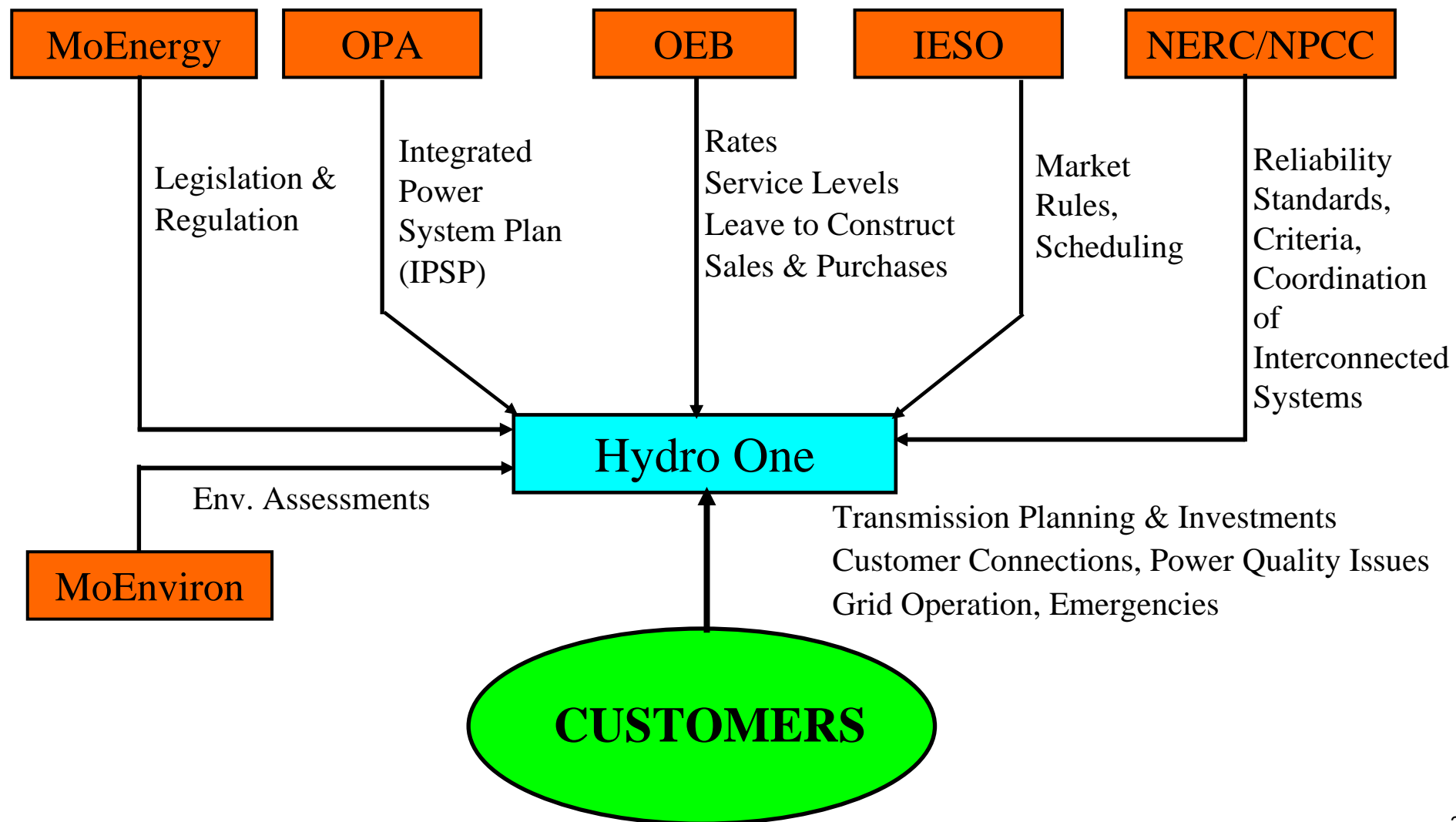
IEEE Power Engineering Society Toronto Chapter

September 27, 2007

# Overview

Summary of transmission planning considerations and Hydro One's transmission plans "Pre-IPSP" (prior to the plans identified in the Integrated Power System Plan (IPSP) issued by Ontario Power Authority)

# Transmission in Ontario



# Hydro One Mandate

Hydro One Transmission License:

- Own, Operate and Maintain Transmission Assets
- Transmission Planning & Investments to meet load growth and to maintain adequate reliability
- Provide Open, Non-Discriminatory, Access to Transmission System
- Comply with:
  - Standards and Codes,
  - Legislation, Regulations, and Market Rules

# Compliance/Guidelines/Assessments

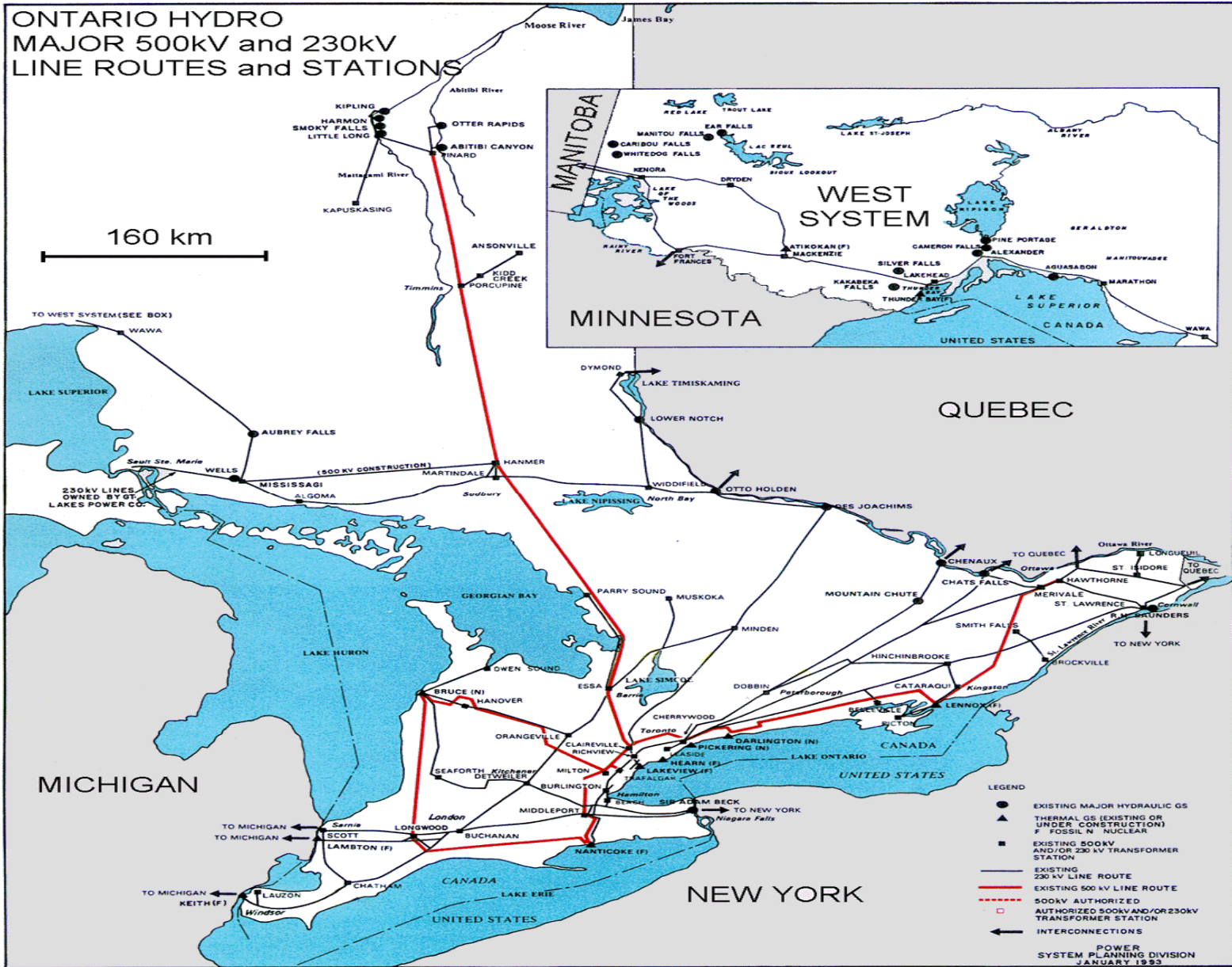
- OEB's Transmission Licence Requirements, including Transmission System code
- IPSP / OPA Assessments
- IESO's Market Rules
- Various approvals, chiefly as required by the EA Act and the OEB Act
- North American Electric Reliability Council (NERC) (NERC)
- Northeast Power Coordinating Council (NPCC)

# Transmission Development Challenges

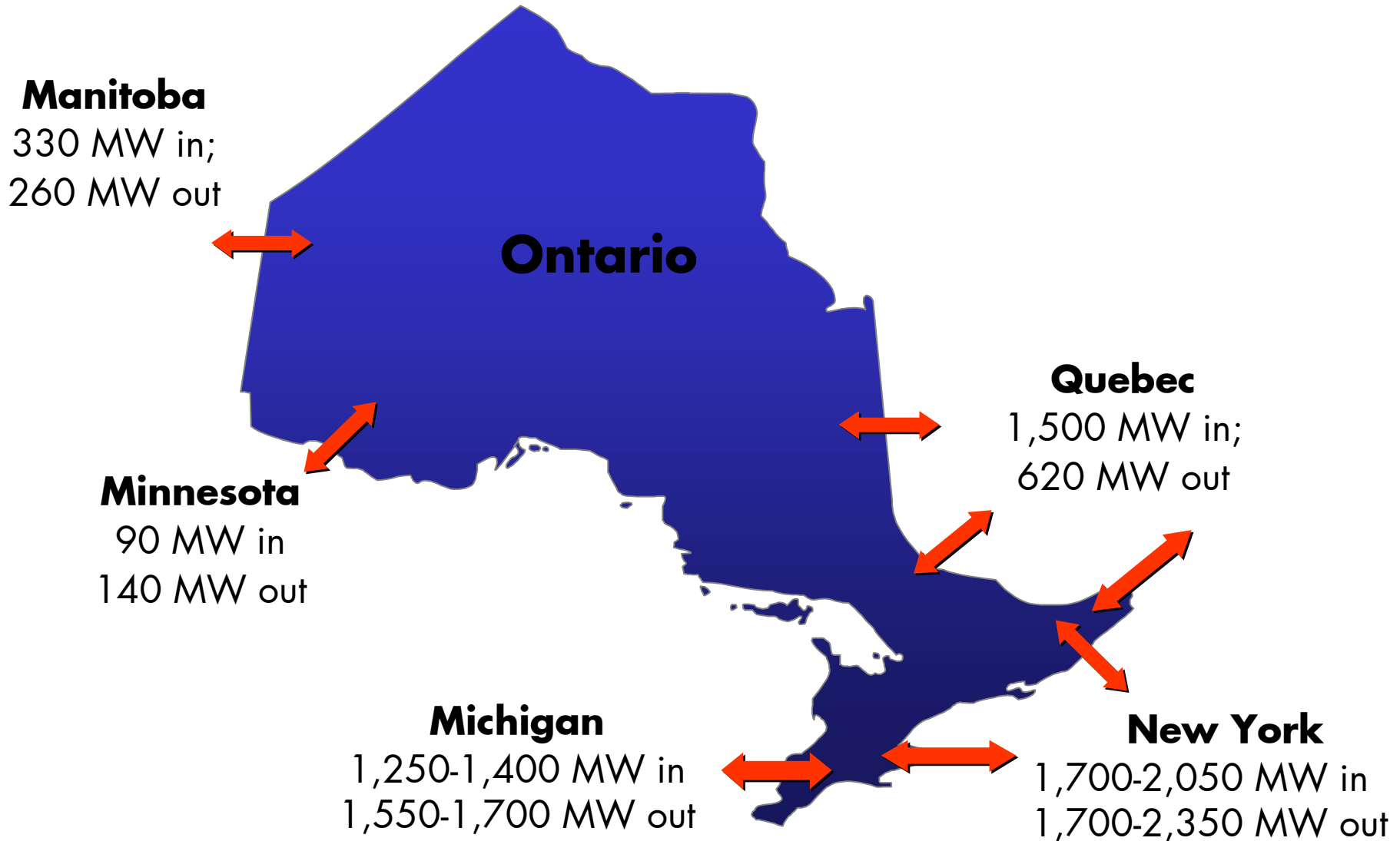
- Many concurrent major projects
- Changing Tx flows
  - Load growth/decline
  - New generation
- Short timelines
  - Lengthy approvals
- Equipment lead time
- Multiple Players
  - OPA, IESO,  
Generators, Loads



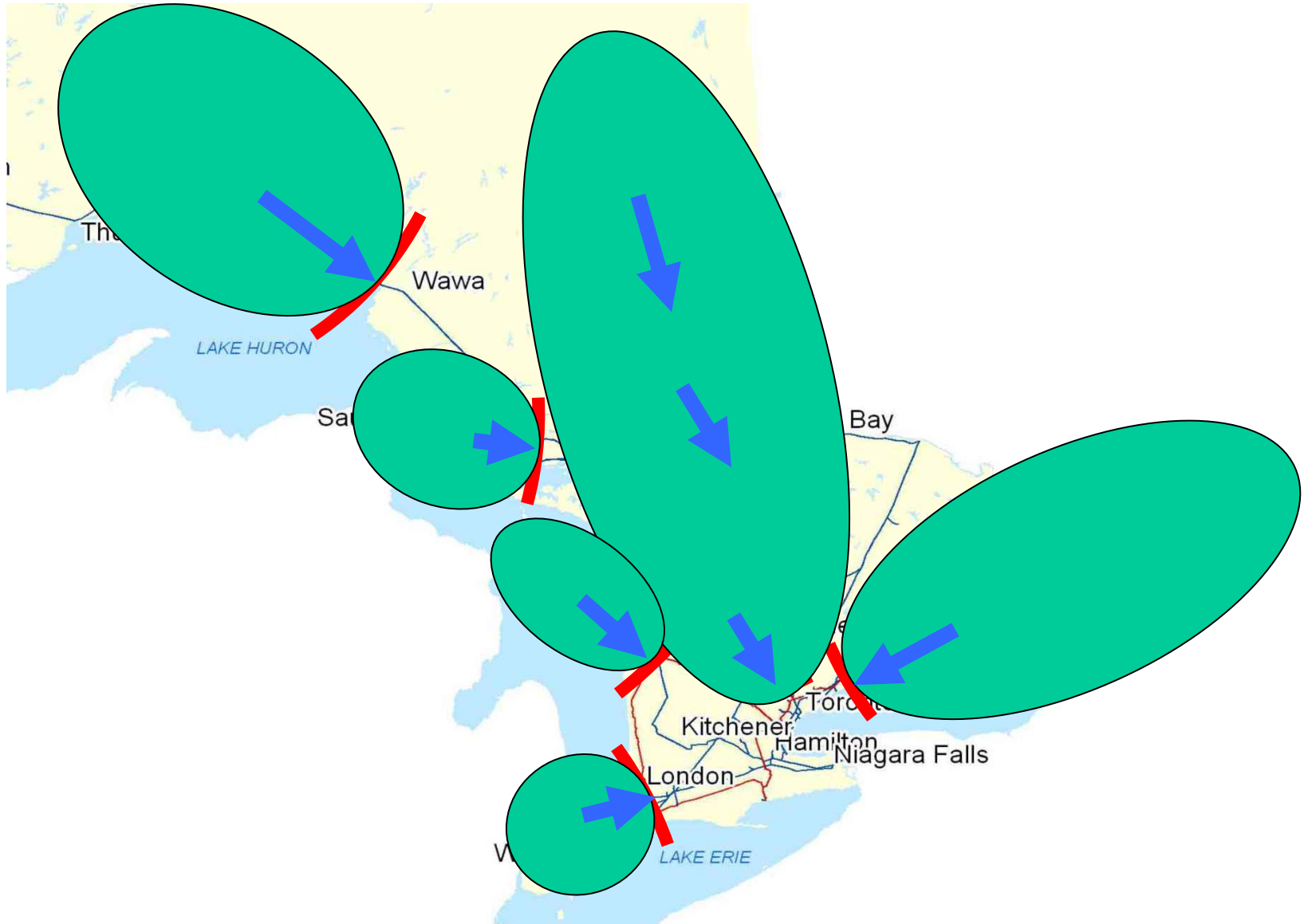
# Hydro One Transmission Network



# Hydro One Transmission Network



# Ontario Transmission Constraints



# Limitation / Need Assessment

Amount of power transmitted through a wire circuit or a set of circuits (interface) can be limited by various factors

- Physical:
  - Conductor rating
  - Ground clearance or sag
- Reliability & Security
  - Acceptable voltage and stable interconnected system following automatic outages (due to lightning, snow/ice storms, equipment failure, etc.)
  - Local area supply adequacy
- Provide for repair and maintenance
- A balancing act between economic scheduling of generation to meet demand and providing optimum transmission facilities

# TX Development Capital Program

Transfer capability and dedicated connections upgrade to reliably connect load, generation, and external jurisdictions to the interconnected system

## Key Drivers:

- Generation Changes & New Additions
  - RFPs, Agreements, etc.
- Changing Load in Certain Areas
  - Area Supply Capacity & Reliability
  - Dedicated Load Connections
- Performance Enhancement & Risk Mitigation
- Interconnection Capability

# Summary of Transmission Plans

# 230 kV Underground Line From John TS to Esplanade TS

**Need:** Area Supply Reliability

**In Service Date:** Early 2008

**Approvals \*:** EA and Section 92  
completed

**Current Status:** Construction in progress



## Description:

- Install two 2.2 km underground cable circuits in a tunnel between John TS and Esplanade TS

\* *EA = Approvals under the Environmental Assessment Act*  
*Section 92 = Leave-to-Construct approval under OEB Act*

# Hydro-Quebec Interconnection



**Need:** Expand Interconnection Capability

**In Service Date:** Mid 2009

**Approvals:** EA and Section 92 approvals obtained

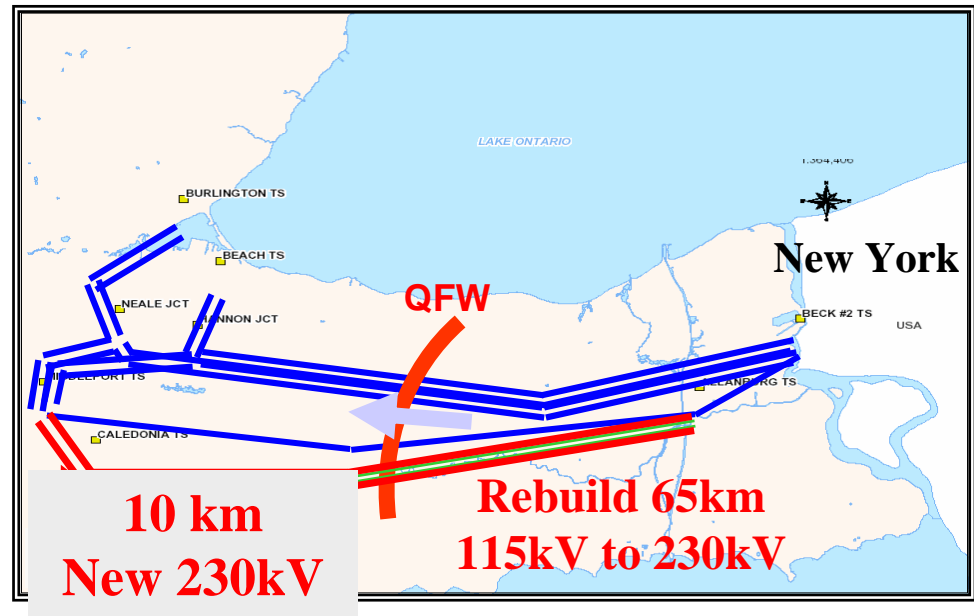
**Current Status:** Construction in progress.

## Description:

- Rebuild the existing 1-cct 115 kV line (Hawthorne x Cumberland Jct) and 1-cct 230 kV line (Cumberland Jct x Masson) to two 2-cct 230 kV lines: one for HQI between Hawthorne x Provincial boundary, and one to replace the existing two circuits
- HVDC Converter station to be built / owned by TransEnergie
- Increase "synchronous" transfer capability by 1,250 MW.

# Niagara Area 230kV Reinforcement

Need: Network and  
Interconnection Capability



**Current Status:** Construction is almost complete

- Work on the project stopped as a result of circumstances beyond the control of Hydro One
- Expected to complete construction in about six weeks after being able to recommence construction
- Increases network transfer capability by 800 MW; interconnection capability by 350 MW to 800 MW depending on load & generation pattern in the Niagara area

# Sarnia Generation Connection Plan

Need: Dedicated Connections

In Service Date: Late 2008

Approvals: EA and Section 92 not required

Current Status: Construction in progress



## Description:

- Upgrade Lambton TS and Sarnia Scott TS switchyards
- Replace “strain busses” at Lambton TS with rigid busses for short-circuit withstand capability
- Connect Greenfield Energy Centre (1147 MW)
- Connect St. Clair Power generation (638 MW)

# Portland Energy Centre Connection

Need: Dedicated Connections

In Service Date: Phase 1-Early 2008

Phase 2-Early 2009

Approvals: EA and Section 92 not required

Current Status: Construction in progress



## Description:

- Connect 550 MW generation
- Install 3 115 kV breakers
- Replace the shield wire on the 115 kV circuits H6LC & H8LC, H5E & H7E and H2JK
- Interchange the connection point of the 230 kV circuits C3L with C17L at Leaside TS

# Circuit Retermination at Richview TS

Need: Short Circuit Limitation

In Service Date: Mid 2009

Approvals: EA and Section 92 not required

Current Status: Work in progress

## Description:

- Install one new 230 kV circuit breaker at Richview TS
- Relocate the termination of circuit V75R in the switchyard
- Rebalance flows and limit short circuit levels as a result of incorporating Sithe Goreway GS



# Southern Georgian Bay Transmission Reinforcement

Need: Area Supply

In Service Date: Early 2009

Approvals: EA and Section 92 obtained

Current Status: Construction underway



## Description:

- Replace existing 27 km 1-circuit 115 kV circuit line between Essa TS and Stayner TS with a 2-circuit 230 kV line
- Install new 230/115 kV autotransformer Stayner TS and connect to circuit S2S to Owen Sound
- Add new breaker position at Essa TS.

# Build Hurontario SS and 230 kV Transmission

Need: Area Supply

In Service Date: Mid 2009

Approvals: EA and Section 92 approvals obtained

Current Status: Construction in progress



## Description:

- Build new Hurontario SS
- Build 230 kV transmission line from Cardiff TS to Hurontario SS, on existing ROW

# Transmission Reinforcement to Jim Yarrow TS

Need: Area Supply

In Service Date: Mid 2009

Approvals: EA and Section 92 approvals submitted

Current Status: Planning stage



Description:

- Build 2 x 230 kV U/G cable circuits Hurontario SS to Jim Yarrow TS

# Woodstock Area Transmission Reinforcement

Need: Area Supply

In Service Date: Mid 2010

Approvals: EA and Section 92 submitted

Current Status: Planning stage



## Description:

- Install new 230/115 kV autotransformer station near Woodstock TS
- Replace existing 115 kV line by building new double circuit 230 kV transmission line and connect to the new transformer station.

# Unbundle Claireville to Cherrywood Circuits

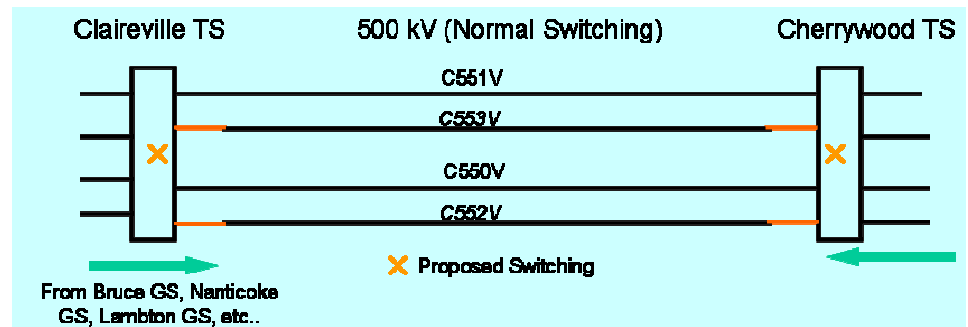
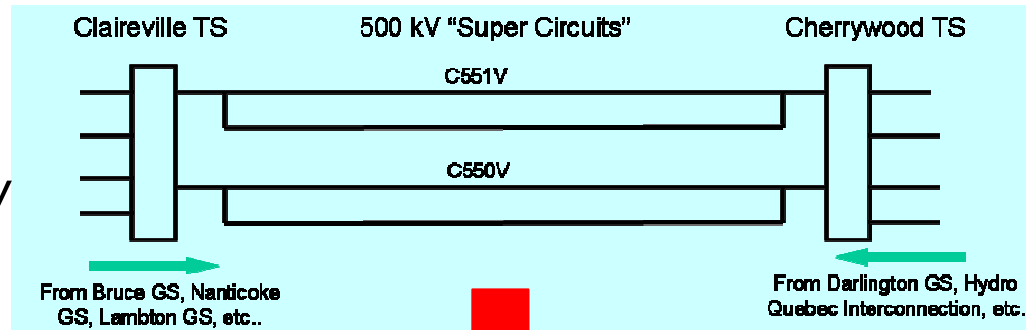
Need: Network Transfer Capability  
In Service Date: Late 2009

Approvals: EA and Section 92 not required

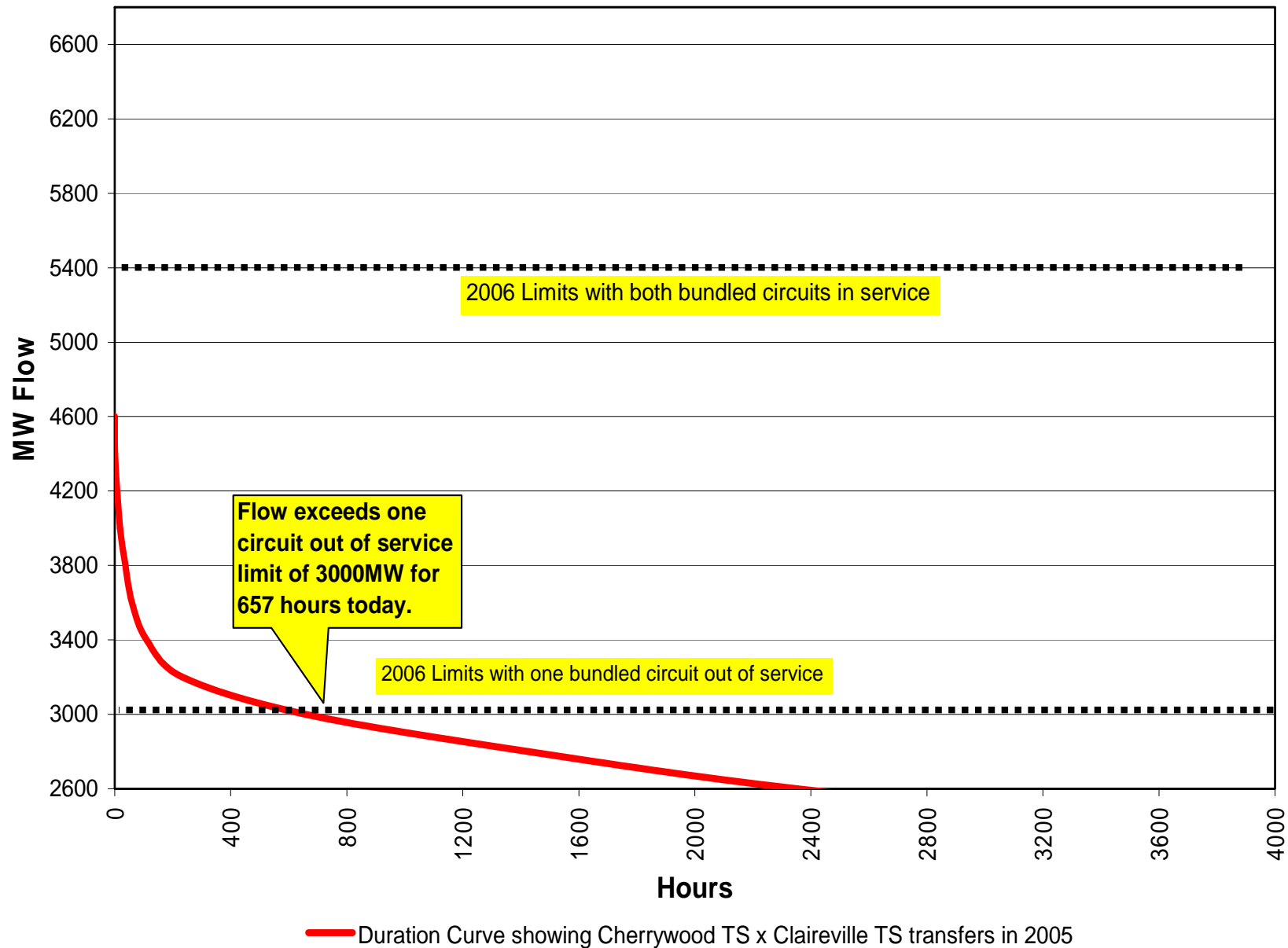
Current Status: Detailed design  
underway

## Description:

- Install 4 new 500 kV circuit breakers
- Replace 4 existing 500 kV circuit breakers
- Reterminate the two existing 500kV "Super Circuits" (2 ccts operated jointly) to provide 4 circuits at Cherrywood TS and Claireville TS
- Increases transfer capability and concerns about generation reliability, and about equipment performance at Cherrywood TS

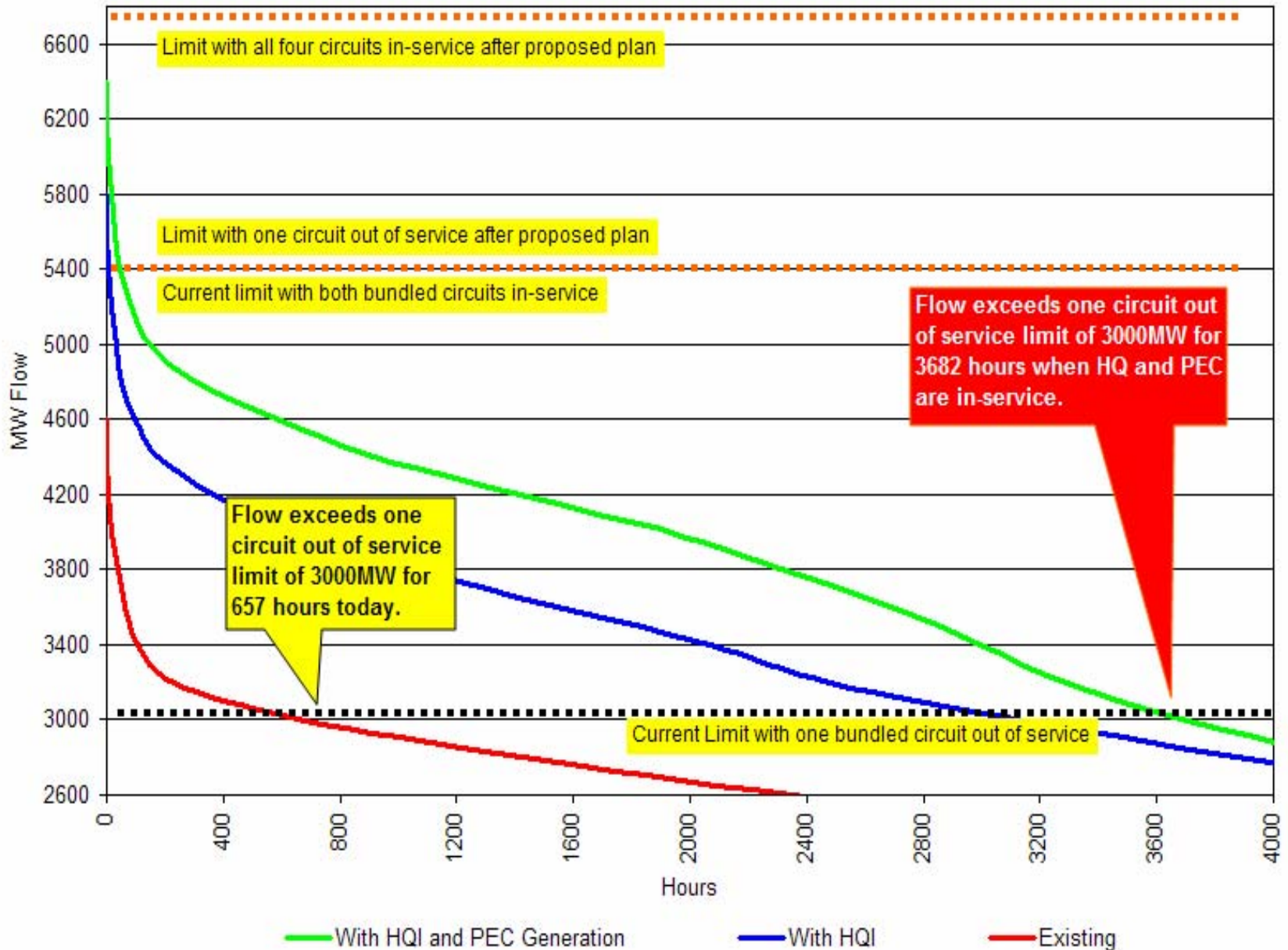


# Figure 2: Cherrywood TS x Claireville TS Interface Flow Limits and Duration Curve for Existing System



# Figure 3: Cherrywood TS x Claireville TS Interface

## Flow Limits (Existing & With Proposed Plan) and Duration Curve with HQI and PEC



# Static Var Compensator (SVC) At Lakehead TS

Need: Equipment Replacement/upgrade

In Service Date: Late 2008

Approvals: EA and Section not required

Current Status: Tendering specification completed

## Description:

- Install +60/-40 Mvar Static-Var-Compensators (SVCs) on the tertiary winding of autotransformer T7
- Replaces failed synchronous condenser



# North-South Transmission Reinforcement

**Need:** Network Transfer Capability

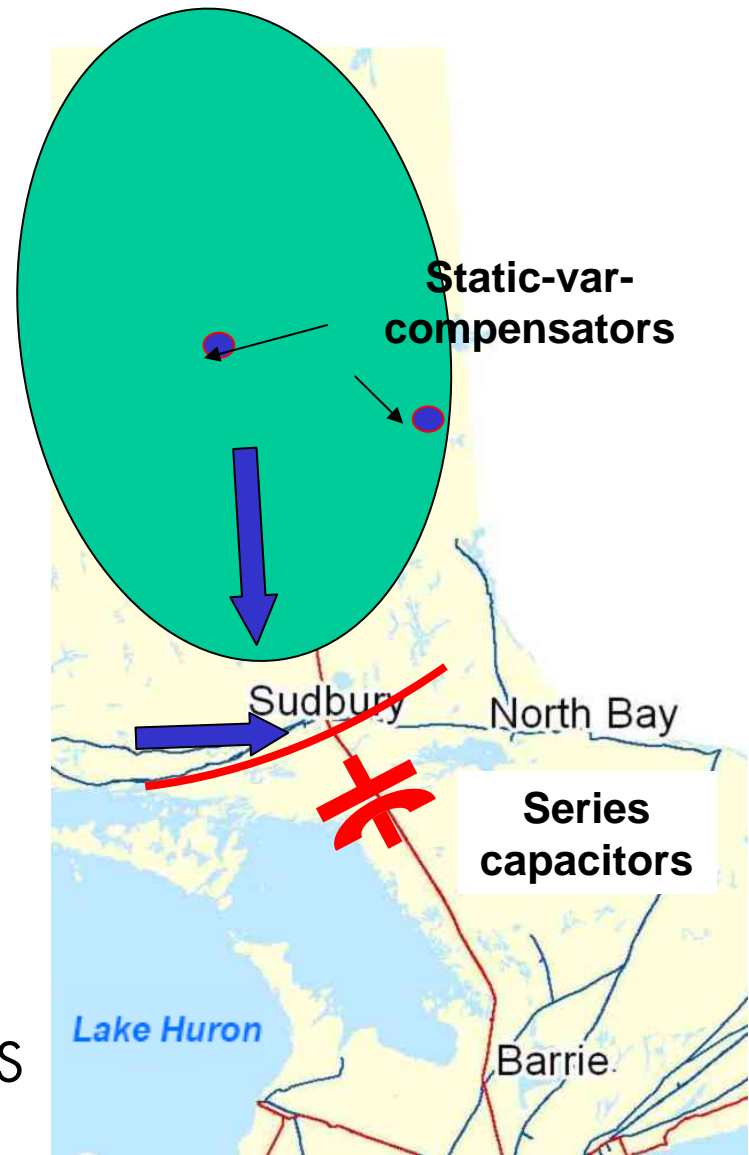
**In Service Date:** Early 2010

**Approvals:** EA completed,  
Section 92 not required

**Current Status:** tendering specifications  
completed

## Description:

- Install two 750 Mvar series capacitors on the 500 kV circuits between Hanmer TS and Essa TS at Nobel SS
- +300/-100 Mvar SVC at Porcupine TS
- +200/-100 Mvar SVC at Kirkland Lake TS
- Increase transfer capability by 500 MW



# Static Var Compensators (SVC) in Southwestern Ontario

**Need:** Network Transfer Capability

**In Service Date:** Late 2009

**Approvals:** EA and Section 92 not required

**Current Status:** Finalizing Planning Specifications

## Description:

- Build Two 400 Mvar Static-Var-Compensators (SVCs) connected to 500 kV system
- Enables reduced operation of Nanticoke
- Near term measure to accommodate flows from Bruce area
- Increase transfer capability by 400 MW



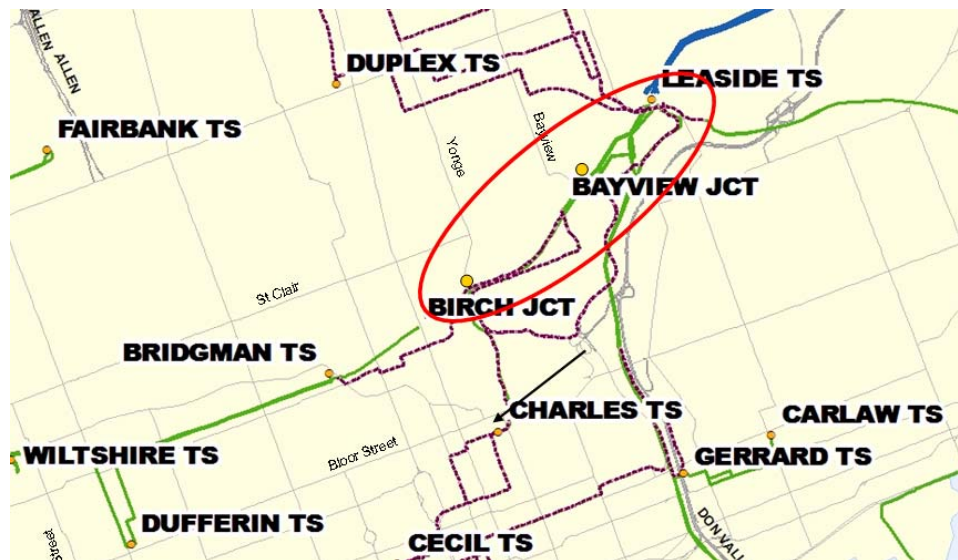
# Leaside TS to Birch Junction Reinforcement

**Need:** Area Supply

**In Service Date:** Mid 2010

**Approvals:** EA and Section 92  
required

**Current Status:** Planning stage

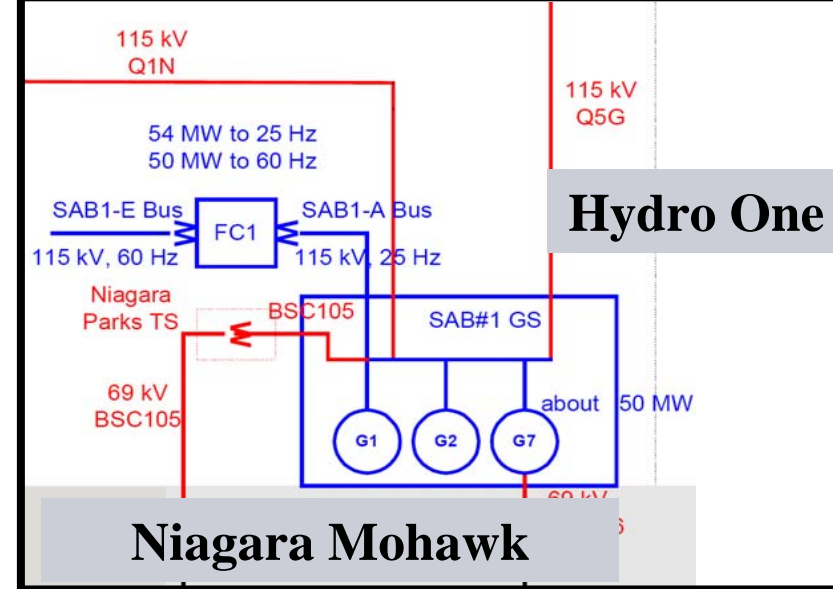


**Description Potential Facilities, subject to EA / Sec. 92 approvals :**

- Provide an additional 115 kV circuit from Leaside TS to Birch Junction
- Refurbish existing underground cable section of 115kV circuit

# Niagara 25 Hz System Update

- Niagara Mohawk Power Corporation decommissioned 25 Hz system facilities (January 2007)



- IESO approved OPGI's staged 25 Hz System Deregistration at SAB GS1 (December 2008 to April 2009)
- Hydro One started the process of decommissioning Parks TS (May 2007)
- All Niagara 25 Hz system facilities scheduled to retire on April 30, 2009

# Tx Reinforcement for Bruce and Wind Generation Connection

Need: Network Transfer Capability

In Service Date: Late 2011

Approvals: EA and Section 92 & 98 in progress

Current Status: SIA and PIC's completed

Description:

- Build new 500 kV double circuit transmission line between Bruce TS and Milton TS
- Increase transfer capability by 3100 MW



# Windsor Area Transformation Reinforcement

Need: Area Supply

In Service Date: Mid 2011

Approvals: EA and Section 92 required

Current Status: Planning stage



Description of Potential Facilities, subject to EA / Sec. 92 approvals:

- New 230/115 kV Autotransformer Station
- Station work at Keith, upgrade J3E/J4E and K2Z/K6Z, and replace 230/115 kV Keith Autos

## Major Committed New Generation

- Bruce GS – Refurbishment of 2 Units (1,500 MW net)
- Greenfiled Energy Centre (1,150 MW)
- St. Clair Energy Centre (640 MW)
- Kingsbridge II Wind Farm (160 MW)
- Other Wind (110 MW)
- Sithe Goreway (1,000 MW)
- Portlands (550 MW)
- Thorold Co-Generation (236 MW)

# Build Holland TS

Need: Area Supply

In Service Date: Early 2009

Approvals: EA Obtained

Current Status: Construction to start shortly



## Description:

- Build a new transformer station ( 2 x 75/125 MVA transformers) in the Northern York Region area to serve Newmarket and surrounding area

# Establish/Expand Transformer Stations As Required by Customers

## Stations

## In Service Date

- |                      |            |
|----------------------|------------|
| •Whitby TS           | Mid 2007   |
| •London Talbot TS    | Mid 2007   |
| •Red Lake TS         | Mid 2007   |
| •Kingston Gardner TS | Mid 2008   |
| •Holland TS          | Early 2009 |
| •Enfield TS          | Mid 2009   |
| •Vansickle TS        | Mid 2009   |
| •NW Mississauga TS   | Mid 2009   |
| •Pleasant TS         | Mid 2012   |

# Summary

- Increasing demand in some load pockets ...
  - New generation based on successful RFP participants participants and Power Purchase Agreements ...
  - IPSP has identified additional requirements ...
- ... place greater demands on the transmission system, requiring investments in new transmission