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Annual Planning Outlook
Transmission Security Outlook Methodology

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System Reliability – Adequacy and Security

Reliability standard requirements encompass both resource adequacy and transmission security.

- Adequacy: the ability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components.[1]
- Security[2]: is the ability of the electric system to withstand sudden disturbances such as electric short circuits or loss of system components.

[1] Definitions for adequacy and security can be found here, North American Electric Reliability Corporation: Definition of "Adequacy Level of Reliability"

[2] North American Electric Reliability Corporation (NERC) replaced the use of term "Security" in 2001 with "Operating Reliability"

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System Reliability – Transmission Security

- Transmission security requirements are found in NERC TPL-001, R7-R10 of Northeast Power Coordinating Council (NPCC) D#1, and in all but section 8 of the Ontario Resource and Transmission Assessment Criteria (ORTAC).
- Assessments are **deterministic,** based on the system's ability to meet performance requirements for the specified disturbances, or "planning events", defined in the standards, while considering scheduled outages and unscheduled outages of critical system elements.
  - This is distinct from resource adequacy assessments, which are **probabilistic**, modelling uncertainty in forecast load and generating unit availability due to forced outages

Firm vs. Non-Firm Capacity

Firm and non-firm supply capacity have implications for calculating transfer capabilities.

- “Firm supply capacity” is considered a resource obligated to be available to inject power to supply the IESO-controlled grid. The magnitude of firm supply capacity is the capacity that can be relied on with a high degree of certainty to supply the peak demand for a portion of the system, i.e., the “dependable capacity”
- “Non-firm supply capacity” is considered a resource that is registered in the IESO administered markets, is physically installed and not on outage, but is not obligated to be available to inject power to supply the IESO-controlled grid.

Determining Transfer Capabilities – Power Transfer Steps (1)

Transfer capabilities are determined by increasing the transfer across an interface until a limiting phenomenon is identified. Supply capacity and inter-area transactions[1] are dispatched up in the “source” (i.e., the sending) sub-system and down in the “sink” (i.e., the receiving) sub-system

The following steps are undertaken to determine an interface’s transfer capability:

1. The dispatch of firm supply capacity and firm inter-area transactions[1] are prioritized over non-firm supply capacity and non-firm inter-area transactions when simulating transfers.

[1] Inter-area transactions are imports or exports between Ontario and neighbouring jurisdictions. A firm inter-area transaction refers to an obligation to import or export across a connection between Ontario and neighbouring jurisdiction.

Determining Transfer Capabilities – Power Transfer Steps (2)

2. Supply capacity is dispatched in a reasonable economic order, considering units' operating characteristics and fuel availability, and respecting all transmission facility ratings and any other transfer capabilities (i.e., the reasonable-economic order shall be secure).

3. Variable or intermittent (e.g. wind) generation is dispatched at its capacity contribution value, unless all firm and non-firm dispatchable supply capacity and inter-area transactions have been exhausted without establishing the transfer capability.

4. Non-firm domestic supply capacity is prioritized over non-firm inter-area transactions to stress transfers.

Determining Transfer Capabilities – Power Transfer Steps (3)

5. The use of fictitious resources, for the sole purpose of establishing transfer capability, are only considered after exhausting all firm and non-firm supply capacity, inter-area transactions, and dispatching variable generation above its capacity contribution without encountering a limit. Modeling fictitious resources applies the use of engineering judgement. Typically, fictitious resources are modelled as negative loads, with zero reactive power injection or withdrawal, and should not bias the natural power transfer distribution.

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Determining Transfer Capabilities – Contingencies

The following governing standards for **assessed contingencies** are used for determining transfer capability of the bulk transmission system:

- Requirements R7-R11 of NPCC Directory #1
- Requirements of NERC Standard TPL-001
- Requirements of NERC Standard FAC-013
- Requirements of ORTAC

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Determining Transfer Capabilities – Limiting Elements and Phenomenon

The following governing standards for **performance criteria** are used for determining transfer capability of the bulk transmission system (i.e. to identify the limiting elements and phenomenon):

- IESO-controlled grid: ORTAC
- New York Independent System Operator (NYISO) Control Area: Transmission Expansion and Interconnection Manual- Attachments F, G, H, and I.
- Midcontinent Independent System Operator (MISO) Control Area: MISO Transmission Expansion Plan (MTEP)- manual BPM 020

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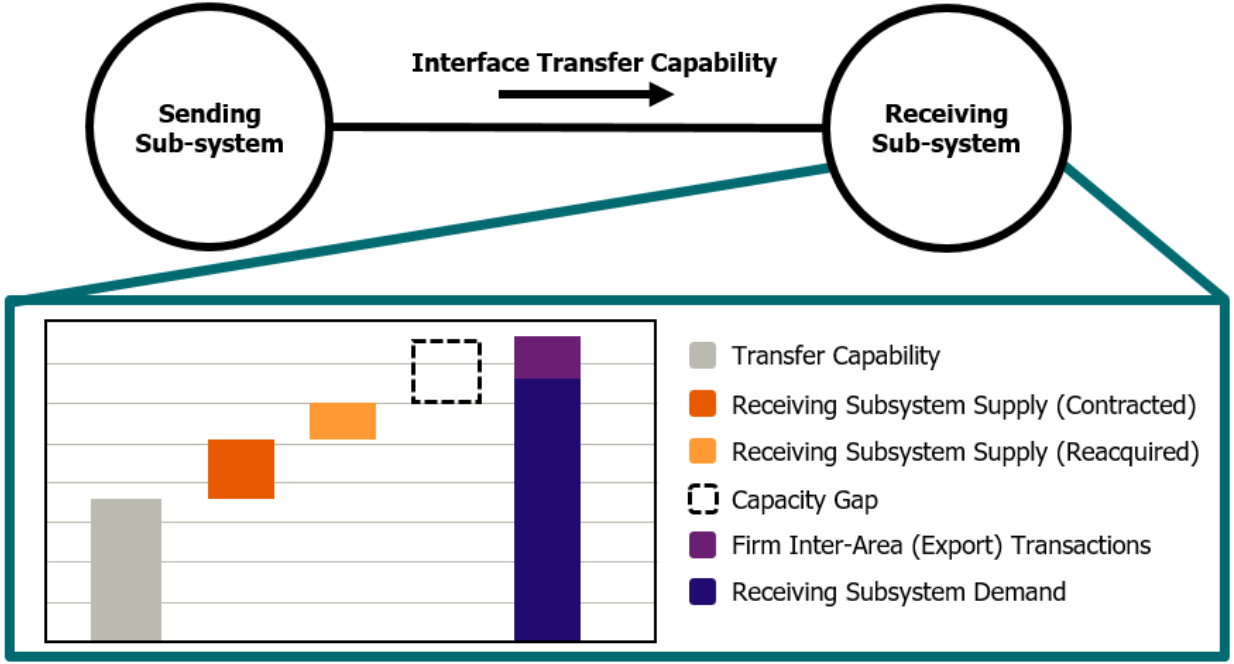
Transmission Security Outlooks – Illustration



* Description on next slide

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Transmission Security Outlooks – Description

- Security outlooks at the zonal level are assessed using a two sub-system representation, the “sending sub-system” which is the portion of the system that the transmission interface is transferring power from, and the “receiving sub-system” which is the portion of the system that the transmission interface is transferring power to.
- A sub-system can be multiple zones.
- The transfer capability, as determined by applying deterministic transmission planning standards and performance criteria, is compared with the required transfer that the receiving sub-system needs in order to be reliable. The required transfer is equal to the difference between the receiving sub-system’s demand (load + losses) and dependable generation.

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Transmission Security Outlooks – Identifying a Deficit

- If the required transfer capability is deficient, this indicates either:
  - A need to reinforce the interface
  - A need for additional supply capacity in the receiving sub-system

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