

Substations

Q. Reference: "2025 Capital Budget Application," Newfoundland Power Inc., June 28, 2024, Supporting Materials, Substations: 2.2, p. 3.

Newfoundland Power utilizes EPRI's Power Transformer Expert System ("PTX") to diagnose and assess the condition of its power transformer fleet. This assessment tool yields a set of indices for each transformer, providing insight into the condition of the cellulose insulation system and the potential for any abnormal incipient fault.

a) Please provide a list of all available inputs for the PTX and indicate which ones are used by Newfoundland Power for assessing its power transformer fleet.

b) Further to footnote 9, is Newfoundland Power aware of any other Canadian utilities using the PTX? If so, please provide further detail on how other Canadian Utilities use PTX.

A. a) See Attachment A for the requested information.

b) As filed in *Hydro One's 2020-22 Transmission Rate Application, EB-2019-0082, Exhibit B-1-1, TSP Section 1.4*, page 1 of 3 Hydro One uses the results of PTX Analysis of Hydro One's Transformer Fleet as a third-party assessment to help inform Hydro One of the condition of its assets and how to effectively and efficiently manage those assets.

ATTACHMENT A:

PTX Inputs

Table 1: PTX Inputs	
Category	Input ¹
General (Transformer)	<p>Equipment ID, Transformer serial number, Transformer manufacturer, Transformer manufacturer date, Transformer energization date, repair date, retired date, utility, region, location, station, designation, core type, top MVA, cooling type, high voltage winding, low voltage winding 1 kV, low voltage winding 2 kV, tertiary winding kV, number of phases, auto transformer, criticality, short circuit impedance for H-X winding, load losses for H-X windings, base MVA</p>
Through Faults	<p>Equipment ID, Peak asymmetrical fault current for short duration throughfault, terminal short duration throughfault current is referred to, typical duration of short duration through fault, estimated annual frequency of short-duration throughfault occurrence, peak asymmetric fault current for long-duration throughfault, terminal that the long duration throughfault current is referred to, typical duration of long duration through fault, estimated annual frequency of long-duration throughfault</p>
Main Tank Dissolved Gas Analysis	<p>Equipment ID, Sample date of when main tank DGA was drawn, Value of Hydrogen (ppm), Value of Methane (ppm), Value of Ethane (ppm), Value of Ethylene (ppm), Value of Acetylene (ppm), Value of Carbon Monoxide (ppm), Value of Carbon Dioxide (ppm), Value of Oxygen (ppm), Value of Nitrogen (ppm), Badsample (used to indicate samples that are bad or suspect)</p>
Online Dissolved Gas Analysis	<p>Equipment ID, Sample date of when main tank DGA was drawn, Value of Hydrogen (ppm), Value of Methane (ppm), Value of Ethane (ppm), Value of Ethylene (ppm), Value of Acetylene (ppm), Value of Carbon Monoxide (ppm), Value of Carbon Dioxide (ppm), Value of Oxygen (ppm), Value of Nitrogen (ppm), Badsample (This flag can be used to indicate samples that are bad or suspect)</p>

¹ PTX inputs utilized by Newfoundland Power are bolded in Table 1

Oil Quality	<p>Equipment ID, Sample date of when main tank DGA was drawn, Top oil temperature at the time of sampling (deg C), Moisture content of the oil (ppm), Acidity or Neutralization Number (mgKOH/g), Interfacial Tension (mN/m), Color number of the oil (0-10), Dielectric breakdown voltage of the oil using D877 electrodes (kV) , Dielectric breakdown voltage of the oil using D1816 electrodes with a 1mm gap (kV), Dielectric breakdown voltage of the oil using D1816 electrodes with a 2mm gap (kV), Dielectric breakdown voltage of the oil tested according to IEC156 (kV), Power factor of the oil at 25C (%), Power factor of the oil at 100C (%)</p>
Furans	<p>Equipment ID, Date the sample was drawn, Level of 2-Furfuraldehyde (2FAL) in the oil (ppb)</p>
Insulation Power Factor	<p>Equipment ID, Date the test was performed, Air temperature at the time of the test (deg C), Measured top oil at the time of the test (deg C), Voltage applied during the test (kV), Major insulation component for which the test applied, Measured power factor for the insulation component specified in the INSULATION field, Measured power factor for the insulation component specified in the INSULATION field with the temperature correction to 20C applied, Measured capacitance for the insulation component specified in the INSULATION field, Baseline</p>
Load Tap Changer	<p>Equipment ID, LTC ID , LTC Manufacturer, LTC Model, LTC Breather Type</p>
Load Tap Changer Dissolved Gas Analysis	<p>Transformer ID, LTC ID, LTC Compartment, Sample date of when LTC oil was drawn, Value of Hydrogen (ppm), Value of Methane (ppm), Value of Ethane (ppm), Value of Ethylene (ppm), Value of Acetylene (ppm), Value of Carbon Monoxide (ppm), Value of Carbon Dioxide (ppm), Value of Oxygen (ppm), Value of Nitrogen (ppm), Badsample (This flag can be used to indicate samples that are bad or suspect)</p>

Load Tap Changer Oil Quality	Equipment ID, LTC ID, LTC Compartment , Sample date of when main tank DGA was drawn, Top oil temperature at the time of sampling (deg C), Moisture content of the oil (ppm), Acidity or Neutralization Number (mgKOH/g), Interfacial Tension (mN/m), Color number of the oil (0-10), Dielectric breakdown voltage of the oil using D877 electrodes (kV) , Dielectric breakdown voltage of the oil using D1816 electrodes with a 1mm gap (kV), Dielectric breakdown voltage of the oil using D1816 electrodes with a 2mm gap (kV), Dielectric breakdown voltage of the oil tested according to IEC156 (kV), Power factor of the oil at 25C (%), Power factor of the oil at 100C (%)
Load Tap Changer Tap Count	Transformer ID, LTC ID, Date of inspection record during which the counter reading was recorded, LTC counter reading, High Tap Position, Low Tap Position
Load Tap Changer Tap Position	Transformer ID, LTC ID, Record Date of the tap change record, Tap Position
Bushing	Transformer ID, Bushing ID , Bushing Manufacturer, Bushing Model, Connection Type, Rated nominal operating voltage of the bushing (kV), Rated current of the bushing (A), BIL of the bushing (kV), C1 power factor measured in the factory (%), C1 capacitance measured in the factory (pF), C2 power factor measured in the factory (%), C2 capacitance measured in the factory (pF)
Bushing Power Factor	Transformer ID, Bushing ID, Test Date, Ambient temperature measured at the time of test (C), Line-to-ground voltage at which the C1 test was performed (kV), C1 power factor (%), C1 power factor (pF), Line-to-ground voltage at which the C2 test was performed (kV), C2 power factor (%), C2 power factor (pF)