



Annual Planning Outlook

Overview of Ontario's Transmission Interfaces and Interties
and Transmission Data

December 2022

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1. Introduction

This module describes the status of Ontario’s transmission interfaces and interties which are key inputs for the resource adequacy and transmission assessments documented in the Annual Planning Outlook (APO).

The transmission interfaces generally represent a group of transmission circuits that separate each of the ten IESO electrical Zones (“IESO Zones”), or a boundary within an IESO Zone that creates a limit to the amount of power that can flow from one part of the province to another. The groups of transmission circuits which connect the IESO-controlled grid to neighbouring electrical systems are referred to the transmission interties (sometimes also referred to as “interconnections”).

2. Ontario’s Interfaces and Interties

The IESO Zones, transmission interfaces, and intertie locations are shown in Figure 1 and Figure 2. The remainder of this section describes the current status of each of these interfaces and interties.

Figure 1 | Ontario’s Transmission Interfaces and Interties

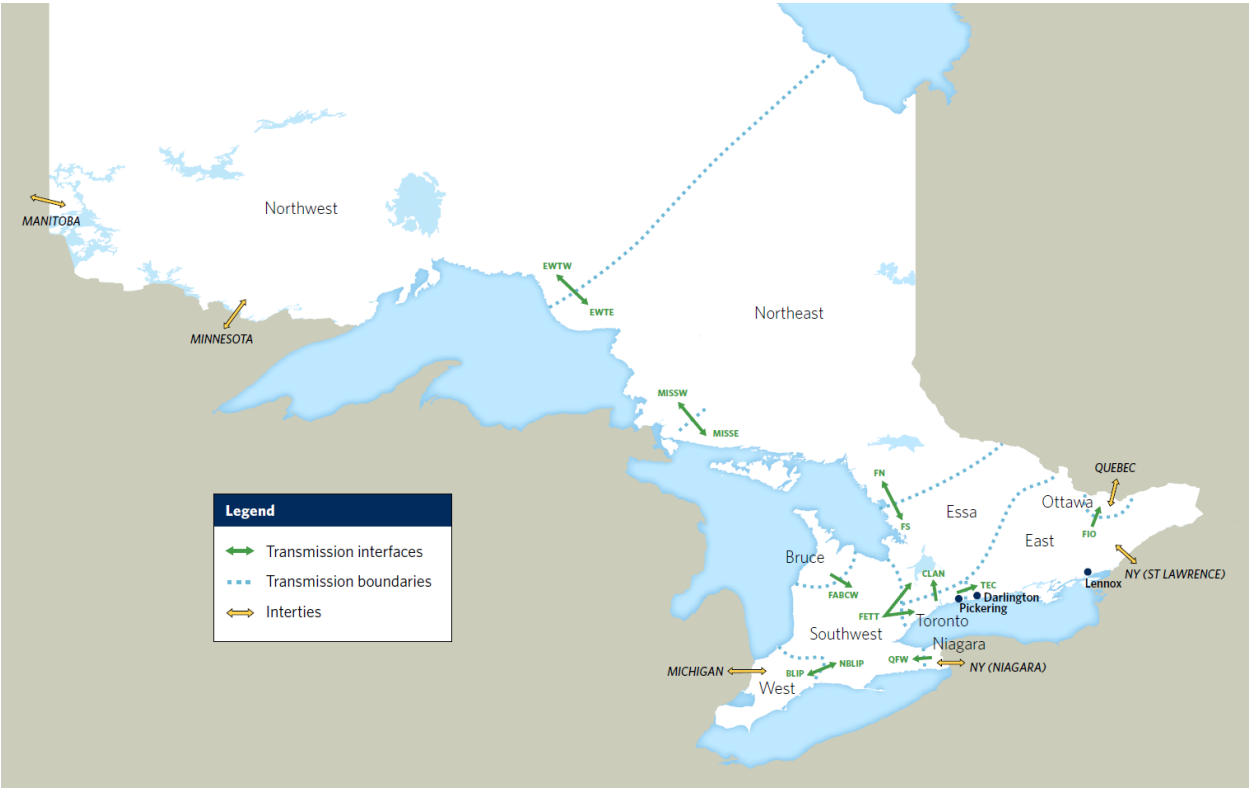


Figure 2 | Focus in on the Interfaces and Interties in Southern Ontario



2.1 The Transmission Interfaces

Buchanan Longwood Input (BLIP) and Negative Buchanan Longwood Input (NBLIP)

The BLIP interface comprises the circuits that connect the West Zone and the Southwest Zone, near the City of London, including three 500 kV circuits into Longwood transmission station (TS) and five 230 kV circuits into Buchanan TS. The NBLIP interface is identical to BLIP, but the power transfer is measured in the opposite direction. The BLIP transfer capability is important for reliably supplying the demand in the West Zone and facilitating exports from Ontario to Michigan, while the NBLIP transfer capability is important for delivering supply to the Southwest Zone as well as delivering power imported from Michigan to the rest of the province.

Both BLIP and NBLIP transfers are generally thermally limited by the transmission circuits between Scott and Buchanan, Lambton and Longwood, or Chatham and Buchanan/Longwood, located west of where BLIP and NBLIP are measured. The area west of the BLIP and NBLIP interface is commonly referred to as the “West of London” system.

Flow Away from Bruce Complex and Wind (FABCW)

The FABCW interface comprises all of the power flows from the Bruce Nuclear Generating Station (NGS), including the Bruce 230 kV and 500 kV stations (six circuits each), plus wind generation in the area. This transfer capability is important for delivering supply from the Bruce Zone to the rest of the province.

FABCW transfers are not normally limited when all transmission facilities are in-service and are effectively managed through the Bruce Remedial Action Scheme under outage conditions.

Queenston Flow West (QFW)

The QFW interface comprises the circuits that connect the Niagara Zone and the Southwest Zone. This includes the four 230 kV circuits out of Beck 2 transformer station (TS) and three 230 kV circuits into Middleport TS. The QFW transfer capability is important for delivering supply from the Niagara Zone and imports from New York at Niagara to the rest of the province.

QFW transfers can be thermally limited at times, but they are not expected to be restrictive under typical conditions, such as normal weather, expected imports, and all transmission facilities in-service.

Flow East Towards Toronto (FETT)

The FETT interface comprises the circuits that connect the Southwest Zone and the Toronto and Essa Zones. This includes the four 500 kV circuits into Claireville TS, two 230 kV circuits out of Orangeville TS to Essa TS, and four 230 kV circuits out of Trafalgar TS to Richview TS and Hurontario SS. FETT transfer capability is important for reliably supplying demand in Toronto, Essa, East, Ottawa, Northeast and Northwest Zones as it delivers supply from West, Southwest, Bruce and Niagara Zones.

The FETT transfer capability is of concern during the summer peak demand periods, when the transmission circuit ratings are low and demands are high, both as result of high ambient temperatures. During summer peak, the 230 kV Trafalgar TS x Richview TS path in Mississauga reaches its capacity before the other two paths of the FETT interface, thus setting the transfer capability for the whole FETT interface. In addition, nuclear generation retirements and outages for refurbishments result in higher portion of FETT transfers on the critical Trafalgar TS x Richview TS path. This would further reduce the FETT transfer capability.

The Richview x Trafalgar reconductoring project, currently being implemented by Hydro One Networks Inc, will increase the transfer capability east of the FETT interface by 2026.

Transfer East of Cherrywood (TEC)

The TEC interface comprises the circuits that connect the Toronto Zone and the East Zone, at points east of Cherrywood TS in Pickering. The interface includes the four 500 kV circuits out of Bowmanville SS, four 230 kV circuits – with one each into Dobbin TS, Almonte TS, Belleville TS and Havelock TS – and two 230 kV circuits into Chats Falls Generating Station. TEC transfer capability is important for reliably supplying demand in the East and Ottawa Zones.

TEC transfers are generally thermally limited and the extent to which they are constraining are highly dependent on local load and the Dobbin area.

Flow into Ottawa (FIO)

The FIO interface comprises the circuits that connect the East Zone and Ottawa Zone. This includes two 500 kV circuits out of Lennox, one 230 kV circuit into St. Isidore TS, one 230 kV circuit out of St. Lawrence TS, one 230 kV circuit out of Chats Falls TS and one 230 kV circuit into Merivale TS. The FIO interface is considered an open interface because the underlying lower-voltage 115 kV circuits that connect the East and Ottawa Zones are not measured by the interface. This is because flows on the 115 kV circuits do not materially impact the ability to transfer bulk quantities of power into the Ottawa Zone. FIO transfer capability is important for reliably supplying demand in the Ottawa Zone and facilitating exports to Quebec.

FIO transfers are not generally limiting with all transmission facilities in service. With one transmission circuit out of service, FIO transfers are limited to ensure acceptable voltage performance and can also be thermally limited under certain situations.

Claireville North (CLAN) and Claireville South (CLAS)

The CLAN interface comprises the circuits that connect the Toronto Zone and Essa Zone. This includes two 500 kV circuits and two 230 kV circuits north from Claireville TS, located in the Toronto Zone. The CLAS interface is defined identically to the CLAN interface, but the power transfer is measured in the reverse direction.

The CLAN and CLAS interfaces are generally not limiting.

Flow North (FN) and Flow South (FS)

The FN interface comprises the circuits that connect the Essa Zone and Northeast Zone. This includes the two 500 kV circuits north from Essa TS and one 230 kV circuit north into Otto Holden TS. The FS interface is defined identically to the FN interface, but the power transfer is measured in the reverse direction. FN transfer capability is important to reliably supply demand in the Northeast and Northwest Zones, as well as facilitate exports to Manitoba, Minnesota and Quebec; FS transfer capability is important to deliver imports and supply from the Northwest and Northeast Zones to the rest of the province.

FN and FS transfers can be limited under certain conditions to ensure acceptable voltage and stability performance. For example, FN can be limiting under low water conditions (less hydro-electric production) and is sensitive to demand levels; and FS can be limiting under high water conditions, i.e., more hydro-electric production.

East-West Transfer East (EWTE) and East-West Transfer West (EWTW)

The EWTW interface comprises the circuits that connect the Northeast and Northwest Zones. This currently includes the two 230 kV circuits into Wawa from Marathon, and the two additional 230 kV circuits into Wawa from Marathon that were added as part of the East-West Tie Reinforcement project. The EWTE interface is defined identically to the EWTW interface, but the power transfer is measured in the reverse direction. EWTW transfer capability is important to reliably supply Northwest Zone demand, while EWTE transfer capability is important for the delivery of Northwest supply and imports from Manitoba and Minnesota to the rest of the province.

EWTE and EWTW transfers have historically been limited by voltage performance and the thermal capability of the underlying 115 kV path, which have been improved following the reinforcement. Once the full benefit of the reinforcement project is realized (i.e., upon completion of the terminal station work), the limiting transmission facilities that restrict transfers between Northwest Ontario and Northeast Ontario shift from the EWTE and EWTW interfaces to Mississagi East and Mississagi West. In the future, changes to the IESO's zonal demarcations in Northern Ontario may be appropriate in order to align with the most restrictive system constraints.

Mississagi Flow West (MISSW) and Mississagi Flow East (MISSE)

The MISSW/MISSE interfaces consist of three 230 kV circuits connecting to Mississagi TS. These circuits include A23P and A24P between Mississagi TS and Algoma TS (at Blind River), and X74P between Mississagi TS and Hanmer TS (in Sudbury).

MISSW refers to the flows westward at Mississagi TS. This interface is important for the reliable supply of demand in Sault Ste. Marie, including steel production in the Sault, as well delivering supply to the Northwest. MISSE refers to the flows eastward out of Mississagi TS, across the same transmission facilities as MISSW, but in the opposite direction. MISSE is important for the delivery of supply from the Northwest to the rest of the province, including renewable generation and imports from Manitoba and Minnesota.

2.2 The Transmission Interties

Ontario-Manitoba

The Ontario-Manitoba interconnection consists of two 230 kV circuits plus one 115 kV circuit. The power transfers across the 230 kV interconnection points can be controlled with the use of phase angle regulators.¹¹ Transfers across this intertie are defined as Ontario-Manitoba Transfer East (OMTE) and Ontario-Manitoba Transfer West (OMTW). Ontario and Manitoba are synchronously connected¹² at 230 kV, while the 115 kV interconnection is operated normally open (i.e., no power flows) except under rare or emergency conditions.

Ontario-Minnesota

The Ontario-Minnesota interconnection consists of one 115 kV interconnection point. The transfers on this interconnection are the Minnesota Power Flow North (MPFN) and the Minnesota Power Flow South (MPFS). The Ontario and Minnesota systems are synchronously connected, and flows across this intertie can be controlled with a phase angle regulator.

Ontario-Michigan

The Ontario-Michigan interconnection consists of two 230/345 kV interconnection points, one 230/115 kV interconnection point, and one 230 kV interconnection point. The Ontario and Michigan systems are synchronously connected, and flows across this intertie can be controlled with phase angle regulators.

Ontario-New York at Niagara

The Ontario-New York Niagara interconnection consists of two 230/345 kV interconnection points and two 230 kV and one 115 kV interconnection points, the latter of which is used for emergency services only. The interconnection is free-flowing.

The Queenston Flow West (QFW) interface is downstream of the New York Niagara interconnection. All flows entering Ontario on the New York Niagara interconnection will impact flows on the QFW interface, including imports and unscheduled flows. Ontario and New York Niagara are synchronously connected.

Ontario-New York at St. Lawrence

The Ontario-New York St. Lawrence interconnection consists of two 230 kV circuits. The interconnection is under the control of phase angle regulators; however, the 2018 failure of the phase angle regulator connected to the Ontario-New York 230 kV interconnection circuit L33P has reduced the province's ability to import electricity from New York through this interconnection, and from Quebec. The phase angle regulators are expected to be replaced in 2022/2023, restoring import capability and improving the ability to control flow on the intertie. Ontario and New York are synchronously connected at St. Lawrence.

Ontario-Quebec

The Northeast Zone has two radial 115 kV interconnection points with Quebec; the East Zone has four 230 kV, and one 115 kV (radial) interconnection points with Quebec; and the Ottawa Zone has one HVDC (non-synchronous) interconnection (consisting of two 230 kV circuits), as well as one 230 kV and one 115 kV (radial) interconnection points.

2.3 Transmission Data

All transmission transfer capabilities and related details about the limiting phenomena are based on the best information available to the IESO at the time of the 2022 APO analysis. These values may change as new and/or updated information and assumptions become available. All values represent the Transmission Transfer Capabilities respecting the planning requirements per applicable standards/criteria, and should not be interpreted as System Operating Limits.

Transmission Interface and Intertie Capabilities

Table 1: Internal Interface All-in-Service Transfer Capabilities

Interface	Capability (MW)	Limiting Phenomenon	Limiting Contingency (Alternate)	Limiting Element (Alternate)	Notes
BLIP	2,020 - 3,700	Thermal	Varies by year	Varies by year	Summer limitation
NBLIP	570-1,550	Thermal	Varies by year	Varies by year	Summer limitation; Pre-contingency overloading
QFW	2,400	Thermal	Q25BM+ Q29HM	Q24HM	Summer limitation; QFW reinforcement, Q26M & Q35M in-service (I/S)
FABCW	7,600	None	None	None	Resources maxed before reaching a limitation
FETT	4,230 - 5,200	Thermal	Hurontario L21L30 (L19L29)	R19TH (R21H)	Summer limitation; dependent on generation patterns
TEC	3,100	Thermal	Chats Falls AL22	P15C	Summer limitation; Maximum transfer capability not expected to be reached (i.e., not limiting)
FIO	2,950	None	None	None	Year round limitation HVDC export maxed before reaching a limitation Local thermal phenomenon can possibly be more restrictive under certain conditions

Interface	Capability (MW)	Limiting Phenomenon	Limiting Contingency (Alternate)	Limiting Element (Alternate)	Notes
FN	1,965	Voltage Decline	Hanmer PL503/PL504	Hanmer 500kV	Year round limitation
FS	2,030	Voltage Collapse	Hanmer PL503/PL504	Hanmer 500kV	Year round limitation
EWTE	350	Voltage Decline	A23P+A24P	Mississagi 230 kV	Year round limitation E-W Tie reinforcement I/S
EWTW	500	Voltage Magnitude	A21L+A22L	Mackenzie 230 kV	Year round limitation E-W Tie reinforcement I/S
MISSW	510 - 585	Voltage Decline	A23P+A24P	Mississagi 230 kV	Year round limitation E-W Tie reinforcement I/S

Table 2: Interconnection All-in-Service Transfer Capabilities

Interconnection	Capability (MW)	Limiting Phenomenon	Limiting Contingency (Alternate)	Limiting Element (Alternate)	Note
Ontario to Manitoba	250	Thermal	K21W (K22W)	K22W (K21W)	Summer limitation; capability can be reduced during certain operating conditions
Manitoba to Ontario	250	Thermal	K21W (K22W)	K22W (K21W)	Summer limitation; capability can be reduced during certain operating conditions
Ontario to Minnesota	150	Thermal	None	F3M	Summer limitation; pre-contingency
Minnesota to Ontario	150	Thermal	None	F3M	Summer limitation; pre-contingency
Ontario to Michigan	1,500	Thermal	B3N	St. Clair DM	Summer limitation
Michigan to Ontario	1,300	Thermal	St. Clair DM (L28C+L29C)	B3N (J5D)	Summer limitation
Ontario to New York at Niagara	1,950	Thermal	PA301/PA302	PA27	Summer limitation
New York to Ontario at Niagara	1,550	Thermal	PA301/PA302	PA27	Summer limitation
Ontario to New York at St. Lawrence	450	Thermal	St. Lawrence L31L33	L34P	Summer limitation
New York to Ontario at St. Lawrence	350	Thermal	B31L+L24A	L21H	Summer limitation
Ontario to Quebec at HVDC	1,250	Converter Limitation	-	-	-
Quebec to Ontario at HVDC	1,250	Converter Limitation	-	-	-
Ontario to Quebec at B31L + B5D	470	External	-	-	Limitation in Quebec power system
Quebec to Ontario at B31L + B5D	400	Stability	-	-	Beauharnois transient stability

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