Preliminary Connection Guidance for the Long-Term 2 Energy Supply (Window 1) Request for Proposals

Issue 3.0
Independent Electricity System Operator
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Document Change History

Issue	Reason For Change	Date
1.0	Preliminary Connection Guidance for Long-Term 2 Procurement first issued	April 16, 2024
2.0	Adjusted area and circuit limits to incorporate expanded circuit Inverter Based Resource (IBR) project size limits and included LT1 RFP results Removed Owen Sound TS from the list of short-circuit limited stations	September 6, 2024
3.0	Added a new Transmission Circuit Capacity table in Appendix A, which lists the capacities of each circuit Adjusted several transmission circuit capacities to reflect better granularity and more recent analyses Updated the list of circuits to "avoid" due to potential Sub-Synchronous Resonance (SSR) issues Updated the list of short-circuit limited stations Introduced new term "not allowed", to distinguish certain circuits previously marked as "avoid", for which projects will be deemed "not deliverable" in final stage deliverability testing Added an acknowledgement to the set aside agreement between Six Nations of the Grand River, Six Nations of the Grand River Development Corporation and the Ministry of Energy and Electrification per Ministerial Directive Minor updates throughout the document	April 4, 2025

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Executive Summary

This document is intended to provide preliminary connection guidance information to potential proponents in the Long-Term 2 Energy Supply (Window 1) Request for Proposal (LT2(e-1) RFP), to help inform project siting decisions to maximize the success of projects through the LT2(e-1) RFP evaluation process. As this procurement is focused on meeting reliability needs, the IESO aims to ensure that awarded projects can operate with a minimized risk of curtailment and congestion on the system. At its discretion, and in consideration of rules and timing of procurement activities, the IESO will update this document should there be new information or if substantial changes to the procurement are required.

This document supercedes Issue 2.0 of the Preliminary Connection Guidance for the Long-Term 2 RFP – Energy Stream published on Sept 6, 2024. The following is a list of the material changes from this document:

- A new Transmission Circuit Capacity table in Appendix A listing the available capacity of each circuit and reason for its limitation, in response to stakeholder feedback.
- Several transmission circuit capacities were adjusted to reflect better granularity in response to stakeholder feedback and more recent analysesci;
- A reduction to the list of circuits to "avoid" due to potential Sub-Synchronous Resonance (SSR) issues, which increases connection opportunities with minor incremental risk of curtailment (under multiple outage conditions);
- An update to the list of short-circuit limited stations to take into account the latest transmitter information;
- Introduced a new term "not allowed", to distinguish certain circuits previously marked as "avoid", for which projects will be deemed "not deliverable" in final stage deliverability testing; and
- Acknowledgement of the set aside agreement between Six Nations of the Grand River, Six Nations of the Grand River Development Corporation and the Ministry of Energy, in accordance with Ministerial Directive.

The IESO will release a separate connection guidance document for the LT2 Capacity Services (Window 1) RFP (LT2(c-1) RFP).

The deliverability process for the LT2(e-1) RFP includes the following two steps:

1. Provide **preliminary connection guidance information** ahead of proposal submission to help proponents select project locations that will more likely contribute to addressing emerging energy reliablity needs (this document);

2. Conduct an **evaluation stage deliverability test** for projects submitted to the LT2(e-1) RFP as part of the proposal evaluation stage to assess whether submitted projects can contribute effectively to addressing emerging reliability needs. The evaluation stage deliverability test methodology will be based on principles and criteria similar to those used in this document.

The IESO, with support from Hydro One Networks Inc. (HONI), has developed a set of preliminary connection guidance information, which considers both system congestion and system reliability factors, as follows:

1. System congestion limitations, as presented in Sections 2, 3 and 5 of the report;
2. Inverter-Based Resource (IBR) limitations, decribed in Section 4;
3. Protection and short circuit limitations, presented in Section 6; and
4. Distribution limitations (HONI stations only), as presented in Section 7.

Given the structure of the Enhanced Power Purchase Agreement (E-PPA) contract to be used for the LT2(e-1) RFP procurements, the IESO assumed that the resources participating in this RFP will have a relatively low capacity factor (below 50%). For resources with higher capacity factors, consultations with IESO staff is recommended as some connection locations may limit the delivery of energy from those resources.

Some locations could be subject to multiple types of limitations. Where multiple limitations apply to a particular location, the most constraining limitation should be used.

Table 1 summarizes the most constraining area limitations identified in this document, indicating the maximum amount of new generation that could connect in a given area.

Further below, Figures 1 and 2 identify all of the area limitations for Northern and Southern Ontario, respectively.

Table 1 | Most constraining Area limitations summary

Zone	IBR Limit[1] (MW)	Area Congestion Limit (MW)[2,3]	Short-Circuit Limited Stations (50 km radius)
Northwest	North = 1,000	West of Wawa TS = 600	No limitation observed
Northeast		East of Widdifield SS = 150	
Essa	East of Toronto = 1,400	East of Minden TS = 250	No limitation observed
Ottawa		East of Dobbin TS = 275 East of Lennox TS = 900 East of Bowmanville SS = 1,900	No limitation observed
East			No limitation observed
Toronto	N/A[5]	N/A[5]	Cherrywood TS Clarington TS Richview TS Manby TS
Niagara[4]	West of Toronto = 2,400	West of Detweiler TS = 600 West of Middleport TS = 1,300 West of Milton SS = 1,100	Allanburg TS Beck 2 TS
Southwest			Trafalgar TS Burlington TS Richview TS Manby TS
Bruce[4]		See West and Southwest Limits	No limitation observed
West		West of Buchanan TS = 1,100 West of Chatham SS = 600	No limitation observed

[1] IBR limits apply to inverter-based resources and depend on the size and location of resources. For example, in Northern Ontario, the "North" IBR limit increases to 1,200 MW if 230 kV circuit connections are limited to 100 MW instead of 200 MW.

[2] Area congestion limits are valid for new resources with capacity factors below 50%. The limits could be further reduced for new resources with a capacity factor above 50%.

[3] Area congestion limits are approximations based on maximum generation that could be injected into the station mentioned as the area limit.

[4] Zonal probabilistic limits for certain technologies in Bruce and Niagara zones are more restrictive – see Section 2 of the document.

[5] Area congestion and IBR Limits were not determined for Toronto since short-circuit limitations will prevent connections to the entire area for LT2(e-1)

Figure 1 | Overall Northern Ontario Limitations Map

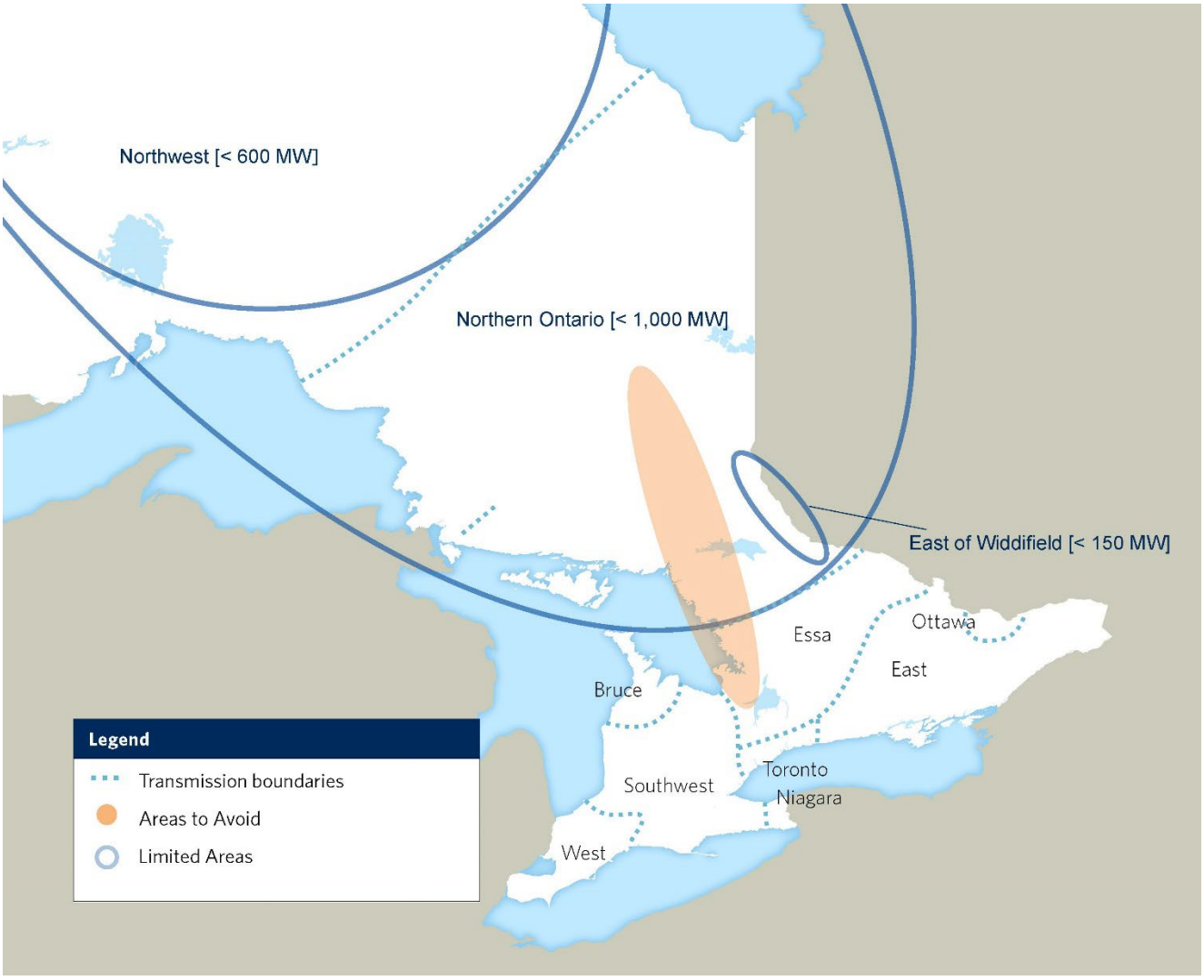
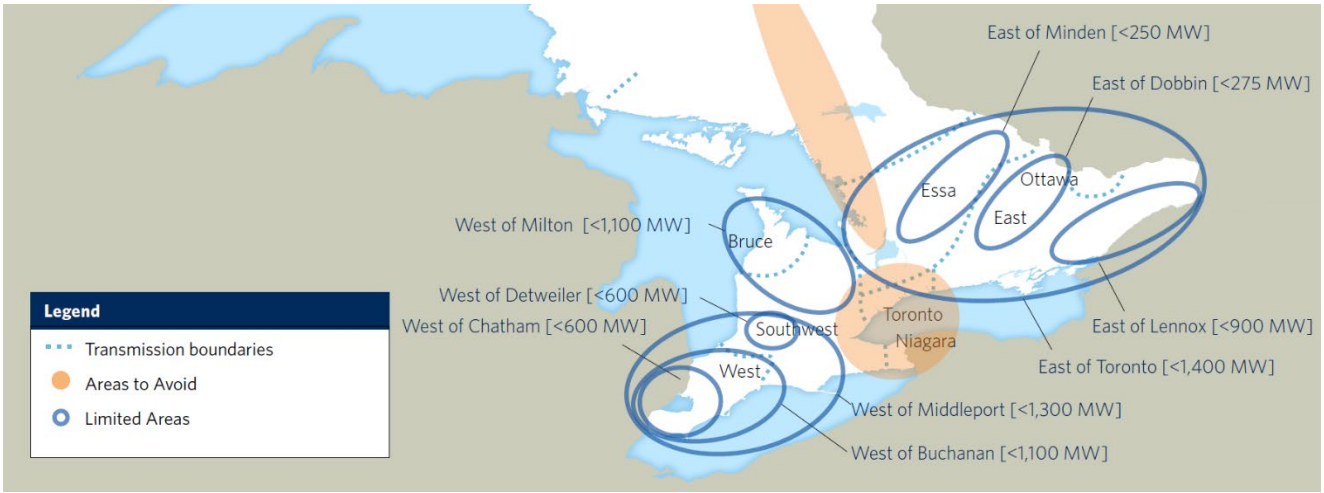


Figure 2 | Overall Southern Ontario Limitations Map



In addition to the zonal and area limitations above, the maximum amount of any type of resources that can connect directly to a single circuit is 250 MW per project proposal. The maximum amount of IBRs that can connect directly to any single circuit is further limited to the bright-line[1] limits as follows:

- 75 MW per 115 kV circuit in both Northern and Southern Ontario; and
- 200 MW per 230 kV circuit in Northern Ontario.

However, there are circuits that are more limiting than the bright-line limits above, as well as circuits that will need to be avoided, and circuits where new connections will not be allowed. Appendix A lists the capacity identified for each transmission circuit, based on the most restrictive limitation, and indicates the area where each circuit belongs.

The results of the RFP evaluation stage deliverability test will be highly dependent on the size and location of LT2(e-1) RFP proposals in the same electrical proximity – proposals may end up competing for the same transmission system availability as determined using the information in this document, during the evaluation stage deliverability test.

While this document considers only the electricity system impacts of project siting, proponents are encouraged to take a fulsome view of where they site their projects and examine other regulatory, permitting, RFP and policy requirements. For example, IESO received policy direction from the Ministry of Energy and Electrification on project considerations for siting on agricultural land. Section 8 of this document lists other connection considerations that the users of this guidance should be aware of.

As this document is only providing preliminary connection guidelines, proponents are still free to submit proposals for projects at locations either not assessed in this document or recommended to "avoid", as well as proposals for project sizes that exceed the circuit congestion limitations presented in this document. However, there is a higher risk to those proposals during the evaluation stage deliverability test. Proposals for projects that seek to connect to circuits that are "not allowed" will be deemed "non-deliverable" in the evaluation stage deliverability test.

[1] Bright-line is a non-objective rule or standard.

1. Introduction

The goal of the LT2(e-1) RFP is to secure at least 3 TWh of energy from new resources to connect by 2030 or earlier.

In addition to the LT2(e-1) RFP, the IESO has introduced another procurement stream under the LT2 RFP, the Long-Term 2 Capacity Services (Window 1) Request for Proposals (LT2(c-1) RFP). The IESO has also indicated that it will be launching a Long Lead-Time Resource Procurement, for which engagement will be separately conducted.

Since the LT2(e-1) RFP is designed to primarily address an energy need, the approach for ensuring procured resources contribute towards the reliability need will be different from past E-LT1 and LT1 RFPs that mainly addressed a capacity need (i.e., the ability to meet system needs at peak times). During the December 2023, February 2024 and April 2024 LT2 RFP webinars, the IESO has proposed a deliverability process comprised of two steps:

1. Provide **preliminary connection guidance information** ahead of proposal submission to help proponents select projects locations that will more likely contribute to addressing emerging energy reliablity needs (this document); and
2. Conduct an **evaluation stage deliverability test** for proposals submitted to the LT2(e-1) RFP, to assess whether submitted projects can contribute effectively to addressing emerging reliability needs. The evaluation stage deliverability test methodology will be based on principles and criteria similar to those used in the development of this guidance document. In accordance with the Minister's Directive dated November 28, 2024 (the "Directive"), the deliverability stage of proposal evaluation for the LT2 RFP will prioritize energy-producing resources.

Stakeholders provided feedback that showed support for this approach, and indicated they would like to know availability and congestion data on a zonal, circuit and bus basis across Ontario.

To respond to the needs of stakeholders, the IESO, with support from HONI, have developed preliminary connection guidance information that takes into account six types of limitations, as follows:

1. Zonal probabilistic limitations – identify the total new generation that could connect into each of Ontario's electrical zones with a positive contribution to Ontario's global resource adequacy, by using a probabilistic resource assessment;
2. Area (multi-zonal, zonal, sub-zonal) congestion limitations – identify the total new generation that can connect into an area and result in a minimum risk of energy curtailments by using load-flow simulations;
3. Inverter-based resource limitations – identify the total amount of new inverter-based generation that can connect to a zone or a circuit and minimize the possibility of unwanted sub-synchronous control interactions (SSCI) with other inverter-based resources and sub-synchronous resonance (SSR) with series capacitors;

4. Circuit congestion limitations – identify the total amount of new generation that can connect to a circuit and result in a minimum risk of energy curtailments by using load-flow simulations;
5. Short-circuit & protection limitations (HONI system only) – identify areas where new resources should avoid connecting because short-circuit levels may exceed the capability of the transmission equipment or circuit protections may become inadequate; and
6. Distribution asset limitations (HONI stations only) – identify available capacity at distribution level assets.

The following sections of the document present the objective, methodology, assumptions and results for each of the six types of limitations. Given the structure of the Enhanced Power Purchase Agreement (E-PPA) contract to be used for the LT2(e-1) RFP procurements, the IESO assumed that the resources participating in this RFP will have a relatively low capacity factor (below 50%). For resources with higher capacity factors, consultations with IESO staff is recommended, as some connection location may limit the delivery of energy from those resource.

Some locations could be subject to multiple types of limitations. For example, availability in a distribution system identified through Section 7 could be further restricted by transmission-level limitations that are applicable to the station, or the area, the distribution system connects to. As well, multiple types of limitations could apply to the transmission connections. Where multiple limitations apply to a particular location, the most constraining limitation should be used.

The preliminary connection guidance information in this document is presented to help potential LT2(e-1) RFP proponents identify project locations where a project is more likely to be considered as "deliverable" at the evaluation stage deliverability assessment of the LT2(e-1) RFP. See Disclaimer above.

2. Zonal Probabilistic Limitations

2.1 Objective

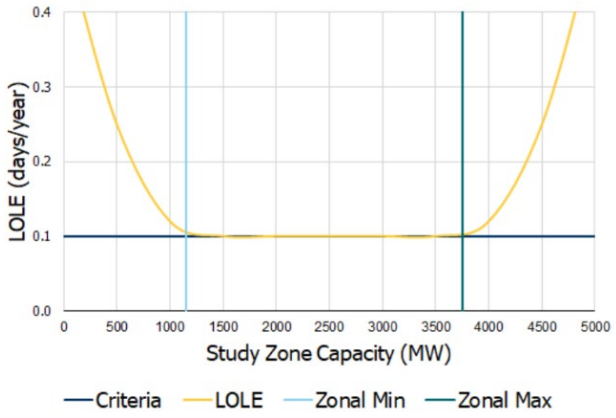
The goal of the probabilistic zonal energy assessment performed was to determine the total new capacity that could be added into an electrical zone and have a positive contribution towards provincial resource adequacy. New energy resources in a zone can contribute toward provincial resource adequacy when the energy is not congested at times of system need. The limit on the total capacity for each zone was determined for scenarios with new generation composed of 100% wind, 100% solar, and a solar - wind energy mix. Limitations for other technologies would depend on their respective capacity factors and production profiles.

2.2 Assumptions and Methodology

To calculate the zonal probabilistic limitations, the methodology used for 'perfect capacity' assessments was modified for renewables. This methodology is outlined in the Annual Planning Outlook: Supply, Adequacy and Energy Outlook Module [1], and is detailed as follows:

Zonal capacity limits are calculated using zonal constraint curves. Zonal constraint curves are developed by adding or removing capacity in a zone and removing or adding a corresponding amount of capacity in the rest of the system, such that the total incremental capacity is constant. The zonal constraint curve is developed using a 'two-zone' representation of the transmission system. The only interfaces that are represented in the capacity adequacy tool should be those that are connected to the study zone; the remainder are removed or set to a non-limiting value. The resulting system loss-of-load expectation (LOLE)[2] across a range of study zone capacities creates the zonal constraint curve, as shown in Figure 3.

Figure 3 | General Shape of Zonal Constraint Curve



[2] Loss-of-load expectation represents the expected probability of occurrence of a power system's inability to meet the demand for electricity within a specified period.

The flat portion of the curve represents the range of study zone capacity where the system LOLE will remain approximately unchanged for an equal and offsetting amount of capacity in the rest of the system. Where the curve slopes downwards to the left, LOLE is decreasing as study zone MWs are added and an equal amount of MWs are removed from the rest of the system. This indicates that additional MWs in the study zone improve total system adequacy. When the curve starts to rise, those additional MW cannot be fully utilized to offset capacity in the rest of the system and a zonal maximum can be established where the LOLE is greater than the LOLE threshold.[3]

2.3 Results

For the LT2(e-1) RFP preliminary connection guidance, the IESO determined the following zonal limits for new generators that could contribute to the adequacy needs of the system and avoid or minimize energy curtailments in each electrical zone, as shown in Table 2.

Table 2 | LT2(e-1) RFP Zonal Capacity Limits

Zone	Solar only Maximum (MW)[1]	Wind only Maximum (MW)[1]	Mix Solar & Wind Maximum (Solar MW, Wind MW)[1]	Other Technologies
Northwest	1200	1400	1200, 600	Zone limits are project dependent
Northeast	2000	1800	1600, 800	
NE + NW	2000	1800	1600, 800	
East	Maximum Studied	1800	Maximum Studied, 1800	
Ottawa	2400	Maximum Studied	1600, 800	
Essa	Maximum Studied	Maximum Studied	Maximum Studied	
Southwest	Maximum Studied	Maximum Studied	Maximum Studied	
West	2000	800	1600, 800	
Niagara	800	0	N/A	
Bruce	0	1800	N/A	
Toronto	2400	0	N/A	

[1]The studies for each zone have tested up to 2,000 MW of wind and up to 4,000 MW of solar generation (solar has a lower capacity factor than wind), and up to 1,000 MW wind + 2,000 MW solar in the mixed case.

[3] LOLE threshold = System LOLE using target capacity requirement (per seasonal allocation) + 0.001 days/year

3. Area Congestion Limitations

3.1 Objective

The goal of the area (multi-zonal, zonal, sub-zonal) congestion limitation guidance assessment is to determine the total amount of new generation that can connect into an area and have a minimum risk of energy curtailment to prevent thermal overload of the transmission equipment downstream of that area.

3.2 Assumptions and Methodology

To determine area congestion limitations, the IESO created three main basecases for three larger sub-systems of focus:

- Northern Ontario sub-system – includes the Northwest and Northeast electrical zones;
- West of Toronto sub-system – includes the Southwest, West, Bruce and Niagara electrical zones; and
- East of Toronto sub-system – includes the Essa, East and Ottawa electrical zones.

Each of these cases was adjusted to deliver energy towards Toronto, and included the following assumptions:

- 2030 coincident minimum load demand for each sub-system of focus, as per the 2024 Annual Planning Outlook (APO) forecast;
- Non-energy-limiting resources, such as nuclear generators, gas generators and run-of the river hydro, were assumed in service at their maximum or normal operating output; with the exception of quick-starting gas fired generators, two Lennox units and one Bruce generating unit, which were assumed out of service;
- Dispatchable energy-limited resources, such as hydroelectric plants, were assumed at 50th percentile MW production, because they were considered able to generate around the intermittent resources and maximize the use of the transmission system;
- Existing wind and solar resources were assumed at 90% of their installed capacity;
- All contracted E-LT1 and LT1 RFP resources were assumed in service, with the storage resources charging at 50% capacity, and any new gas generators were dispatched as per the gas generation assumptions above;
- All major transmission projects committed to come into service by 2030 were considered, as per 2024 APO;
- Summer thermal ratings were used; and

- For any results that indicated a high level of congestion due to high natural gas generation output, additional sub-cases were tested, one with a 50th percentile demand forecast, and one with 50% gas fired generation level. The lowest limit between the two sub-cases is reported for the area limits.

For each of the three cases and sub-cases developed, new generation was injected at various major stations until pre or post-contingency thermal violations were observed. The use of Remedial Action Schemes (RAS) for the purpose of accommodating new resources was not considered in the assessments to avoid reliance on RAS with all transmission elements in-service.

The maximum injection determined using the methodology above was used as an approximation for the amount of generation that could connect into the area upstream of the station under assessment, and includes the station under assessment. For those scenarios where any upstream transmission circuits were found to have no available capacity (as per Appendix A), new generators may be required to connect directly into the stations.

3.3 Results

For Northern Ontario, the following limitations were identified:

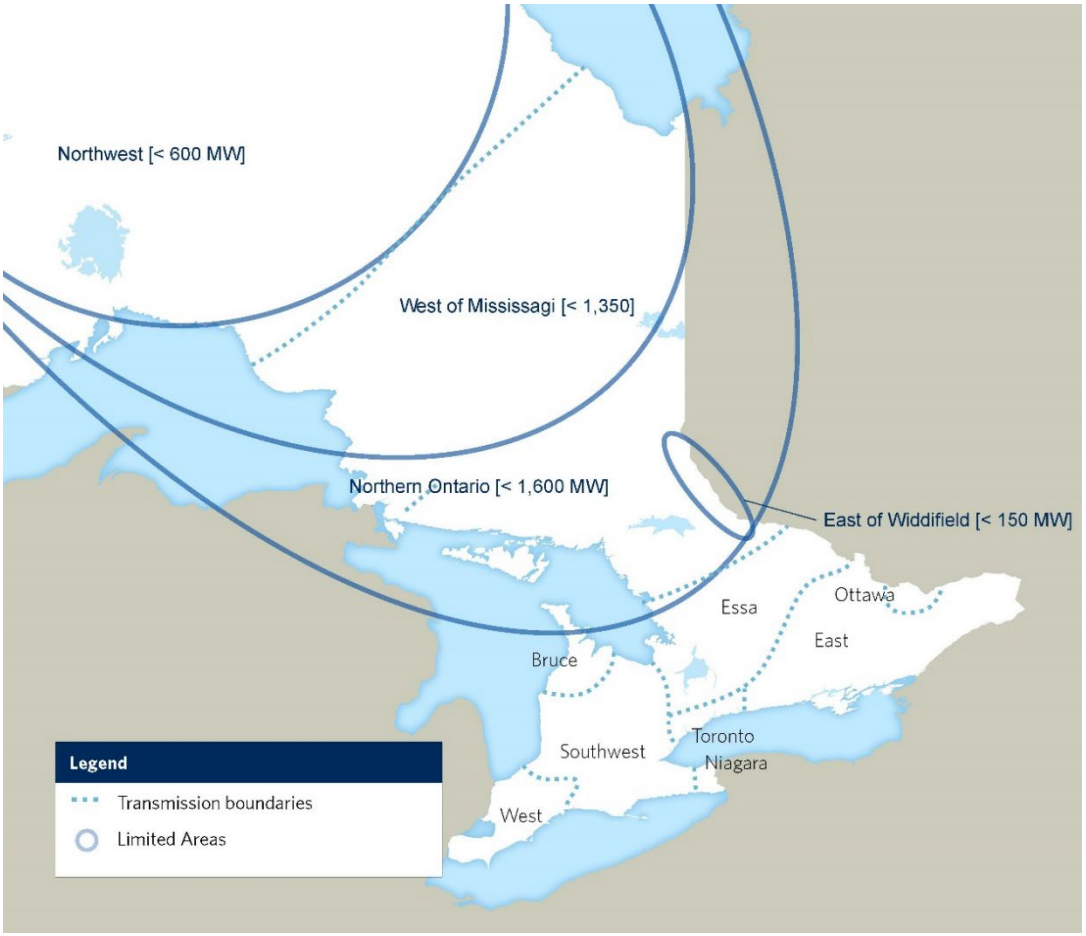
Table 3 | Northern Ontario Area Congestion Limits

Area	**Area Limit (MW)** [2]
Northwest[1]	600
West of Mississagi TS	1,350
East of Widdifield SS	150
Northern Ontario	1,600

[1]The West of MacKenzie TS and West of Lakehead TS areas were tested and are not limiting beyond the West of Wawa zone.
[2]Area limits are approximations based on maximum generation that could be injected into the station.

Figure 4 illustrates approximate geographical boundaries for each area above.

Figure 4 | Area Congestion Limits within Northern Ontario



In addition, new project connections will not be allowed in certain areas that are prone to transient instability and where congestion is often present, such as North and West of Pinard TS, the 115 kV system North of Lakehead TS and the 115 kV system North of Kenora TS.

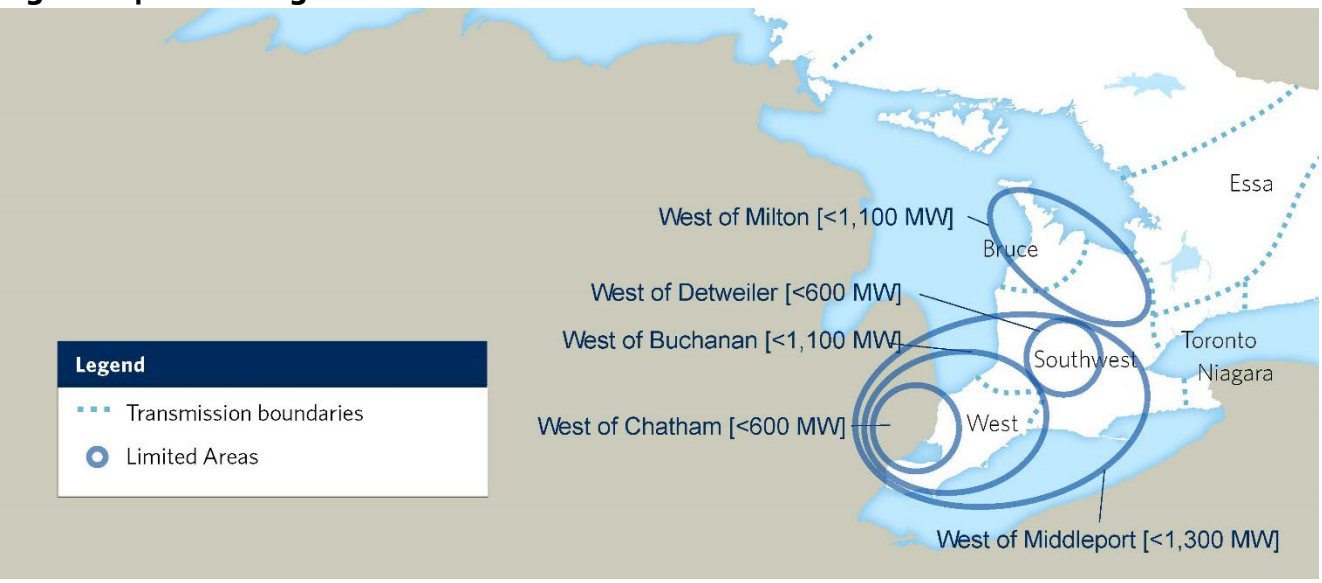
For the West of Toronto scenario, the following area limitations were determined:

Table 4 | West of Toronto Area Congestion Limits

Area	Area Limit (MW)
West of Chatham SS	600
West of Buchanan TS	1,100
West of Detweiler TS	600
West of Middleport TS	1,300
West of Nanticoke TS	1,300
West of Milton SS	1,100

Figure 5 shows the approximate geographical boundaries for some of the areas above.

Figure 5 | Area Congestion Limits for West of Toronto



As per subsection 5(k) of the Directive, the IESO will reduce the capacity available for LT2 projects proposing to connect to the 230 kV circuits that connect to Nanticoke TS and/or the Niagara Reinforcement Line between Allanburg Transformer Station and Middleport Transformer Station[4] by 300 MW. Further, this 300 MW of capacity will be set aside for any renewable energy projects that are owned by, or have majority equity interest from, Six Nations of the Grand River Development Corporation ("SNGRDC Projects"), as applicable under the agreement between Six Nations of the Grand River, Six Nations of the Grand River Development Corporation and the (then) Ministry of Energy that is posted to the website of Six Nations Future (here). This 300 MW of capacity can be awarded to one or more SNGRDC Projects under LT2 provided they meet all procurement requirements. The set aside capacity will be accounted for during the Deliverability Test.

For the East of Toronto scenario, the following area limitations were determined:

Table 5 | East of Toronto Area Congestion Limits

Area	Area Limit (MW)
East of Dobbin TS	275
East of Minden TS	250
East of St. Lawrence TS	400
East of Hinchinbrooke TS	1,100
East of Lennox TS	900
East of Bowmanville SS	1,900

Figure 6 shows the approximate geographical boundaries for some of the areas above.

[4] These circuits include: K40M, N20K, N21J, N22J, N37S, N5M, N6M, Q26M, Q35M and S39M.

Figure 6 | Area Congestion Limits for East of Toronto

In addition, new project connections will not be allowed in certain areas that are prone to transient instability and where congestion is often present, such as the 115 kV system bounded by the Barrett Chute, Merivale and Cataraqui stations.

4. Inverter Based Resource Limitations

4.1 Objectives

The goal of the Inverter Based Resource (IBR) limitations guidance assessment is to provide information on the amounts of IBR generation that could connect to different parts of the grid with minimal risk of introducing sub-synchronous resonance (SSR) with the existing series capacitors located at the Nobel Switching Station (SS), or introducing undesirable sub-synchronous control interactions (SSCI).

4.2 Assumptions and Methodology

IBRs have a history of oscillating under certain system conditions, typically when they are in proximity of other IBRs in weakly connected systems, or when they are radially connected to series compensated transmission circuits.

In order to avoid potential SSR issues with the series capacitors at Nobel SS on circuits X503E and X504E, the IESO performed a topology scan and excluded certain connection points that could become radially connected to these series capacitors for credible scenarios.

Potential SSCI were determined by the IESO using a screening tool that was developed in-house and that takes the following factors into consideration:

- System topology;
- Ratings and location of neighbouring IBRs; and
- Minimum short circuit ratio (SCR) specified by the OEM for stable operation of the IBR.

The following was assumed:

- For each IBR, a minimum SCR of 5 at its point of interconnection is assumed for stable operation;
- An SCR of 2-3 is used for existing IBRs at the inverter level; and
- Available Fault Level (AFL) is an indicator of whether the system is strong enough to support stable operation of a new IBR connection at the location measured without the risk of SSCI. It is calculated using the methodology explained in Section 6.6 of 'Connection of wind farms to weak AC networks' [2].

The size and locations of IBR injections were tested as follows[5]:

- Northern Ontario (Northeast + Northwest)

[5] The issue 2.0 of the document evaluated an increase of project sizes from the originally developed document as follows: 75 MW instead of 30 MW for 115 kV circuits, 200 MW instead of 100 MW for the 230 kV circuits in the Northern Ontario, and 250 MW instead of 150 MW for 230 kV network circuits and 100 MW radial circuits in the Southern Ontario.

- Tested up to 2,200 MW of IBRs using the following bright-line connection criteria:
    - Limit IBR 115 kV connections to 75 MW per circuit – the 115 kV network was found incapable of accommodating significant IBR injections in comparison to a stronger 230 kV network;
    - Limit IBR 230 kV connections to 200 MW per circuit; and
    - A maximum of one injection per circuit was assessed.

- Southern Ontario
    - Size and location of IBRs were chosen using the following bright-line connection criteria:
        - Avoid the limiting circuits of a major transmission interface – to avoid reducing the transfer capability of those interfaces that may have an imbalance of flows;
        - Limit IBR 115 kV connections to 75 MW per circuit;
        - Limit IBR 230 kV circuit connections to 250 MW per circuit; and
        - A maximum of one injection per circuit was assessed.
    - West of Toronto case – tested up to 2,400 MW of IBRs, following the criteria above
    - East of Toronto case – tested up to 1,400 MW of IBRs, following the criteria above.

4.3 Results

4.3.1 Sub-Synchronous Resonance

The results of the SSR topology scan identified that the following circuits could end up in a radial connection to the Nobel SS series capacitors for credible contingencies, and as a result, connection of any IBRs would not be allowed.

Table 6 | Circuits Classified as 'Not Allowed' due to Potential SSR Issues

Circuits Connected to Hanmer
X503E
X504E

With consideration to the identifed circuits for SSR issues, connecting approximately 1,200 MW of IBRs to the remaining northern 230 kV circuits was tested and passed in Northern Ontario. The approximate region where these circuits are located is illustrated in Figure 7.

Figure 7 | Approximate Region of Circuits classified as 'Not Allowed' due to Potential IBR Issues

4.3.2 Sub-Synchronous Control Interactions

Out of the 1,200 MW of IBRs that passed the SSR scan in Northern Ontario, approximately 1,000 MW were found to be feasible for connection in Northern Ontario due to SSCI, where connection sizes to 115 kV circuits are limited to 75 MW and 230 kV circuits are limited to 200 MW per circuit. Amounts up to 1,200 MW can be connected in Northern Ontario where connections to 115 kV and 230 kV circuits are reduced in size to 30 MW and 100 MW, respectively.

For both West and East of Toronto cases in Southern Ontario, injections of 2,400 MW and 1,400 MW respectively, were found to be feasible from an SSCI perspective, where connections to 115 kV circuits are limited to 75 MW and 230 kV circuits are limited to 250 MW per circuit.

Given the impact of individual IBR connections to the area connection limitations, the maximum amount of IBRs that can connect directly to any single circuit is limited to the bright-line limits as follows:

- 75 MW per 115 kV circuit in both Northern and Southern Ontario;
- 200 MW per 230 kV circuit in Northern Ontario; and
- 250 MW per 230 kV circuit in Southern Ontario.

4.4 Other Considerations

With respect to the above results for guidance, the following must be taken into consideration:

- The analysis is meant to be used for high-level screening purposes only, and is not expected to cover all possible LT2(e-1) RFP combinations that may be submitted, as the outcomes of these tests are highly dependent on the size and location of the IBRs modeled;
- A further IBR SSCI assessment will be performed by the IESO during the evaluation stage deliverability test, once the size and location of LT2(e-1) RFP projects are known;
- As per input from Hydro One, connection of IBRs can introduce voltage unbalance on the transmission system. This issue can be particularly severe for generation connecting to radial circuits. Typically, voltage unbalance will become unacceptable if the product of the line length (in km) and generation (in MW) exceeds 10,000 for 230 kV radial lines (e.g. 100 MW on a 100 km long radial circuit) and 2,500 for 115 kV radial lines (e.g. 50 MW on a 50 km long radial circuit). Generation proponents will be responsible for mitigating any unacceptable unbalance observed;
- Voltage unbalance can also occur on (non-radial) network circuits; however, it is most likely to only become an issue under outage conditions (e.g. if one line terminal opens, leaving the generation connected radially to the other terminal). In these scenarios, generation will need to be reduced or curtailed for the duration of the outage to mitigate the issue; and
- More detailed SSR, SSCI, voltage unbalance, and additional Electromagnetic Transient (EMT) studies, will be required once detailed models are known, which will most likely occur during the Connection Assessment stage as part of a System Impact Assessment (SIA).

5. Circuit Congestion Limitations

5.1 Objective

The goal of the circuit congestion limitations guidance assessment is to determine the amount of new generation that could inject into a circuit and not require energy curtailments to prevent thermal overload of the transmission equipment.

5.2 Assumptions and Methodology

To determine the maximum incremental generation that could inject into a circuit, the same cases that were developed for the Area Congestion Limitations analysis were used. Using the three basecases and the two additional sub-cases for the West of Toronto area and two sub-cases for the East of Toronto area described in the Area Congestion Limitations section, the maximum incremental injection into each circuit in each of the three areas of study was calculated by determining the remaining capacity between the short-term emergency thermal rating of the circuit and the post-contingency flow through the circuit following the most limiting recognized contingency, for the most limiting section of the main circuit.

In determining these limits, the following additional criteria was used:

- Where the load-flow study results indicated that a circuit has a capability that exceeds the bright-line connection criteria from the IBR Limitations section, the limit for the circuit was capped at the bright-line level;
- Circuits that were identified to be on the weak path of an interface, to which a direct connection would result in a material reduction in transfer capability, were deemed as "Not Allowed";
- Available capacity was discounted for circuits on which connecting new resources would have a direct impact on the operability of existing generation units, even those dispatchable. Direct impact could occur if a new resource is located in the proximity of an existing resource and the local transmission capability to evacuate energy is limited, and would significantly inhibit the existing resource to generate, requiring frequent generation redispatch.

5.3 Results

The results of the circuit congestion assessment are included in the tables presented in Appendix A.

5.4 Other Considerations

- Connection to 500 kV circuits should be avoided;
- Connections to intertie circuits are not allowed, to maintain intertie transfer capability with neighboring system operators;

- Any connection to HONI transmission circuits will need to comply with Hydro One Transmission Generation Interconnection Requirements document;
- Connection to circuits forming a parallel transmission path may require a configuration that balances the flows on all circuits in the path; and
- Connections to new transmission circuits that have a committed in-service date beyond December 31, 2029, as confirmed by the transmission developer at the time of the proposal submission deadline, are not allowed. This is to minimize the risk of procuring new resources that may not be able to connect due to potential delays with the new transmission projects.

6. Short-Circuit & Protection Limitations (HONI transmission system only)

6.1 Objective

The goal of the short-circuit limitations guidance assessment is to identify areas where the short-circuit levels are close to, or exceed, the short-circuit capability of the transmission equipment, and there are no feasible solutions to be implemented before year 2030; therefore, those areas should be avoided by the potential proponents in the LT2(e-1) RFP.

6.2 Assumptions and Methodology

HONI has identified transmission stations and equipment with short-circuit capabilities that could be close to their limits or exceeded by 2030 considering the committed generation and transmission projects expected to be in-service prior to the connection of the LT2(e-1) RFP projects, as specified by the IESO.

Because any addition of generation resources will increase the short-circuit levels in the proximity of their connection, HONI has recommended that proposals should avoid to connect within a radius of 50 km (electrical) from a station with short-circuit limitations.

A short-circuit assessment will be performed for all proposals in the evaluation stage deliverability test, regardless of their location.

6.3 Results

The following table presents HONI's transmission stations with known short circuit limitations. Stations identified as 'limited room' have limited capacity for new generation nearby as short-circuit levels at these stations are approaching maximum equipment capabilities.

Table 7 | Stations with Short-Circuit Limitations (HONI)

Station	Limiting Issue
Allanburg	Strain bus
Beck #2	Breaker rating
Burlington (limited room)	Breaker rating
Cherrywood	Breaker rating
Clarington	Breaker rating
Manby	Station grounding
Richview	Breaker rating
Trafalgar (limited room)	Breaker rating

Other limitations due to station grounding, skywires, strain buses and cable sections will be identified after the size and connection point of the proposed generators are known. Additional constraints may

also arise depending on the generation proposing to connect. Although HONI had indicated that the approximate distance to avoid was 50 km (electrical), to give the reader a rough geographical context, Figure 8 illustrates the approximate regions to avoid by drawing a 50 km radius around each of the stations identified in Table 7.

Figure 8 | Approximate Regions to Avoid Due to Potential Short-Circuit Limitations

6.4 Constraints Due to Protection

The total generation capacity and number of taps that could connect into a circuit may be limited due to line protection considerations. For example, protection may not reliably detect a circuit fault with a new generator connection on the circuit if the circuit is supplied by stations with low short-circuit levels. This determination can be made only after generator parameters and connection points are known.

Connecting into circuits with a large number of customer connections or circuits that are equipped with line differential protections introduce major complexities and require costly solutions, from installing sectionalizing breakers and new protection elements, to installing a full switching station at the connection point. It is, therefore, recommended to avoid connecting into these circuits.

A list of circuits recommended to avoid connecting new generation due to these issues, are shown in Table 8. Please note that constraints due to protection adequacy may not necessarily apply to distribution connected projects or projects wishing to connect to existing tap lines to transmission connected customer facilities.

Table 8 | HONI Owned Circuits to avoid due to line protection constraints

Circuit	Voltage (kV)	Reason
B4V	230	Too many taps
B5C	115	Too many taps
B5V	230	Too many taps
B6C	115	Too many taps
F11C	115	Too many taps
F12C	115	Too many taps
J3E	115	Line differential
J4E	115	Line differential
J20B	230	Line differential
K21C	230	Line differential
K23C	230	Line differential
L25V	230	Line differential
L27V	230	Line differential
L28C	230	Line differential
L20H	230	Too many taps
L21H	230	Too many taps
L22H	230	Too many taps
M20D	230	Too many taps
M21D	230	Too many taps
M31W	230	Too many taps
M32W	230	Too many taps
M33W	230	Too many taps
N20K	230	Line differential
N37S	230	Line differential
Q23BM	230	Line differential
Q24HM	230	Line differential
Q25BM	230	Line differential
Q26M	230	Line differential
Q28A	230	Line differential
Q29HM	230	Line differential
Q30M	230	Line differential
Q35M	230	Line differential
R24C	230	Line differential
S39M	230	Line differential
S47C	230	Line differential
V41N	230	Line differential
V43N	230	Line differential
W44LC	230	Line differential
W45LS	230	Line differential

7. Distribution Asset Limitations (only HONI stations)

Available capacity at the HONI distribution assets can be found using HONI's Station and Feeder Capacity Calculator, located here. This list shows an approximate amount of generation that can be added at each bus or station owned by HONI.

Please note that upstream restrictions on the high voltage stations may limit the number of resources connecting at the distribution level. Transmission connected resources near a station will increase the fault level in the distribution system of that station, and will therefore compete for the available capacity. Connections to distribution stations will not be allowed if they are directly connected to any circuits deemed "Not Allowed" for connection in Appendix A.

This document does not provide guidance regarding any limitations or availability for connections to the distribution systems owned by Local Distribution Companies (LDCs) beyond the available capacity at distribution level stations supplied from Hydro One stations. Interested proponents are recommended to contact the LDCs operating the distribution system they intend to connect to.

8. General Considerations

The preliminary connection guidance provided in this document is intended to only be used in the context of the procurement of energy under the LT2(e-1) RFP, and only addresses electrical transmission system availability and energy deliverability limitations. Proponents are encouraged to take a fulsome view of where they site their projects and examine other regulatory, permitting, RFP and policy requirements. Any residual capacity needs that may need to be addressed through the LT2(c-1) RFP or subsequent procurements will rely on different methodologies and may leverage the deliverability testing processes established under the E-LT1 and LT1 RFPs, pending further detail.

In making use of this guidance document, there are several considerations and limitations, in addition to those detailed in other sections, that are important to consider. They are listed as follows:

- The connection guidance provided in this document is valid for resources with lower capacity factors (below 50%) for the LT2(e-1) RFP. For resources with higher capacity factors, consultations with IESO staff is recommended as some connection locations may limit the delivery of energy from those resources;
- Some locations could be subject to multiple types of limitations. Where multiple limitations apply to a particular location, the most constraining limitation should be used;
- The conclusions of this document are highly dependent on the size and location of LT2(e-1) RFP proposals in the same electrical proximity. For example, the total amount that could be injected into a multi-circuit line or corridor could be less than the sum of the maximum single circuit injection value. As a result, proposals in the LT2(e-1) RFP may compete for the same transmission system availability during the evaluation stage deliverability test;
- The assumptions and methods used to provide this guidance document are reflective of a limited number of historical and forecasted operating scenarios. At the time of the evaluation stage deliverability test, there may be other scenarios, methods and changes to forecasts to consider, which could provide different results;
- Direct connections into a transmission station were not assessed for possible limitations due to physical space available, auto-transformer rating and other operability issues at the station, beyond the limitations described in this document;
- In order to avoid a situation where a connection configuration turns out to be infeasible, impractical or too costly, applicants are encouraged to have discussions with transmitters and LDCs prior to making a submission into the LT2(e-1) RFP. Connection configurations must meet the transmitter's or LDC's connection requirements;
- The IESO strongly recommends that potential generation proponents with proposed projects connecting to the transmission system, or proposed projects larger than or equal to 10 MW connecting to the distribution system, delay their SIA applications until the results of the procurement are announced. If an applicant chooses to apply for an SIA, it is important to note that the SIA may need to be updated or restarted after the results of the procurement are announced, as an SIA completed earlier would not have included all successful projects in the assessment; and

- Potential proponents considering projects for future procurements should be aware that the outcome of the LT2(e-1) RFP, as well as the purpose of the procurement (e.g., acquisition of energy or capacity), will make the information in this document inadequate for purpose of siting projects for these future procurements.

9. Conclusions

The results of the assessments presented in this document indicate locations that are more viable and locations that are more limited from an energy deliverability perspective, and is intended to guide the siting of new generation for the purpose of participating in the LT2(e-1) RFP.

As this document is only intended to provide preliminary connection guidelines, proponents are still free to submit proposals into the LT2(e-1) RFP for projects at locations that are either not assessed or recommended to avoid in this document, as well as proposals for project sizes that exceed the limits presented in this document. However, there is a higher risk that those proposals will not be successful in the energy deliverability test in the evaluation stage of the LT2(e-1) RFP. Proposals for projects that seek to to connect to circuits that are "not allowed" will be deemed "non-deliverable" in the evaluation stage deliverability test.

10. References

[1] IESO, "Annual Planning Outlook: Supply, Adequacy and Energy Outlook Module", March 2024.

[2] CIGRE Working Group B4.62, "Connection of wind farms to weak AC networks", December 2016.

11. Appendix A: Transmission Circuit Capacities

The following tables list the circuits in each of the three sub-systems studied. The tables list the incremental generation that could connect into each circuit based on the assessments performed in Section 5. However, the actual capacity that can connect into each circuit may be further restricted by other limitations identified through the assessments described in the other sections of the document. All of the limitations associated with a particular circuit are also identified in the following tables for comparison, and the most limiting should be used.

The actual capacity that can be connected to a specific location on a circuit will be determined by evaluation stage deliverability test.

The following criteria was used to determine if a circuit was classified as "avoid" or "not allowed":

- A circuit is classified as "Not Allowed" if the circuit is:
    - In an area with existing stability issues;
    - Part of an intertie connected to a neighboring transmission system;
    - At a higher risk of potential SSR issues;
    - Identified to be on the weak path of an internal interface; and
    - A new circuit with an in-service date of December 31, 2029 or later. This is to minimize the risk of procuring new resources that may not be able to connect due to potential delays with the new transmission projects.
- A circuit is classified as "Avoid" if the circuit is:
    - A 500 kV circuit. Capacities on these circuits are currently listed as 'n/a' as in the unlikely scenario that connection to the 500 kV system is feasible in terms of timeline and cost, the capacity of connection to a 500kV is highly dependent on connection configuration;
    - Identified to have no capacity based on the congestion analysis performed;
    - Identified to have potential protection limitations; and
    - Identified to be within 50 km of a short-circuit limited station (partial or fully).

Although there are capacities listed for circuits classified as "Avoid", there is a higher risk that a project of that size will not be successful in the energy deliverability test in the evaluation stage of the LT2(e-1) RFP.

The maximum amount of any type of resources that can connect directly to any single circuit is 250 MW. The maximum amount of IBRs that can connect directly to any single circuit is further limited to the bright-line limits as follows:

- 75 MW per 115 kV circuit in both Northern and Southern Ontario; and
- 200 MW per 230 kV circuit in Northern Ontario.

Proponents are allowed to submit proposals for projects that:

- Are at locations either not assessed in this document or on circuits recommended to "avoid";
- Exceed the circuit congestion limitations presented in the tables below; and
- Exceed the IBR bright-line limits if they are not an IBR.

However, there is a higher risk to those proposals during the evaluation stage deliverability test.

Proposals for projects that seek to connect to circuits that are "not allowed" will be deemed "non-deliverable" in the evaluation stage deliverability test.

Table 9 | Transmission Circuit Capacities and Limitations for Northern Ontario

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
15M1	Not Allowed	0	115	Northwest	y		y	Existing stability issues[6]
29M1		60	115	Northwest	y		y	Circuit Congestion
56M1	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
57M1	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
A1B	Avoid	0	115	Northwest	y		y	Circuit Congestion
A21L		200	230	Northwest	y		y	IBR bright-line
A22L		200	230	Northwest	y		y	IBR bright-line
A23L		200	230	Northwest	y		y	IBR bright-line
A23P		200	230	Northeast			y	IBR bright-line
A24L		200	230	Northwest	y		y	IBR bright-line
A24P		200	230	Northeast			y	IBR bright-line
A3M		75	115	Northwest	y		y	IBR bright-line
A4H	Avoid	0	115	Northeast			y	Circuit Congestion
A4L	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
A5A	Avoid	0	115	Northwest	y		y	Circuit Congestion
A5H	Avoid	0	115	Northeast			y	Circuit Congestion
A6P	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
A7L	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
A7V	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
A8K	Avoid	0	115	Northeast			y	Circuit Congestion

[6] 115 kV system North of Kenora TS

[7] 115 kV system North of Lakehead TS

[8] North or West of Pinard TS

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
A8L	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
A9K	Avoid	0	115	Northeast			y	Circuit Congestion
ALGOMA1		75	115	Northeast			y	IBR bright-line
ALGOMA2		75	115	Northeast			y	IBR bright-line
ALGOMA3		75	115	Northeast			y	IBR bright-line
B15		75	115	Northwest	y		y	IBR bright-line
B3E		75	115	Northeast			y	IBR bright-line
B4B		75	115	Northeast			y	IBR bright-line
B4E		75	115	Northeast			y	IBR bright-line
B5		30	115	Northwest	y		y	Circuit Congestion
B6M		30	115	Northwest	y		y	Circuit Congestion
C1A	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
C1C	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
C2A	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
C2M	Avoid	0	115	Northwest	y		y	Circuit Congestion
C3A	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
C3W	Avoid	0	115	Northwest	y		y	Circuit Congestion
CLERGUE1		10	115	Northeast			y	Circuit Congestion
CLERGUE2		10	115	Northeast			y	Circuit Congestion
D23G	Not Allowed	0	230	Northeast			y	Existing stability issues[8]
D26A		200	230	Northwest	y		y	IBR bright-line
D2H	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
D2L		50	115	Northeast			y	Circuit Congestion
D3H	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
D3K	Not Allowed	0	115	Northeast			y	Weak path of an interface

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
D4	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
D4Z	Not Allowed	0	115	Northeast			y	Intertie Circuit
D501P	Avoid	n/a	500	Northeast			y	500 kV Circuit
D5D		60	115	Northwest	y		y	Circuit Congestion
D6T	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
E1C	Avoid	0	115	Northwest	y		y	Circuit Congestion
E2R		20	115	Northwest	y		y	Circuit Congestion
E4D		30	115	Northwest	y		y	Circuit Congestion
F1B		50	115	Northwest	y		y	Circuit Congestion
F1E	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
F25A		200	230	Northwest	y		y	IBR bright-line
F2B		75	115	Northwest	y		y	IBR bright-line
GARTSHO1	Avoid	0	115	Northeast			y	Circuit Congestion
GARTSHO2	Avoid	0	115	Northeast			y	Circuit Congestion
GARTSHO3	Avoid	0	115	Northeast			y	Circuit Congestion
H22D	Not Allowed	0	230	Northeast			y	Existing stability issues[8]
H23S		140	230	Northeast		y	y	Circuit Congestion
H24S		140	230	Northeast		y	y	Circuit Congestion
H2N	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
H4Z	Not Allowed	0	115	Northeast			y	Intertie Circuit
H6T		20	115	Northeast			y	Circuit Congestion
H7T		10	115	Northeast			y	Circuit Congestion
H9K	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
HARRIS1		10	115	Northeast			y	Circuit Congestion
HIGHFAL1		10	115	Northeast			y	Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
HIGHFAL2		20	115	Northeast			y	Circuit Congestion
HOGG1	Avoid	0	115	Northeast			y	Circuit Congestion
HOLSWT		20	115	Northeast			y	Circuit Congestion
K2	Avoid	0	115	Northeast			y	Circuit Congestion
K21W	Not Allowed	0	230	Northwest	y		y	Intertie Circuit
K22W	Not Allowed	0	230	Northwest	y		y	Intertie Circuit
K23D		200	230	Northwest	y		y	IBR bright-line
K24F		200	230	Northwest	y		y	IBR bright-line
K24G		200	230	Northeast			y	IBR bright-line
K2M	Not Allowed	0	115	Northwest	y		y	Existing stability issues[6]
K38S	Not Allowed	0	230	Northeast			y	Existing stability issues[8]
K3D		60	115	Northwest	y		y	Circuit Congestion
K4		75	115	Northeast			y	IBR bright-line
K4W	Not Allowed	0	115	Northwest	y		y	Existing stability issues[6]
K5A	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
K5W	Not Allowed	0	115	Northwest	y		y	Existing stability issues[6]
K6F		50	115	Northwest	y		y	Circuit Congestion
K7K		75	115	Northwest	y		y	IBR bright-line
L1S		75	115	Northeast			y	IBR bright-line
L20D	Not Allowed	0	230	Northeast			y	Existing stability issues[8]
L21S	Not Allowed	0	230	Northeast			y	Existing stability issues[8]
L3P		60	115	Northwest	y		y	Circuit Congestion
L4P		75	115	Northwest	y		y	IBR bright-line
L5H		60	115	Northeast			y	Circuit Congestion
L8L	Avoid	0	115	Northeast			y	Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
LEISBAY		75	115	Northeast			y	IBR bright-line
M1M	Avoid	0	115	Northwest	y		y	Circuit Congestion
M1S		10	115	Northwest	y		y	Circuit Congestion
M23L		200	230	Northwest	y		y	IBR bright-line
M24L		200	230	Northwest	y		y	IBR bright-line
M2D		75	115	Northwest	y		y	IBR bright-line
M2W	Avoid	0	115	Northwest	y		y	Circuit Congestion
M31		40	115	Northeast			y	Circuit Congestion
M37L		200	230	Northwest	y		y	IBR bright-line
M38L		200	230	Northwest	y		y	IBR bright-line
M3E		30	115	Northwest	y		y	Circuit Congestion
M3K	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
M9K	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
MACKAY1	Avoid	0	115	Northeast			y	Circuit Congestion
MACKAY2	Avoid	0	115	Northeast			y	Circuit Congestion
MAGPIE1		10	115	Northeast			y	Circuit Congestion
MISSION1		10	115	Northeast			y	Circuit Congestion
MxD1		200	230	Northwest	y		y	New circuit - MacKenzie to Dryden. IBR bright-line.
N93A		70	230	Northwest	y		y	Circuit Congestion
NORTHRN1		75	115	Northeast			y	IBR bright-line
P13T		75	115	Northeast			y	IBR bright-line
P15T		75	115	Northeast			y	IBR bright-line
P1T		75	115	Northwest	y		y	IBR bright-line
P21G		200	230	Northeast			y	IBR bright-line
P22G		200	230	Northeast			y	IBR bright-line

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
P23G		200	230	Northeast			y	New circuit - Mississagi to Third Line. IBR bright-line.
P24G		200	230	Northeast			y	New circuit - Mississagi to Third Line. IBR bright-line.
P25W		170	230	Northeast			y	Circuit Congestion
P26W		170	230	Northeast			y	Circuit Congestion
P27W	Not Allowed	0	230	Northeast			y	New circuit - Porcupine to Wawa
P3B		75	115	Northwest	y		y	IBR bright-line
P502X	Avoid	n/a	500	Northeast			y	500 kV Circuit
P5M		75	115	Northwest	y		y	IBR bright-line
P7B		75	115	Northwest	y		y	IBR bright-line
P7G		50	115	Northeast			y	Circuit Congestion
P91G		100	230	Northeast			y	Circuit Congestion
R1LB	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
R21D	Not Allowed	0	230	Northeast			y	Existing stability issues[8]
R2LB	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
R9A	Not Allowed	0	115	Northwest	y		y	Existing stability issues[7]
S1C		75	115	Northwest	y		y	IBR bright-line
S21N		200	230	Northeast			y	IBR bright-line
S22A		200	230	Northeast			y	IBR bright-line
S2B		20	115	Northeast			y	Circuit Congestion
S5M		75	115	Northeast			y	IBR bright-line
S6F		75	115	Northeast			y	IBR bright-line
SAULT3		20	115	Northeast			y	Circuit Congestion
SK1	Not Allowed	0	115	Northwest	y		y	Intertie Circuit
STEEPHL1		10	115	Northeast			y	Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
T1B	Avoid	0	115	Northeast			y	Circuit Congestion
T1M	Avoid	0	115	Northwest	y		y	Circuit Congestion
T27P	Avoid	0	230	Northeast			y	Circuit Congestion
T28P	Avoid	0	230	Northeast			y	Circuit Congestion
T2R		75	115	Northeast			y	IBR bright-line
T61S		75	115	Northeast			y	IBR bright-line
T7M	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
T8M	Not Allowed	0	115	Northeast			y	Existing stability issues[8]
W21M		200	230	Northwest	y		y	IBR bright-line
W22M		200	230	Northwest	y		y	IBR bright-line
W23K		200	230	Northeast			y	IBR bright-line
W2C		50	115	Northeast			y	Circuit Congestion
W35M		200	230	Northwest	y		y	IBR bright-line
W36M		200	230	Northwest	y		y	IBR bright-line
W3C	Not Allowed	0	115	Northwest	y		y	Existing stability issues[6]
W54W		200	230	Northwest	y		y	IBR bright-line
W71D		200	230	Northeast		y	y	IBR bright-line
X23N		200	230	Northeast			y	IBR bright-line
X25S		200	230	Northeast			y	IBR bright-line
X26S		200	230	Northeast			y	IBR bright-line
X27A		200	230	Northeast			y	IBR bright-line
X29S		200	230	Northeast			y	IBR bright-line
X503E	Not Allowed	0	500	Northeast			y	500 kV Circuit. Potential SSR Issues.
X504E	Not Allowed	0	500	Northeast			y	500 kV Circuit. Potential SSR Issues.

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)			Notes
					Northwest (600 MW)	East of Widdifield SS (150 MW)	Northern Ontario (1,600 MW)	
X74P		200	230	Northeast			y	IBR bright-line
X75P	Not Allowed	0	500	Northeast			y	New circuit - Mississagi to Hanmer

Table 10 | Transmission Circuit Capacities and Limitations for East of Toronto

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)				< 50 km of Short Circuit Limited Station?	Notes
					East of Minden TS (250 MW)	East of Dobbin TS (275 MW)	East of Lennox TS (900 MW)	East of Bowmanville SS (1,900 MW)		
79M1	Not Allowed	0	115	Ottawa						Intertie Circuit
A2		75	115	Ottawa						IBR bright-line
A3RM		75	115	Ottawa						IBR bright-line
A41T	Not Allowed	0	230	Ottawa						Intertie Circuit
A42T	Not Allowed	0	230	Ottawa						Intertie Circuit
A4K		75	115	Ottawa						IBR bright-line
A5RK		75	115	Ottawa						IBR bright-line
A6R		75	115	Ottawa						IBR bright-line
A8M		75	115	Ottawa						IBR bright-line
B1S	Not Allowed	0	115	East						Existing stability issues[9]
B31L	Not Allowed	0	230	East			y	y		Intertie Circuit
B5D	Not Allowed	0	230	Ottawa			y	y		Intertie Circuit
B5QK	Not Allowed	0	115	East			y	y		Existing stability issues[9]
B88H	Avoid	150	230	Essa					y (partial)	Circuit Congestion
B89H	Avoid	150	230	Essa					y (partial)	Circuit Congestion
C25H		140	230	East						Circuit Congestion
C27P		160	230	East		y				Circuit Congestion
C3S		250	230	Ottawa						IBR bright-line limit

[9] 115 kV system bounded by Barrett Chute, Merivale, and Cataraqui stations

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)				< 50 km of Short Circuit Limited Station?	Notes
					East of Minden TS (250 MW)	East of Dobbin TS (275 MW)	East of Lennox TS (900 MW)	East of Bowmanville SS (1,900 MW)		
C7BM	Not Allowed	0	115	East						Existing stability issues[9]
D1M		110	230	Essa	y					Circuit Congestion
D2M		110	230	Essa	y					Circuit Congestion
D3M		110	230	Essa	y					Circuit Congestion
D4M		110	230	Essa	y					Circuit Congestion
D5A	Not Allowed	0	230	Ottawa						Intertie Circuit
D5H	Not Allowed	0	230	Essa						Weak path of an interface
D6		75	115	Essa	y					IBR bright-line
E20S		250	230	Essa						IBR bright-line limit
E21S		250	230	Essa						IBR bright-line limit
E26	Avoid	0	230	Essa						Existing IBR connected
E27	Avoid	0	230	Essa						Existing IBR connected
E28		250	230	Essa						IBR bright-line limit
E29		250	230	Essa						IBR bright-line limit
E34M	Avoid	150	230	East						Protection adequacy
E510V	Avoid	n/a	500	Essa					y (partial)	500 kV Circuit
E511V	Avoid	n/a	500	Essa					y (partial)	500 kV Circuit
E8V	Not Allowed	0	230	Essa						Weak path of an interface

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)				< 50 km of Short Circuit Limited Station?	Notes
					East of Minden TS (250 MW)	East of Dobbin TS (275 MW)	East of Lennox TS (900 MW)	East of Bowmanville SS (1,900 MW)		
E9V	Not Allowed	0	230	Essa						Weak path of an interface
F10MV		75	115	Ottawa						IBR bright-line
H23B		170	230	East						Circuit Congestion
H27H		120	230	East						Circuit Congestion
H9A	Not Allowed	0	115	Ottawa						Intertie Circuit
H82V	Avoid	150	230	Essa					y	Circuit Congestion
H83V	Avoid	150	230	Essa					y	Circuit Congestion
L1MB		20	115	East			y	y		Circuit Congestion
L20H	Avoid	80	230	East			y	y		Protection adequacy
L21H	Avoid	80	230	East			y	y		Protection adequacy
L22H	Avoid	170	230	East			y	y		Protection adequacy
L24A		210	230	Ottawa			y	y		Circuit Congestion
L2M		30	115	Ottawa			y	y		Circuit Congestion
L2M (north)		75	115	Ottawa						North of Chesterville. IBR bright-line.
L33P	Not Allowed	0	230	East			y	y		Intertie Circuit
L34P	Not Allowed	0	230	East			y	y		Intertie Circuit
L5C	Not Allowed	0	115	East						Intertie Circuit
M1R		75	115	Ottawa						IBR bright-line
M30A	Avoid	0	230	Ottawa						Connection difficulties

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)				< 50 km of Short Circuit Limited Station?	Notes
					East of Minden TS (250 MW)	East of Dobbin TS (275 MW)	East of Lennox TS (900 MW)	East of Bowmanville SS (1,900 MW)		
M31A	Avoid	0	230	Ottawa						Connection difficulties
M32S		250	230	Ottawa						IBR bright-line limit
M4G		75	115	Ottawa						IBR bright-line
M5G		75	115	Ottawa						IBR bright-line
M6E		40	230	Essa						Circuit Congestion
M7E		40	230	Essa						Circuit Congestion
M80B		150	230	Essa						Circuit Congestion
M81B		150	230	Essa						Circuit Congestion
P15C	Avoid	150	230	East					y (partial)	Circuit Congestion
P3S	Avoid	75	115	East		y			y (partial)	IBR bright-line
P4S	Avoid	75	115	East		y			y (partial)	IBR bright-line
PxT1	Avoid	170	230	East					y	New circuit - Clarington to Dobbin
PxT2	Avoid	170	230	East					y	New circuit - Clarington to Dobbin
Q3K		75	115	East			y	y		IBR bright-line
Q3M6		75	115	East			y	y		IBR bright-line
Q6S		20	115	East			y	y		Circuit Congestion
S1K		75	115	East			y	y		IBR bright-line
S7M	Not Allowed	0	115	Ottawa						Existing stability issues[9]
T22C	Avoid	75	230	East					y (partial)	Circuit Congestion
T25B	Avoid	170	230	East					y (partial)	

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)				< 50 km of Short Circuit Limited Station?	Notes
					East of Minden TS (250 MW)	East of Dobbin TS (275 MW)	East of Lennox TS (900 MW)	East of Bowmanville SS (1,900 MW)		
T32H	Avoid	140	230	East					y (partial)	Circuit Congestion
T31H	Avoid	120	230	East					y (partial)	
T33E	Avoid	150	230	East					y (partial)	
V12M		75	115	Ottawa						IBR bright-line
W3B	Not Allowed	0	115	East						Existing stability issues[9]
W6CS	Not Allowed	0	115	East						Existing stability issues[9]
X1H		250	230	East			y	y		IBR bright-line limit
X1P	Not Allowed	0	230	East		y				Existing stability issues[10]
X21		250	230	East			y	y		IBR bright-line limit
X22		250	230	East			y	y		IBR bright-line limit
X2H		250	230	East			y	y		IBR bright-line limit
X2Y	Not Allowed	0	115	Ottawa						Intertie Circuit
X3H		250	230	East			y	y		IBR bright-line limit
X4H		250	230	East			y	y		IBR bright-line limit
X503E	Not Allowed	0	500	Toronto						500 kV Circuit. Potential SSR Issues.

[10] System East of Dobbin

Circuit	Avoid/ Not Allowed	Capacity (MW)	Voltage (kV)	Zone	Areas (Congestion Limit)				< 50 km of Short Circuit Limited Station?	Notes
					East of Minden TS (250 MW)	East of Dobbin TS (275 MW)	East of Lennox TS (900 MW)	East of Bowmanville SS (1,900 MW)		
X504E	Not Allowed	0	500	Toronto						500 kV Circuit. Potential SSR Issues.
X520B	Avoid	n/a	500	East				y	y (partial)	500 kV Circuit
X521B	Avoid	n/a	500	East				y	y (partial)	500 kV Circuit
X522A	Avoid	n/a	500	Ottawa			y	y		500 kV Circuit
X523A	Avoid	n/a	500	Ottawa			y	y		500 kV Circuit
X526B	Avoid	n/a	500	East				y	y (partial)	500 kV Circuit
X527B	Avoid	n/a	500	East				y	y (partial)	500 kV Circuit
X534N	Avoid	n/a	500	East			y	y		500 kV Circuit
X538N	Avoid	n/a	500	East			y	y		500 kV Circuit
X6	Not Allowed	0	115	East						Existing stability issues[10]

Table 11 | Transmission Circuit Capacities and Limitations for West of Toronto

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
A36N	Avoid	75	115	Niagara						y	IBR bright-line
A37N	Avoid	75	115	Niagara						y	IBR bright-line
A565L	Avoid	n/a	500	Bruce							500 kV Circuit
A6C	Avoid	75	115	Niagara						y	IBR bright-line
A7C	Avoid	75	115	Niagara						y	IBR bright-line
B10	Avoid	75	115	Southwest						y (limited)	IBR bright-line
B11	Avoid	75	115	Southwest						y (limited)	IBR bright-line
B12BL	Avoid	50	115	Southwest						y (partial)	
B13BL	Avoid	50	115	Southwest						y (partial)	
B18H	Avoid	220	230	Southwest						y	Circuit Congestion
B2	Avoid	75	115	Southwest						y (limited)	IBR bright-line
B20H	Avoid	220	230	Southwest						y	Circuit Congestion
B20P	Avoid	0	230	Bruce					y		Circuit Congestion
B22D		40	230	Southwest			y	y			Circuit Congestion
B23D		40	230	Southwest			y	y			Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
B24P	Avoid	0	230	Bruce					y		Circuit Congestion
B27S	Avoid	0	230	Bruce							Circuit Congestion
B28S	Avoid	0	230	Bruce							Circuit Congestion
B3	Avoid	75	115	Southwest						y (partial)	IBR bright-line
B3N	Not Allowed	0	230	West	y	y		y			Intertie Circuit
B4	Avoid	75	115	Southwest						y (partial)	IBR bright-line
B40C	Avoid	250	230	Southwest						y	
B41C	Avoid	250	230	Southwest						y	
B4V	Avoid	50	230	Southwest					y		Protection adequacy
B501M	Avoid	n/a	500	Southwest					y	y (partial)	500 kV Circuit
B502M	Avoid	n/a	500	Southwest					y	y (partial)	500 kV Circuit
B560V	Avoid	n/a	500	Toronto					y	y (partial)	500 kV Circuit
B561M	Avoid	n/a	500	Bruce					y	y (partial)	500 kV Circuit
B562E	Avoid	n/a	500	Bruce							500 kV Circuit
B563A	Avoid	n/a	500	Bruce							500 kV Circuit
B569B	Avoid	n/a	500	Bruce					y		500 kV Circuit
B5C	Avoid	30	115	Southwest						y (partial)	Protection adequacy
B5V	Avoid	50	230	Southwest					y		Protection adequacy
B6C	Avoid	30	115	Southwest						y (partial)	Protection adequacy

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
B7	Avoid	75	115	Southwest						y (limited)	IBR bright-line
B8	Avoid	75	115	Southwest						y (limited)	IBR bright-line
BP76	Not Allowed	0	230	Niagara						y	Intertie Circuit
C12		75	115	Southwest				y		y (limited)	IBR bright-line
C2P	Avoid	75	115	Niagara						y	IBR bright-line
C31	Avoid	0	230	West	y	y		y			Proximity of other IBRs
C42H		210	230	West	y	y		y			
C43H		70	230	West	y	y		y			Circuit Congestion
C64H		250	230	West	y	y		y			IBR bright-line limit
C65H		250	230	West	y	y		y			IBR bright-line limit
C87H		250	230	West	y	y		y			IBR bright-line limit
C88H		250	230	West	y	y		y			IBR bright-line limit
C9		75	115	Southwest				y		y (limited)	IBR bright-line
CP1J	Avoid	0	115	Bruce					y		Proximity of other IBRs
D10H		75	115	Southwest			y	y	y		IBR bright-line
D10S	Avoid	70	115	Niagara						y	Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
D11K		75	115	Southwest			y	y			IBR bright-line
D12K		75	115	Southwest			y	y			IBR bright-line
D1A	Avoid	75	115	Niagara						y	IBR bright-line
D1W		75	115	Southwest			y	y			IBR bright-line
D3A	Avoid	75	115	Niagara						y	IBR bright-line
D4W		220	230	Southwest			y	y			Circuit Congestion
D5W		220	230	Southwest			y	y			Circuit Congestion
D6V		210	230	Southwest					y		Circuit Congestion
D7F		75	115	Southwest			y	y			IBR bright-line
D7V		210	230	Southwest					y		Circuit Congestion
D8S		75	115	Southwest			y	y			IBR bright-line
D9F		75	115	Southwest			y	y			IBR bright-line
D9HS	Avoid	75	115	Niagara						y	IBR bright-line
E564L	Avoid	n/a	500	Bruce							500 kV Circuit
E578P	Avoid	n/a	500	Bruce							500 kV Circuit
E8F	Avoid	0	115	West	y	y		y			Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
E9F	Avoid	0	115	West	y	y		y			Circuit Congestion
F11C	Avoid	75	115	Southwest			y	y			Protection adequacy
F12C	Avoid	75	115	Southwest			y	y			Protection adequacy
H25J		50	230	West	y	y		y			Circuit Congestion
H26J		50	230	West	y	y		y			Circuit Congestion
H38		250	230	West		y		y			IBR bright-line limit
H39		250	230	West		y		y			IBR bright-line limit
H53Z		200	230	West	y	y		y			Circuit Congestion
H54Z		200	230	West	y	y		y			Circuit Congestion
H5K	Not Allowed	0	115	Southwest						y (limited)	Short cables
H6K	Not Allowed	0	115	Southwest						y (limited)	Short cables
H75		150	230	West	y	y		y			Circuit Congestion
H76		150	230	West	y	y		y			Circuit Congestion
H9W	Avoid	0	115	West		y		y			Proximity of other IBRs
HL3	Avoid	75	115	Southwest						y (limited)	IBR bright-line
HL4	Avoid	75	115	Southwest						y (limited)	IBR bright-line

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
J1B	Avoid	0	115	West	y	y		y			Circuit Congestion
J20B	Avoid	0	230	West	y	y		y			Circuit Congestion. Protection adequacy
J2N	Avoid	0	115	West	y	y		y			Circuit Congestion
J3E	Avoid	0	115	West	y	y		y			Protection adequacy
J4E	Avoid	0	115	West	y	y		y			Protection adequacy
J5D	Not Allowed	0	230	West	y	y		y			Intertie Circuit
K12		75	115	Southwest				y			IBR bright-line
K1G	Avoid	0	115	Southwest						y	
K2G	Avoid	0	115	Southwest						y	
K2Z	Avoid	0	115	West	y	y		y			Proximity of other IBRs
K40M	Avoid	250	230	Southwest				y		y (limited)	
K6Z	Avoid	0	115	West	y	y		y			Proximity of other IBRs
K7		75	115	Southwest				y			IBR bright-line
L23N		250	230	West	y	y		y			IBR bright-line limit
L24L		150	230	West	y	y		y			Circuit Congestion
L25V	Avoid	200	230	West	y	y		y			Protection adequacy

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
L26L		150	230	West	y	y		y			Circuit Congestion
L27V	Avoid	200	230	West	y	y		y			Protection adequacy
L28C	Avoid	0	230	West	y	y		y			Protection adequacy
L29C		150	230	West	y	y		y			Circuit Congestion
L34C		250	230	West		y		y			New circuit - Lambton to Chatham
L35C		250	230	West		y		y			New circuit - Lambton to Chatham
L4D	Not Allowed	0	230	West		y		y			Intertie Circuit
L51D	Not Allowed	0	230	West		y		y			Intertie Circuit
L7S	Avoid	0	115	Southwest			y	y			Proximity of other IBRs
LxL1	Not Allowed	0	500	West		y		y			New 500 kV circuit - Longwood to Lakeshore
M18	Avoid	0	115	Southwest			y	y			Proximity of other IBRs
M20D	Avoid	200	230	Southwest				y		y (limited)	Protection adequacy
M21D	Avoid	200	230	Southwest				y		y (limited)	Protection adequacy
M27B	Avoid	210	230	Southwest						y (partial)	Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
M28B	Avoid	210	230	Southwest						y (partial)	Circuit Congestion
M31W	Avoid	200	230	Southwest				y		y (limited)	Protection adequacy
M32W	Avoid	200	230	Southwest				y		y (limited)	Protection adequacy
M33W	Avoid	200	230	Southwest				y		y (limited)	Protection adequacy
M34H	Avoid	250	230	Southwest						y (partial)	
M570V	Avoid	n/a	500	Toronto						y	500 kV Circuit
M571V	Avoid	n/a	500	Toronto						y	500 kV Circuit
M572T	Avoid	n/a	500	Southwest						y	500 kV Circuit
M573T	Avoid	n/a	500	Southwest						y	500 kV Circuit
M585M	Avoid	n/a	500	Southwest					y	y (partial)	500 kV Circuit
N1S		75	115	West	y	y		y			IBR bright-line
N20K	Avoid	250	230	Southwest				y			Protection adequacy
N21J		250	230	Southwest				y			IBR bright-line limit
N21W	Avoid	0	230	West	y	y		y			Circuit Congestion
N22J		250	230	Southwest				y			IBR bright-line limit
N22W	Avoid	0	230	West	y	y		y			Circuit Congestion
N37S	Avoid	250	230	Southwest				y			Protection adequacy

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
N4S		75	115	West	y	y		y			IBR bright-line
N580M	Avoid	n/a	500	Southwest				y		y (partial)	500 kV Circuit
N581M	Avoid	n/a	500	Southwest				y		y (partial)	500 kV Circuit
N582L	Avoid	n/a	500	Southwest				y		y (limited)	500 kV Circuit
N5M	Avoid	110	230	Southwest				y		y (limited)	Circuit Congestion
N6C		75	115	West	y	y		y			IBR bright-line
N6M	Avoid	250	230	Southwest				y		y (limited)	
N6S		80	230	West	y	y		y			Circuit Congestion
N7C		75	115	West	y	y		y			IBR bright-line
N7S		80	230	West	y	y		y			Circuit Congestion
PA27	Not Allowed	0	230	Niagara						y	Intertie Circuit
PA301	Not Allowed	0	230	Niagara						y	Intertie Circuit
PA302	Not Allowed	0	230	Niagara						y	Intertie Circuit
Q10P	Avoid	0	230	Niagara						y	Circuit Congestion
Q11S	Avoid	75	115	Niagara						y	IBR bright-line
Q12S	Avoid	75	115	Niagara						y	IBR bright-line
Q21P	Avoid	0	230	Niagara						y	Circuit Congestion
Q22P	Avoid	0	230	Niagara						y	Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
Q23BM	Avoid	130	230	Niagara						y (partial)	Protection adequacy
Q24HM	Avoid	120	230	Niagara						y (partial)	Protection adequacy
Q25BM	Avoid	130	230	Niagara						y (partial)	Protection adequacy
Q26M	Avoid	230	230	Niagara						y (partial)	Protection adequacy
Q28A	Avoid	70	230	Niagara						y	Protection adequacy
Q29HM	Avoid	120	230	Niagara						y (partial)	Protection adequacy
Q2AH	Avoid	50	115	Niagara						y	Circuit Congestion
Q30M	Avoid	230	230	Niagara						y (partial)	Protection adequacy
Q35M	Avoid	230	230	Niagara						y (partial)	Protection adequacy
Q3N	Avoid	75	115	Niagara						y	IBR bright-line
Q4N	Avoid	75	115	Niagara						y	IBR bright-line
S1H		20	115	Southwest					y		Circuit Congestion
S24V	Avoid	0	230	Southwest					y		Circuit Congestion
S2N	Avoid	0	115	West	y	y		y			Circuit Congestion
S2S		20	115	Southwest					y		Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
S39M	Avoid	250	230	Southwest				y		y (limited)	Protection adequacy
S47C	Avoid	100	230	West		y		y			Protection adequacy
T36B	Avoid	250	230	Southwest						y	
T37B	Avoid	250	230	Southwest						y	
T38B	Avoid	0	230	Southwest						y	Circuit Congestion
T39B	Avoid	0	230	Southwest						y	Circuit Congestion
V41N	Avoid	200	230	West	y	y		y			Protection adequacy
V43N	Avoid	200	230	West	y	y		y			Protection adequacy
V586M	Avoid	n/a	500	Southwest					y	y (partial)	500 kV Circuit
W12		75	115	West		y		y			IBR bright-line
W14	Avoid	0	115	West		y		y			Proximity of other IBRs
W1W	Avoid	0	115	West		y		y			Circuit Congestion
W2S		60	115	West		y		y			Circuit Congestion
W36		150	230	West		y		y			Circuit Congestion
W37		150	230	West		y		y			Circuit Congestion
W42L		200	230	West		y		y			Circuit Congestion

Circuit	Avoid/ Not Allowed	Capacity	Voltage (kV)	Zone	Areas (Congestion Limit)					< 50 km of Short Circuit Limited Station?	Notes
					West of Chatham SS (600 MW)	West of Buchanan TS (1,100 MW)	West of Detweiler TS (600 MW)	West of Middleport TS (1,300 MW)	West of Milton SS (1,100 MW)		
W43L		200	230	West		y		y			Circuit Congestion
W44LC	Avoid	110	230	West		y		y			Protection adequacy
W45LS	Avoid	100	230	West		y		y			Protection adequacy
W5N		75	115	West		y		y			IBR bright-line
W6NL		75	115	West		y		y			IBR bright-line
W7		75	115	West		y		y			IBR bright-line
W8T	Avoid	0	115	West		y		y			Proximity of other IBRs
W9L		75	115	West		y		y			IBR bright-line
WT1A	Avoid	0	115	West		y		y			Proximity of other IBRs
WT1T	Avoid	0	115	West		y		y			Proximity of other IBRs
X520B	Avoid	n/a	500	West		y		y			500 kV Circuit
X521B	Avoid	n/a	500	West		y		y			500 kV Circuit
X526B	Avoid	n/a	500	West		y		y			500 kV Circuit
X527B	Avoid	n/a	500	West		y		y			500 kV Circuit
Z1E	Avoid	0	115	West		y		y			Circuit Congestion
Z7E		75	115	West		y		y			IBR bright-line

– End of Document–

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