System Impact Assessment Report

Final Report - Public

CAA ID: 2023-768
Project: Algoma Steel-EAF Project Stage 2B
Connection Applicant: Algoma Steel Inc.

June 12, 2024

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Powering Tomorrow.

Acknowledgement

The IESO wishes to acknowledge the assistance of Hydro One and PUC Transmission 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 PUC Transmission LP 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 PUC Transmission LP 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.

The IESO provides no comment, representation or opinion, express or implied, with respect to who should bear the cost of IESO requirements for connection in this report and disclaims any liability in connection therewith.

Hydro One and PUC Transmission

The results reported in this report are based on the information available to Hydro One and PUC Transmission (as applicable), 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 or PUC Transmission (as applicable) circuit breakers. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One or PUC Transmission (as applicable) 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 or PUC Transmission (as applicable) and discussed with any connection applicant upon request.

The ampacity ratings of Hydro One or PUC Transmission (as applicable) facilities are established based on assumptions used in Hydro One or PUC Transmission (as applicable) 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

Algoma Steel Inc. (the "connection applicant") is proposing to increase their Electric Arc Furnace (EAF) load from 140 MW to 250 MW at their 115 kV EAF Customer Transformer Station (CTS) (the "project). EAF CTS's connection will be moved in Q3, 2026 from the 115 kV system supplied by Third Line TS to Tagona West TS, owned and operated by PUC Transmission LP (the "transmitter"), via 115 kV circuits F1 and F2, owned by the connection applicant (all assessed under CAA 2021-704). After the project, the instantaneous load at EAF CTS will ramp up and down between 75 MW and 250 MW as many as 12 times per hour at a maximum rate of 10 MW/s. The power factor of the EAF load will remain constant at 0.97 lagging at all times. To support this load increase, all units at Lake Superior Power (LSP) CGS will be in-service at their maximum output, 110 MW, during EAF operation to offset the load increase and provide voltage support to the local area; the net sum of the instantaneous peak load from EAF CTS and LSP CGS will continue to be a maximum of 140 MW, as was previously assessed under CAA 2021-704.

The in-service date of this project is expected to be Q3 2027.

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 impact studies were carried out to assess the impact of the project in accordance with Chapter 8 of Market Manual 1.4. The studied scenarios and main assumptions are available in Appendix C and detailed study results are available in Appendix D of this report. Based on the assessment results, we have identified the following findings:

1. Under the Ontario Resources and Transmission Assessment Criteria (ORTAC) system conditions studied, i.e. peak load conditions and low hydraulic generation during drought seasons, the resulting MISSW[1] flow after the integration of the project will exceed the existing MISSW transfer limit of 700 MW under all elements in-service condition. Transfer limits under outage conditions will also be exceeded. As such, EAF operation will be restricted to keep MISSW interface flow below its limit should these system conditions materialize. Based on historical MISSW flow and projected load data, there is a low probability EAF load curtailment will be required with all elements in-service.

[1] MISSW – Mississagi Flow West, defined as the MW flow on circuits A23P, A24P, and X74P into Mississagi TS.

2. The full ramping of the EAF load will not result in voltage changes in excess of 2% in the transmission system at all levels of MISSW transfers up to 730 MW as long as all LSP CGS units and the voltage control solution as required under CAA 2021-704 are in-service.
3. The frequency and magnitude of EAF ramping will cause significant and frequent swings in active power (MW) flow through critical interfaces in Northeastern and Northwestern Ontario. Maintaining power flows within the operating security limits will require careful coordination of EAF operation with IESO's operations planning and real-time operations teams.
4. The full 175 MW ramping of the EAF load could result in a change of 14 MW on the Minnesota interconnection and a total of 24 MW on the Manitoba interconnection. Compared to the EAF ramping magnitude assessed under CAA 2021-694, these quantities are an incremental increase of 1.6 MW and 4.0 MW on the Minnesota and Manitoba interconnections, respectively. Minnesota phase shifters will automatically change tap positions should the difference between the actual and scheduled flows exceed 10 MW. Manitoba phase shifters will automatically change tap positions should the difference between the actual and scheduled flows exceed 25.6 MW. Minnesota Power and Manitoba Hydro have been informed and have agreed to monitor the additional duty on the phase shifters once the project goes in-service to determine whether further investigation is needed.

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, upgrading of equipment and any project specific items not covered in the general requirements.

Requirements for the Connection Applicant

1. The connection applicant must operate the EAF within the boundaries of the load profile provided for the project, as identified in Figure 1 and Table 2 in Appendix B of this report.
2. All LSP units must be in service providing at least 110 MW and +/-40 MVars.
3. The connection applicant must continue to participate in the Third Line and Northwest Remedial Action Schemes (RAS) that will automatically disconnect the EAF load for system events.
4. The connection applicant must be prepared to revert EAF operations to the requirements under CAA 2021-704 or manually disconnect the EAF load during high risk or extreme operating scenarios, for planned or forced outage conditions, and during any other operating situations where the IESO cannot manage the power or voltage fluctuations triggered by the EAF's operation.

5. The connection applicant shall provide single points of contact to the IESO, reachable 24/7, and participate in operations planning and real-time operations processes when required by the IESO to allow for:

    a. the IESO to be aware of the intended next-day and real-time operations of the EAF and LSP units, and

    b. the connection applicant to be aware when EAF operation needs to be restricted, as communicated by the IESO market forecasts and integration team (MFI) or the IESO control room.

6. The connection applicant shall have a demand management procedure acceptable to the IESO and the transmitter that ensures that the EAF operation can be curtailed within 5 minutes.

    The demand management procedure is subject to the following conditions:

    a. The connection applicant shall reduce up to the entire EAF 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 the project from the transmission grid;

    b. The connection applicant shall set up a dedicated direct line for the IESO and Hydro One Networks Inc. to reach the facility control room, which will be staffed at all times when the EAF is in service;

    c. The connection applicant shall prepare a detailed procedure outlining how the EAF load reduction and/or EAF shutdown will be implemented. The procedure is to be approved by the IESO and Hydro One Networks Inc. ;

    d. The connection applicant will be allowed to reconnect the project load once notified by IESO;

    e. The connection applicant shall adhere to the above-mentioned conditions regardless of the frequency or duration of the need to curtail the load; and,

    f. 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.

7. The connection applicant must revert EAF operations to the requirements under CAA 2021-704 should the IESO deem, in its sole and absolute discretion, that real-time operations under this project has an adverse impact on the reliability of the grid. This reversion would continue for as long as the IESO considers necessary or appropriate to protect the reliability of the grid.

Requirement for the Transmitter

1. The locally placed fast-acting reactive compensation device(s) and associated control scheme for voltage support required in CAA 2021-704 must be in service at full capability.

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: General Requirements 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 the project have 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 of the project by adjusting its reactive compensation at any time, upon the IESO's or the transmitter's request. However, it is recognized that the project with its reactive compensation required by the IESO in-service may normally operate outside this range.
3. 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 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.

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

   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).

5. As per Market Manual 1.4: Connection Assessment and Approval (formerly Market Manual 2.10), 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 (formerly Market Manual 2.10) 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 (formerly Market Manual 2.10).

Appendix B: Project Data (Confidential)

Appendix C: Study Scope of Work (Confidential)

Appendix D: Detailed Study Results (Confidential)

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