Evaluation Stage Deliverability Test Methodology for the Long-Term 2 Energy Supply (Window 1) Request for Proposals

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1. Introduction

The Evaluation Stage Deliverability Test ("Deliverability Test") described in this document applies to projects submitted into the IESO's Request for Proposals for the Procurement of Energy for the Long-Term 2 Energy Supply (Window 1) Request for Proposals (LT2(e-1) RFP).

This document describes the processes, methodologies, inputs, assumptions, roles and responsibilities associated with the Deliverability Test in the LT2(e-1) RFP, as well as an explanation of possible outcomes of the Deliverability Test. It is intended to inform participants of how the Deliverability Test will be performed, and to maintain the fairness and integrity of the associated procurement process.

The Deliverability Test methodology is similar, but not identical, to the methodology used for the preliminary connection guidance[1] issued for the LT2(e) RFP. The two are different as the deliverability methodology is used for evaluating deliverability of specific proposals (e.g., size, location, technology), while the connection guidance is used for identifying available room to connect resources in general.

Terms in *italics* are defined in the *Market Rules*.

1.1 Scope of the Deliverability Test

As this procurement is focused on meeting reliability needs, the IESO aims to ensure projects awarded contracts can operate with minimized risk of curtailment and congestion on the system.

The Deliverability Test assesses the ability of a project, as an energy resource, to deliver the intended energy during a commitment period or contract term. It will not consider system or market conditions outside those conditions defined in this document. Thus, a project that receives a result of "Deliverable" under the Deliverability Test may still encounter situations where their output is curtailed or otherwise constrained in real-time due to specific system conditions.

The Deliverability Test does not replace or impact any of the connection assessments that are necessary for project connection and required under applicable regulations. The Connection Assessment and Approval process is outlined in Market Manual 1: Connecting to Ontario's Power System - Part 1.4: Connection Assessment and Approval.

Receiving a result of "Deliverable" in a Deliverability Test does not imply that the project will pass the connection assessment and approval process, or that connection costs or connection in-service dates will be within any specific range or estimate.

For clarity, the Deliverability Test does not evaluate the technical solution to connect a proposed project. Applicants are encouraged to discuss that aspect with applicable *transmitters* and Local Distribution Companies (LDCs) prior to submitting a proposal into the LT2(e-1) RFP.

[1] Connection guidance refers to the 'Preliminary Connection Guidance for the Long-Term 2 RFP – Energy Stream' and subsequent versions of the document.

2. Deliverability Test

Only proposals (including any associated Proposal PQ Alternates[2]) that are on the ranked Preliminary List as defined and determined in Stage 4[3] of the LT2(e-1) RFP proposal evaluation process will have their deliverability assessed in accordance with the Deliverability Test. Proposals will be tested for deliverability sequentially, based on their ranking within the Preliminary List.

2.1 Roles and Responsibilities

The Deliverability Test process will be led by the IESO in collaboration with *transmitters* and LDCs. The following is an overview of roles and responsibilities of these parties in this process:

- LDCs are responsible for assessing if a project connecting to a *distribution system* is deliverable to the point of connection with transmitter owned equipment. This assessment includes performing congestion and short circuit tests for the distribution network;
- *Transmitters* are responsible for assessing deliverability from the point of connection with the distributor to the point of connection with the transmission system (including load transformers), and completing the short-circuit tests for the transmission network;
- The IESO is responsible for assessing if there is sufficient capacity on the transmission system to deliver the energy to meet Ontario's forecasted demand, and for screening for potential Inverter-Based Resource (IBR) specific interactions;
- The IESO is responsible for providing the Deliverability Test results for each eligible project under consideration.

2.2 Deliverability Test Result Explanation

For a project to obtain a "Deliverable" result, it must pass all applicable tests included in the Roles and Responsibilities section above. A project will be deemed "Not Deliverable" if it fails any of these tests.

If the test result for a given project is "Not Deliverable", the IESO will identify one of the following reasons for this status:

- Distribution system limitations (e.g. congestion, short-circuit);

[2] As per Item #2 in the Table Section 3.7(c) of the Draft LT2(e) RFP: In its Economic Bid Statement, the Proponent may, but is not obligated to, indicate up to two (2) ranked alternative smaller sizes for the Contract Capacity of the proposed Long-Term Energy Project (to be located within the boundaries of the same identified Project Site, using the same Monthly Imputed Production Factors and using the same Connection Point as set out in the Proposal), each with a corresponding proposed Fixed Price (each such alternative, a "Proposal PQ Alternate") for purposes of the Deliverability Test assessment.

[3] As per Section 4.4 of the Draft LT2(e) RFP. The proposal evaluation will be conducted in 5 stages, with Stage 4 being the 'Review of Economic Bid Statement', and Stage 5 the 'Deliverability Assessment' stages.

- Transmission system limitations (e.g. congestion, short-circuit, potential interaction of inverter-based resources).

3. Deliverability Test Methods and Assumptions

The following sets out the primary assumptions to be used by the IESO in carrying out the Deliverability Test for the LT2(e-1) RFP. The IESO is responsible for establishing the methods and assumptions used in the parts of the Deliverability Test under its purview, subject to any applicable standards, codes or other regulatory instruments. The Deliverability Test will follow similar methods to, but not identical with, those that were used for the development of the preliminary connection guidance issued for the LT2(e) RFP. The two are different as the deliverability methodology is used for evaluating deliverability of specific proposals (e.g., size, location, technology), while the connection guidance is used for identifying available room to connect resources in general. The Deliverability Test will include the following:

- System congestion assessment;
- Zonal probabilistic assessment;
- IBR sub-synchronous control interactions (SSCI) and sub-synchronous resonance (SSR) assessment;
- Short-circuit and protections assessment; and
- A distribution asset assessment.

As per subsection 5(k) of Minister's Directive dated November 28, 2024, 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.

3.1 System Congestion Assessment

The goal of this assessment is to determine which projects can be accommodated without causing thermal overloads of transmission equipment in order to minimize the risk of energy curtailment.

3.1.1 Assumptions

For the system congestion assessment, the IESO will use three main basecases for three larger sub-systems of focus:

- Northern Ontario sub-system – includes the Northwest and Northeast electrical zones;

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

- 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 the three basecases will include the following assumptions:

- Scenario 1
  - 50th percentile demand forecast from the normal weather scenario for each sub-system of focus, as per of the 2025 Annual Planning Outlook (APO) for year 2030;
  - Gas generators dispatched to their maximum operating output; apart from quick-starting gas fired generators and two Lennox units, which will be assumed out-of-service;
- Scenario 2
  - Minimum coincident normal weather demand forecast for each sub-system of focus, as per the 2025 APO for year 2030;
  - Gas generators dispatched to 50th percentile output; apart from quick-starting gas fired generators and two Lennox units, which will be assumed out-of-service;
- Common assumptions between Scenarios 1 and 2
  - Non-energy-limited resources, such as nuclear generators and run-of the river hydro, will be assumed in service at their maximum or normal operating output; with the exception of one Bruce generating unit, which will be assumed out-of-service;
  - Dispatchable energy-limited resources, such as hydroelectric plants, will be assumed at their minimum output, which is in general 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 will be assumed at 90% of their installed capacity;
  - All contracted E-LT1 and LT1 RFP resources will be assumed in-service, with the storage resources charging at 50% capacity, and any new gas generators dispatched as per the gas generation assumptions above;
  - LT2(e-1) RFP projects will be dispatched to their proposed install capacity as indicated by the Proponent as part of their Proposal;
  - LT2(e-1) RFP projects with parallel circuit connections will be modeled without a low-voltage side connection;
  - Summer thermal ratings will be used;
  - All major transmission projects committed to come into service by 2030 (listed in Table 1), as per the 2025 Annual Planning Outlook, will be considered in the cases studied[5].

[5] Transmission reinforcements forthcoming from in-flight or future plan developments will be considered in subsequent procurements, as appropriate.

Table 1 | Transmission projects considered in-service for 2030

Transmission Projects	Zone	In-service Date
New 2-CCT 230 kV Transmission Line from Lakehead to MacKenzie	Northwest	2025
New 2-CCT 230 kV Transmission Line from Chatham to Lakeshore	West	2025
Richview to Manby Transmission Reinforcement Phase 1	Toronto	2026
Richview to Trafalgar Conductor Upgrade	Toronto	2026
Essa to Orangeville Conductor Upgrade	Southwest	2027
New 2-CCT 230 kV Transmission Line from Lambton to Chatham	West	2028
New 1-CCT 500 kV Transmission Line from Mississagi to Hanmer	Northeast	2029
New 2-CCT 230 kV Transmission Line from Mississagi to Third Line	Northeast	2029
New 2-CCT 230 kV Transmission Line from the GTA to Dobbin	East	2029
*New 1-CCT 230 kV Transmission Line from MacKenzie to Dryden	Northwest	2030
*New 1-CCT 230 kV Transmission Line from Porcupine to Wawa	Northeast	2030
Richview to Manby Transmission Reinforcement Phase 2	Toronto	2030
Keith TS: PSR5 Replacement	West	2030
*New 1-CCT 500 kV Transmission Line from Longwood to Lakeshore	West	2030

*In accordance with preliminary connection guidance issued for the LT2(e) RFP, projects are not allowed to connect to circuits with an in-service date beyond December 31st, 2029

3.1.2 Study Criteria

Each project will be added to the basecase sequentially, based on their ranking within the Preliminary List. All projects that were deemed "deliverable" in previous tests will be maintained in the model for the assessment of proposals lower on the Preliminary List.

Each project will be tested for pre-contingency and post-contingency system performance by monitoring their impact on power flows and system voltages in the two scenarios listed in Section 3.1.1.

The contingencies to be applied are outlined in Section 2.7.1 and 2.7.2 of the Ontario Resource and Transmission Assessment Criteria (ORTAC). The performance criteria are described in Sections 4.2, 4.3 and 4.7 of ORTAC.

For a project to pass the system congestion assessment, the grid needs to meet the pre and post-contingency thermal and voltage performance criteria for both scenarios listed in Section 3.1.1 with the project at its maximum output.

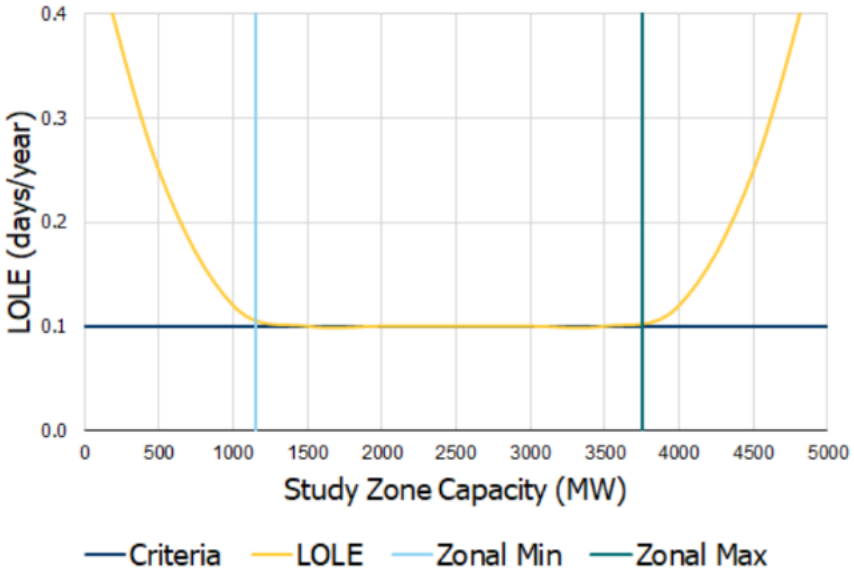
3.2 Zonal Probabilistic Assessment

Each project will be tested based on their ranking within the Preliminary List to ensure they have a positive contribution towards provincial resource adequacy. The methodology will be based upon the Zonal Probabilistic Limitations methodology described in the preliminary connection guidance issued for the LT2 RFP document, presented below:

Zonal minimum and maximum capacity values 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 LOLE across a range of study zone capacities creates the zonal constraint curve, as shown in Figure 1.

Figure 1 | General Shape of Zonal Constraint Curve



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 right, 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.

3.3 Inverter-Based Resource Assessment

The purpose of this assessment is to check if projects submitted in a given area do not lead to undesirable sub-synchronous control interactions (SSCI) or introduce sub-synchronous resonance (SSR) with the existing series capacitors located at the Nobel Switching Station (SS).

IBRs have a history of oscillating under certain system conditions, typically due to interactions with local network and/or other IBRs in weakly connected systems, or when they are radially connected to a series of compensated transmission circuits.

3.3.1 Assumptions and Methodology

To avoid potential SSR issues with the series capacitors at Nobel SS, any proposed connections to the circuits listed in Table 2 will be deemed "Not Deliverable". Please note that this list is reduced significantly from the list published in the LT2(e) Connection Guidance Document version 2 as it has been determined that the combination of concurrent outages that would result in potential SSR

issues for the removed circuits would be very unlikely, and the risk of curtailment to prevent these issues from occurring is acceptable.

Table 2 | Circuits identified for potential SSR issues

Circuits connected to Hanmer
X503E
X504E

Potential SSCI will be determined by the IESO based on consideration of the following factors:

- System topology;
- Ratings and location of neighbouring IBRs; and
- Minimum short circuit ratio (SCR).

The following will be assumed:

- An SCR of 7 is used for existing IBRs at the point of interconnection;
- The potential risk of SSCI due to new IBRs connecting into the system is determined by calculating the Available Fault Level (AFL). AFL is an indicator of whether the system is strong enough to support stable operation of a new IBR connection at the location. It is calculated using the methodology explained in Section 6.6 of '*Connection of wind farms to weak AC networks*[6];
- If the Original Equipment Manufacturer is not known at the time of submission, the following assumptions will be used:
    - Minimum Short-Circuit Ratio of 5 at the point of interconnection
    - No damping controller and no Grid-Forming capability

Each project will be tested sequentially, based on their ranking within the Preliminary List. All projects that were deemed "deliverable" in previous tests will be maintained in the SCR model for the assessment of proposals lower on the Preliminary List.

3.4 Transmission Short-Circuit and Protections Assessment

This assessment will be performed by the Transmitters, who will be responsible for assessing deliverability from the point of connection with the distributor to the point of connection with the transmission system (including load transformers), completing a short-circuit test, and any other applicable protections assessments for the transmission network.

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

Each project will be tested sequentially, based on their ranking within the Preliminary List. All projects that were deemed "deliverable" in previous tests will be maintained in the short-circuit model for the assessment of proposals lower on the Preliminary List.

During the deliverability test, IESO will coordinate with the Transmitters and ensure the short-circuit and protection assessments consider projects from the Preliminary List in their order of ranking.

3.5 Distribution System Assessment

LDCs are responsible for performing the distribution system assessment. LDCs will check if a project connecting to a distribution system is deliverable to the point of connection with transmitter owned equipment, which includes congestion and short-circuit tests for the distribution network. The assessment will be conducted with all distribution elements in service (no outage conditions).

Each project will be tested sequentially, based on their ranking within the Preliminary List. All projects that were deemed "deliverable" in previous tests will be maintained in the model for the assessment of proposals lower on the Preliminary List.

During the deliverability test, IESO will coordinate with the LDCs and ensure the distribution assessments consider projects from the Preliminary List in their order of ranking.

3.6 System Changes During Final Evaluation Period

The electricity system is dynamic and subject to change during the Deliverability Test process. For fairness and consistency, final test assumptions will be established just before the technical tests for each Deliverability Test is initiated and will remain unchanged throughout the tests. If the test assumptions presented in this document need to be updated prior to a Deliverability Test being initiated, the changes will be publicly communicated.

3.7 Remedial Action Scheme Considerations

A project that obtains a contract may need to be part of an existing or a new Remedial Action Scheme (RAS) to minimize generation bottling. This requirement will be determined during the Connection Assessment and Approval Process as part of the System Impact Assessment (SIA).

4. Appendix A: Connection Process considerations

All projects proposing to connect to the Ontario electricity grid must apply for a connection assessment as part of the connection assessment and approval process. Transmission connection assessments will include an SIA carried out by the IESO and a Customer Impact Assessment (CIA-TX) carried out by a *transmitter*. Distribution connection assessments will include a CIA-DX carried out by an LDC. A distribution connected project that is ≥ 10 MW also requires an SIA and a CIA-TX.

These assessments examine the equipment that is proposed to be connected and verify that it will meet the requirements of the *Market Rules,* Transmission System Code and/or Distribution System Code, and that the manner in which the facility is connected would not result in an adverse impact on system reliability or to connected customers.

On the transmission side, an SIA does not assess whether or not the electricity moving to/from the proposed project can be delivered, because when it can't be delivered, the assumption in an SIA is that the facility will be constrained off. This is the reason that a project which may have already obtained an SIA and/or a CIA-TX cannot be deemed to be "Deliverable" for the purposes of IESO procurements without first applying for a Deliverability Test. In addition, a completed SIA does not reserve connection capacity. As stated previously, before deciding on siting a project, applicants should have preliminary discussions with their *transmitters* or LDC.

Similarly, on the distribution side, a project that has already obtained a CIA-DX will not be deemed to be "Deliverable" without going through the Deliverability Test.

Applicants are precluded from applying for a CIA-DX for *distribution system* connected projects until the conclusion of the Deliverability Test for the LT2(e-1) RFP. For clarity, projects submitted for a Deliverability Test for the LT2(e-1) RFP must rescind any current CIA-DXs related to project of interest for the LT2(e-1) RFP. The IESO will work with LDCs in order to verify that this has been completed. Should this requirement not be met, those projects will not be included in the Deliverability Test for the LT2(e-1) RFP, and hence, would not be eligible for the LT2(e-1) RFP.

After the Deliverability Test for the LT2(e-1) RFP is concluded, projects that obtained "Deliverable" results and that propose to connect to a *distribution system* may apply for a CIA-DX.

Similar to the requirement under the E-LT1 and LT1 RFPs, since CIA-DXs reserve capacity on the *distribution system*, it is expected that applicants (and contracted facility expansion applicants) that are not offered contracts through the LT2(e-1) RFP will be required to rescind any CIA-DXs associated with the projects submitted. The return of Proposal Security submitted as part of the LT2(e-1) RFP is tied to an applicant rescinding any CIA-DX for an unsuccessful project per section 5.4(a)(ii) of the LT2(e-1) RFP document (a draft of this document can be found here).

The IESO strongly recommends that potential applicants proposing *transmission system* projects or ≥ 10 MW *distribution system* projects delay their SIA applications until the results of the LT2(e-1) RFP 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 LT2(e-1) RFP are announced, as an SIA

completed earlier would not have included all successful projects as firm projects (and as noted above, a completed SIA does not reserve connection capacity).

Independent Electricity System Operator
1600-120 Adelaide Street West
Toronto, Ontario M5H 1T1

Phone: 905.403.6900
Toll-free: 1.888.448.7777
E-mail: customer.relations@ieso.ca

ieso.ca

@IESO_Tweets
linkedin.com/company/IESO

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