



System Impact Assessment Report

Final Report- Public

CAA ID: 2022-722

Project: Niagara-on-the-Lake - Cryptocurrency Connection
Connection Applicant: Niagara-on-the-Lake Hydro.

March 20, 2023



Acknowledgement

The IESO wishes to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IESO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IESO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IESO should issue a notice of conditional approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Conditional approval of the project is based on information provided to the IESO by the connection applicant and Hydro One at the time the assessment was carried out. The IESO assumes no responsibility for the accuracy or completeness of such information, including the results of studies carried out by Hydro One at the request of the IESO. Furthermore, the conditional approval is subject to further consideration due to changes to this information, or to additional information that may become available after the conditional approval has been granted.

If the connection applicant has engaged a consultant to perform connection assessment studies, the connection applicant acknowledges that the IESO will be relying on such studies in conducting its assessment and that the IESO assumes no responsibility for the accuracy or completeness of such studies including, without limitation, any changes to IESO base case models made by the consultant. The IESO reserves the right to repeat any or all connection studies performed by the consultant if necessary to meet IESO requirements.

Conditional approval of the proposed connection means that there are no significant reliability issues or concerns that would prevent connection of the proposed project to the IESO-controlled grid. However, the conditional approval does not ensure that a project will meet all connection requirements. In addition, further issues or concerns may be identified by the transmitter(s) during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with physical or equipment limitations, or with the Transmission System Code, before connection can be made.

This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant and the IESO in accordance with Chapter 4, section 6 of the Market Rules. This report does not in any way constitute an endorsement of the proposed connection for the purposes of obtaining a contract with the IESO for the procurement of supply, generation, demand response, demand management or ancillary services.

The IESO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IESO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. In the event that the IESO provides a draft of this report to the connection applicant, the connection applicant must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to the connection applicant. Although the IESO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that the most recent version of this report is being used.

Hydro One

The results reported in this report are based on the information available to Hydro One, at the time of the study, suitable for a System Impact Assessment of this connection proposal.

The short circuit and thermal loading levels have been computed based on the information available at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed facilities on load and generation customers.

In this report, short circuit adequacy is assessed only for Hydro One circuit breakers. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One circuit breakers and identifying upgrades required to incorporate the proposed facilities. These results should not be used in the design and engineering of any new or existing facilities. The necessary data will be provided by Hydro One and discussed with any connection applicant upon request.

The ampacity ratings of Hydro One facilities are established based on assumptions used in Hydro One for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and facility loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades which are required to incorporate the proposed facilities have been identified to the extent permitted by a System Impact Assessment under the current IESO Connection Assessment and Approval process. Additional facility studies may be necessary to confirm constructability and the time required for construction. Further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.



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Project Description

Niagara-on-the-Lake Hydro Inc. (the “connection applicant” and “distributor”) is proposing a 50 MW load addition to NOTL #1 municipal transformer station (MTS) (the “project”). NOTL #1 MTS is connected to Hydro One’s (the “transmitter”) 115 kV circuit Q12S. The connection applicant is proposing to ramp up the load in stages, tentatively scheduled in June 2023.

Notification of Conditional Approval

This assessment concludes that the proposed connection of the project is expected to have no material adverse impact on the reliability of the integrated power system, provided that all requirements in this report are implemented. Therefore, the assessment supports the release of the Notification of Conditional Approval for connection of the project.

Assessment Findings

System studies were carried out to identify the impact of the project on the loading of transmission facilities, system voltages, load security, and to verify that the applicable reliability standards, market rules, and the Ontario Resource and Transmission Assessment Criteria (ORTAC) are met. The studied scenarios and main assumptions are available in Appendix B of this report. The detailed study results are available in Appendix C of this report. Based on the assessment results, we have identified the following:

1. Under peak load conditions with outages to either of the 115 kV circuits D1A or D3A, the companion circuit is overloaded above the short term emergency (STE) rating following the Beck 1 E-bus contingency.
2. Under peak load conditions with outages to either of the 115 kV transmission circuits D10S or Q11S, the 115 kV transmission circuit D9HS is overloaded above its STE rating following the Beck 1 E-bus contingency or the inadvertent breaker operation (IBO) of the 115 kV breaker A8Q12S.
3. Under peak load conditions with outages to the 115 kV breaker A8Q12S, the 115 kV transmission circuit D9HS is overloaded above its STE rating following D10S or Q11S contingencies.

IESO Requirements for Connection

Specific Requirements:

The following specific requirements are applicable for the incorporation of the project and its connection facilities. Specific requirements pertain to the level of reactive power compensation needed, operation restrictions, remedial action scheme (RAS), upgrading of equipment and any project specific items not covered in the general requirements.

Requirements for the Connection Applicant

1. To address the issues identified in the Assessment Findings, the connection applicant shall coordinate with the transmitter to install a new remedial action scheme (RAS) to make the project load selectable for load rejection upon receiving a trip signal following the single contingencies below:

1. 115 kV Beck 1 E-bus
2. 115 kV circuit D10S
3. 115 kV circuit Q11S
4. IBO of A8Q12S.

Preliminary IESO studies indicate that the NOTL RAS may qualify as a Limited Impact RAS (formerly known as Type III RAS). To avoid any delay to the project, it is strongly recommended the RAS facilities be designed to meet NPCC Reliability Reference Directory #7 for NPCC Type I RAS before the RAS type classification is finalized via the NPCC RAS review process as per NPCC Reliability Reference Directory #7 Remedial Action Schemes. If deemed or expected to be a Non-Limited Impact RAS by the review process, the connection applicant is responsible for the modifications required at the RAS facilities to comply with NPCC Reliability Reference Directory #7 for non-limited RAS in case the RAS is re-classified as such in the future as the system evolves.

Telemetry, including but not limited to, MW, Mvar and breaker status for the feeders/equipment tripped by the RAS, as specified by the IESO at the time of registration, shall be provided.

2. To address the issues identified in the Assessment Findings prior to RAS implementation, the connection applicant may be required to curtail the project load during outages to certain transmission elements. The need for curtailing the project load will depend on the system conditions at the time of the outage and will be determined as part of the IESO's outage management process or in real-time operations. As agreed by the connection applicant, under these conditions, they will be responsible for manually managing the project's load via a voluntary demand management procedure. The voluntary demand management procedure will be subject to the following conditions:

- The connection applicant understands that the project load may be subject to manual load curtailment under outage conditions, which can be of either forced or planned nature;
- The connection applicant will reduce up to the entire project load, upon direction by the IESO or Hydro One Networks Inc., within 5 minutes. Failure to follow the direction could result in immediate disconnection of their distribution facility from the transmission grid;
- The connection applicant will set up a dedicated direct line for the IESO and Hydro One Networks Inc. to reach their control room, which will be staffed at all times (24/7);
- The connection applicant must prepare a detailed procedure outlining how the manual load reduction will be implemented. The procedure is to be approved by IESO and Hydro One Networks Inc. prior of the connection of the project's load;
- The connection applicant will be allowed to reconnect the project load when the transmission elements of concern are restored;
- The connection applicant will adhere to the above-mentioned conditions regardless of the frequency or duration of the outages;
- The connection applicant will ensure that no additional load will be transferred to NOTL #1 MTS beyond the peak forecast load shown in Table 2 which includes the project load; and
- Telemetry, including but not limited to, MW, Mvar and breaker status for the relevant equipment, as specified by the IESO at the time of registration, shall be provided.

Requirements for the Transmitter

During the IESO Market Registration process, a new Facility Description Document (FDD) for NOTL RAS must be provided and finalized at least nine months prior to in-service. The FDD must contain the finalized RAS matrix as well as expected operating times. The actual operating times must be measured during commissioning and documented as a Performance Validation Record.

If the FDD or performance testing as per the Performance Validation Record indicates a change in design or slower than expected operating times, as compared to what was assumed in this assessment, then further analysis of the project will need to be done by the IESO. This may delay the grant of IESO final approval to place the project in-service.

Preliminary IESO studies indicate that the NOTL RAS may qualify as a Limited Impact RAS (formerly known as Type III RAS). To avoid any delay to the project, it is strongly recommended the RAS facilities be designed to meet NPCC Reliability Reference Directory #7 for NPCC Type I RAS before the RAS type classification is finalized via the NPCC RAS review process as per NPCC Reliability Reference Directory #7 Remedial Action Schemes. If deemed or expected to be a Non-Limited Impact RAS by the review process, the transmitter shall ensure the RAS facilities have provisions at the transmitter facilities to comply with NPCC Reliability Reference Directory #7 for non-limited RAS in case the RAS is re-classified as such in the future as the system evolves.

Telemetry, as specified by the IESO at the time of registration, shall be provided.

General Requirements

The connection applicant shall satisfy all applicable requirements specified in the Market Rules, the Transmission System Code (TSC) and reliability standards. Some of the general requirements that are applicable to this project are presented in detail in Appendix A of this report.

Appendix A: General Requirements

The connection applicant shall satisfy all applicable requirements specified in the Market Rules, the Transmission System Code and reliability standards. This section highlights some of the general requirements that are applicable to the project.

1. The connection applicant must notify the IESO at connection.assessments@ieso.ca as soon as they become aware of any changes to the project scope or data used in this assessment. The IESO will determine whether these changes require a re-assessment.
2. In accordance with Appendix 4.3 of the Market Rules, the connection applicant shall ensure that the existing transmission connected load/distribution facility, behind which the project is connected, has the capability to maintain the power factor within the range of 0.9 lagging and 0.9 leading as measured at the defined meter point after the incorporation of the project.
3. In accordance to Reference 4 of Appendix 4.3 of the Market Rules, distributors connected to the IESO-controlled grid with directly connected load facilities of aggregated rating above 20 MVA and with the capability to regulate distribution voltages under load, shall install and maintain facilities and equipment to provide voltage reduction capability. After connecting the project, the connection applicant will have directly connected load facilities of aggregated rating above 20 MVA and the project has the capability to regulate voltages under load. As such, the connection applicant shall install and maintain facilities and equipment to provide voltage reduction capability at the project. Voltage reduction capability represents the capability of reducing demand by lowering the distribution voltage by 3% and 5% within five minutes from receiving directions from the IESO. The IESO uses voltage reductions to reduce load when supply resources are limited. The voltage reduction capability can be provided using the proposed under-load tap changers (ULTC) at the project.
4. The connection applicant has a total peak load at all its owned facilities, including the project, which is greater than 25 MW. According to Section 10.4.6 of Chapter 5 of the Market Rules and Section 11.3 of the Market Manual 7.1, the connection applicant is required to participate in the automatic Under-Frequency Load Shedding (UFLS) program and must select 35% of total peak load among its owned facilities for under-frequency tripping, based on a date and time specified by the IESO that approximates system peak, according to Section 10.4 of Chapter 5 of the Market Rules.

The UFLS relay connected loads shall be set to achieve the amounts to be shed as stated in Section 11.3 of Market Manual 7.1. Table 1: UFLS relay settings summarizes UFLS relay settings as a function of the total peak load of all facilities, including the project, owned by the connection applicant.

Table 1: UFLS relay settings

Aggregate Summer Peak Load	UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)	Load Shed at stage as % of Connection Applicant's Load	Cumulative Load Shed at stage as % of Connection Applicant's Load
25 MW or more and less than 50 MW	1	59.5	0.3	≥ 35	≥ 35
50 MW or more and less than 100 MW	1	59.5	0.3	≥ 17	≥ 17
	2	59.1	0.3	≥ 18	≥ 35
100 MW or greater	1	59.5	0.3	7 – 9	7 – 9
	2	59.3	0.3	7 – 9	15 – 17
	3	59.1	0.3	7 – 9	23 – 25
	4	58.9	0.3	7 - 9	32 - 34
	Anti-Stall	59.5	10.0	3 – 4	35 - 37

The connection applicant, in conjunction with the transmitter, must also ensure that capacitor banks connected to the same station bus as the load are shed by UFLS facilities at 59.5 Hz with a time delay of 3 seconds.

The maximum load that can be connected to any single UFLS relay is 150 MW to ensure that the inadvertent operation of a single under-frequency relay during the transient period following a system disturbance does not lead to further system instability.

The IESO will review the requirements annually and inform the relevant market participants of their automatic UFLS obligations.

5. The connection applicant shall ensure that the connection equipment is designed to be fully operational in all reasonably foreseeable ambient conditions. Failures of the connection equipment must be contained within the project and have no adverse impact on the IESO-controlled grid.
6. In accordance with Section 7.5 of Chapter 4 of the Market Rules, the connection applicant shall provide to the IESO the applicable telemetry data listed in Appendix 4.17 of the Market Rules on a continual basis. The data shall be provided in accordance with the performance standards set forth in Appendix 4.22, subject to Section 7.6A of Chapter 4 of the Market Rules. The whole telemetry list will be finalized during the IESO's Market Registration process.

The connection applicant must install monitoring equipment that meets the requirements set forth in Appendix 2.2 of Chapter 2 of the Market Rules. As part of the IESO's Market Registration process, the connection applicant must also complete end to end testing of all necessary telemetry points with the IESO to ensure that standards are met and that sign conventions are understood. All found anomalies must be corrected before IESO's final approval to connect any phase of the project is granted.

7. The connection applicant must initiate the IESO's Market Registration process at least eight months prior to the commencement of any project related outages.

The connection applicant is required to provide "as-built" equipment data for the project during the IESO Market Registration process. If the submitted equipment data differ materially from the ones used in this assessment, then further analysis of the project may need to be done by the IESO before final approval to connect is granted.

At the sole discretion of the IESO, performance tests may be required at generation and transmission facilities. The objectives of these tests are to demonstrate that equipment performance meets the IESO requirements, and to confirm models and data are suitable for IESO purposes. The transmitter may also have its own testing requirements. The IESO and the transmitter will coordinate their tests, share measurements and cooperate on analysis to the extent possible.

Once the IESO's Market Registration process has been successfully completed, the IESO will provide the connection applicant with a Registration Approval Notification (RAN) document, confirming that the project is fully authorized to connect to the IESO-controlled grid. For more details about this process, the connection applicant is encouraged to contact IESO's Market Registration at market.registration@ieso.ca

Be advised that any registration changes could have an impact on a market participant's monthly global adjustment charges. Such registration changes include but are not limited to:

- New facility registrations
- Modifications to existing facility registration
- Electrical configuration changes
- Meter installation reconfigurations
- Full or partial transfers of a facility to a separate legal entity
- Transferring a facility between the retail electricity market and the IESO-administered wholesale electricity market (IAM)

Note that any newly registered facility in the IAM will automatically be treated as a Class B facility, unless stated otherwise in Ontario Regulation 429/04. It is the sole responsibility of the market participant to declare if any such provisions of Ontario Regulation 429/04 are applicable.

Subject to compliance with all regulatory requirements, a new facility may become eligible to participate in the Industrial Conservation Initiative (ICI) program (i.e. to be treated as a Class A facility) after the facility has been registered in the IAM for the entire duration of a base period (i.e. the facility has registered withdrawals from the IESO-controlled grid from May 1 to April 30 of the following calendar year).

During the IESO Market Registration process, a new Facility Description Document (FDD) for the RAS must be provided by the transmitter nine months prior to in-service. The FDD must contain the finalized RAS matrix as well as expected operating times. The actual operating times must be measured during commissioning, documented as a Performance Validation Record, and posted on Hydro One - IESO secured web portal.

If the FDD or performance testing as per the Performance Validation Record indicates a change in design or slower than expected operating times, than what was assumed in this assessment, then

further analysis of the project will need to be done by the IESO. This may delay the grant of IESO final approval.

8. If the connection applicant is currently a participant in the Ontario Power System Restoration Plan, its restoration participant attachment is required to be updated to include the project according to Market Manual 7.8. For either an existing or newly identified participant in the Ontario Power System Restoration Plan, details regarding restoration participant requirements will be finalized during the IESO Market Registration process.

If the project is classified as a Key Facility that is required to establish a Basic Minimum Power System following a system blackout, it shall meet testing requirements of Critical Components belonging to Key Facilities as specified in Market Manual 7.8. Key Facility, Basic Minimum Power System and Critical Component terms are defined in the NPCC Glossary of Terms.

9. As per Market Manual 1.4: Connection Assessment and Approval, the connection applicant will be required to provide a status report of its proposed project with respect to its progress upon request of the IESO using the project status report form on the IESO website. Failure to comply with project status requirements listed in Market Manual 1.4: Connection Assessment and Approval will result in the project being withdrawn.

The connection applicant will be required to also provide updates and notifications in order for the IESO to determine if the project is “committed” as per Section 3.3 of Market Manual 1.4: Connection Assessment and Approval.



Appendix B: Study Scope of Work (Confidential)

Appendix C: Detailed Study Results (Confidential)

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