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CUSTOMER IMPACT ASSESSMENT ADDENDUM

Proposed Newpost Creek Hydraulic Generation

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Disclaimer

This Customer Impact Assessment Addendum was prepared based on preliminary information available about the connection of the proposed Newpost Creek Hydraulic Generation facilities, near the town of Cochrane, Ontario. It is intended to highlight significant impacts, if any, to affected transmission customers early in the project development process and thus allow an opportunity for these parties to bring forward any concerns that they may have, including those needed for the review of the connection and for any possible application for leave to construct. Subsequent changes to the required modifications or the implementation plan may affect the impacts of the proposed connection identified in this Customer Impact Assessment. The results of this Customer Impact Assessment and the estimate of the outage requirements are subject to change to accommodate the requirements of the IESO and other regulatory or municipal authority requirements. The fault levels computed as part of this Customer Impact Assessment are meant to assess current conditions in the study horizon and are not intended to be used for the purposes of sizing equipment or making other project-design decisions. Many other factors beyond the existing fault levels go into project-design decisions.

Hydro One Networks Inc. shall not be liable, whether in contract, tort or any other theory of liability, to any person who uses the results of the Customer Impact Assessment under any circumstances whatsoever for any damages arising out of such use unless such liability is created under some other contractual obligation between Hydro One Networks Inc. and such person.

A Customer Impact Assessment for the proposed Newpost Creek Hydraulic Generation was initially issued on February 25th, 2010. This Customer Impact Assessment Addendum has been prepared to assess proposed changes to the project.

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1.0 INTRODUCTION

1.1 Study Scope

This Customer Impact Assessment (CIA) study assesses the potential impacts of the proposed Newpost Creek Hydraulic Generation (NPC) on the transmission-connected customers in the local vicinity. This study is intended to supplement the System Impact Assessment "CAA ID 2007-294" issued by the Independent Electricity System Operator (IESO).

This study covers the impact of the generation addition of the NPC on the Hydro One Networks Inc. (Hydro One) system in the area. The primary focus of this study is to identify the impact on existing transmission-connected customers and operating constraints based on facility voltage performance. The study also assists to determine if any transmission system upgrade is required to integrate the proposed interconnection during possible system conditions.

This study does not evaluate the overall impact of the NPC on the bulk electricity system. The impact of the new generator on the bulk electricity system is the subject of the System Impact Assessment (SIA) which is issued by the IESO.

This study does not evaluate the impact of the NPC on the existing network Protection and Control facilities. Protection and Control aspects are reviewed under the Protection Impact Assessment, which is part of the SIA.

1.2 Background

Ontario Power Generation Inc. is proposing to develop a hydraulic generating station near Cochrane, which is located in northeastern Ontario, approximately 100km north of Timmins. The new development will provide a total installed capacity of 29MW. This CIA will address the connection to the Hydro One grid via the Hydro One 115kV circuit D6T between Pinard SS and Otter Rapids SS.

A previous CIA study was completed on February 25th, 2010 for NPC. Subsequent to that study, Hydro One's 115kV transmission circuits in the area have been reconfigured. This CIA addendum assesses the impact of NPC on area customers after the reconfiguration.

The NPC facility is comprised of two hydroelectric generators and has a nameplate rating of 16.1 MVA at 0.9 pf. The facility is connected to the transmission system through a 6.9/121 kV step-up transformer and a 7 km 115 kV transmission line tapping onto circuit D6T between Pinard SS and Otter Rapids SS.

The scheduled in-service date for the new facility is Q4 2017.

1.3 Affected Customers

The focus of this study is on customers supplied by stations that are supplied by the D6T circuit. The affected customers are shown below.

Table 1: Existing customers affected by NPC

Customer	Station(s)
Ontario Power Generation Inc.	Otter Rapids GS
O.N.Tel. Inc.	Renison CTS
	Onakawana CTS

1.4 Power System Analysis

Power system analysis is an integral part of the transmission planning process. It is used by Hydro One to evaluate the capability of the existing network to deliver power and energy from generating stations to provide a reliable supply to customers. Two relevant aspects of power system analysis are used for this assessment:

a. **Load-flow studies** are carried out to analyze the impact of new facilities on the voltage performance of existing Hydro One customers in the affected area. An AC load-flow program is used to set up a base case with the NPC generating facility.

b. **Short-circuit studies** are carried out to assess the fault contribution of the proposed NPC generators. A short-circuit analysis program is used to determine the fault-level impact on customers in the affected area.

2.0 LOAD-FLOW STUDIES

2.1 Base Case and Study Assumptions

The 2014 summer peak load conditions (within operating limits) incorporated in the IESO-provided base case are used for the load-flow analysis. The NPC generation facility is modeled into the base case, prior to performing contingency studies, with the following assumptions:

- The equivalent generator is supplying 29MW (maximum active power); and
- The equivalent generator is operating at 0.9 lagging power factor (maximum reactive power).

2.2 Contingency Analysis

The following single transmission-element contingencies are considered for this study:

- Loss of NPC; and
- Loss of 115kV circuit D3H.

2.3 Voltage-Performance Criteria

To establish the impact of incorporating the proposed NPC facility the following pre- and post-contingency voltage criteria must be met with all existing facilities in service, as per the IESO's *Ontario Resource and Transmission Assessment Criteria* [1].

Table 2: Pre-contingency voltage limits

Nominal Bus Voltage (kV)	500	230	115	Transformer Stations		
				44	27.6	13.8
Maximum Continuous (kV)	550	250	127	106% of nominal		
Minimum Continuous (kV)	470	207	108	98% of nominal		

Table 3: Post-contingency voltage change limits

Nominal Bus Voltage (kV)	500	230	115	Transformer Stations		
				44	27.6	13.8
% voltage change **before** tap changer action	10%	10%	10%	10%		
% voltage change **after** tap changer action	10%	10%	10%	5%		
AND within the range						
Maximum (kV)	550	250	127	112% of nominal		
Minimum (kV)	470	207	108	88% of nominal		

The voltage performance of Hydro One customers supplied by circuits in the area has to meet the above standard subsequent to the addition of the NPC project.

2.4 Study Results

Table 4: Summary of load-flow study results

Bus Name	Pre- Contingency Voltage (kV)	Loss of NPC		Loss of D3H	
		Pre-ULTC	Post-ULTC	Pre-ULTC	Post-ULTC
PINARD TS	130.32	0.3%	0.3%	0.2%	0.2%
OTTER RAPIDS SS	132.3	0.4%	0.5%	0.2%	0.2%
ONAKAWANA CTS	133.38	0.5%	0.5%	0.2%	0.2%
RENISON CTS	134.29	0.4%	0.5%	0.2%	0.3%

3.0 SHORT-CIRCUIT STUDIES

3.1 Base Case and Study Assumptions

The 2014 base case is used for the short-circuit analysis which includes all existing and committed generation facilities in the area. The complete list of generators included in this analysis is detailed in section 4 of the New Post Creek System Impact Assessment. The NPC generation facility is modeled into the base case to assess its impact on fault levels in the affected area. The study assumptions are identical to those used for the load-flow analysis (see *Section 2.1*).

Typical values are used when necessary due to the unavailability of some of the data.

3.2 Short-Circuit Criteria

To establish the impact of incorporating the proposed NPC facility the fault levels are determined with the wind farm both in service and out of service. The following maximum symmetrical three-phase and single-line-to-ground (SLG) faults must be met, as per the usual values in the Ontario Energy Board's *Transmission System Code*.

Table 5: Maximum symmetrical fault levels

Nominal Voltage (kV)	Max 3-Phase Fault (kA)	Max SLG Fault (kA)
230	63	63
115	50	50
27.6 (4-wire)	17	12
13.8	21	10

3.3 Study Results

A summary of the maximum fault levels after the addition of NPC is tabulated below in Table 7.

Table 7: Fault level after addition of NPC

Fault Location	Max Voltage (kV)	3-Phase Fault (kA)		SLG Fault (kA)	
		Sym	Asym	Sym	Asym
OTTER RAPIDS SS	127	2.39	2.47	1.62	1.65
ONAKAWANA CTS	127	1.16	1.16	0.76	0.76
RENISON CTS	127	0.76	0.76	0.48	0.48

4.0 CUSTOMER RELIABILITY

The proposed NPC connects to Hydro One's 115kV circuit D6T via a 7km tap line. NPC will provide HV breakers at the generation site and motorized disconnect switches at the point of interconnection to minimize the effects of faults to existing customers on D6T. The proposed facility will not adversely impact the local voltage performance in the area.

4.1 Preliminary Outage Impact Assessment

The exact outage schedule will be made available during the detailed engineering phases of the project and established in consultation with load customers in the area. The outage duration will be minimized and the risk will be managed with proper outage planning and co-ordination.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This CIA study concludes that the proposed 29MW NPC does not adversely impact existing Hydro One customers based on the following:

- The load-flow studies indicate that the voltage changes on the high-voltage customer connections are well within the acceptable range of the voltage-performance criteria outlined in *Section 3.3*.
- The short-circuit studies show that some stations in the affected area encounter small increases in fault levels at their connection points, but these increases are well within the maximum fault levels outlined in *Section 4.2*.

Although the short-circuit increases are within the capability of the existing Hydro One facilities, affected customers should review the fault levels at their connection points to confirm their equipment is capable of withstanding the increased fault and voltage levels.

6.0 REFERENCES

[1] Independent Electricity System Operator**, Ontario Resource and Transmission Assessment Criteria**, Issue 5.0, August 22, 2007.

[2] Ontario Energy Board, **Transmission System Code**, August 26th, 2013.

APPENDIX A: STUDY RESULTS

Table A-1: Complete load-flow study results

Bus Name	Pre-Contingency Voltage (kV)	Loss of New Post Creek				Loss of D3H			
		Pre- ULTC	%	Post- ULTC	%	Pre- ULTC	%	Post- ULTC	%
PINARD TS	130.32	130.66	0.3%	130.67	0.3%	130.59	0.2%	130.59	0.2%
OTTER RAPIDS SS	132.3	132.89	0.4%	132.9	0.5%	132.58	0.2%	132.58	0.2%
ONAKAWANA CTS	133.38	133.99	0.5%	134.01	0.5%	133.7	0.2%	133.71	0.2%
RENISON CTS	134.29	134.88	0.4%	134.91	0.5%	134.62	0.2%	134.64	0.3%