

September 28, 2012

Mr. Ted Lyberogiannis
Sustainment Manager - Transmission Stations Planning
Hydro One Networks Inc.
483 Bay Street
Toronto, Ontario
M5G 2P5

Dear Mr. Lyberogiannis:

***Replacement of T1 at Keith TS
Notification of Conditional Approval of Connection Proposal
CAA ID Number: 2012-EX622***

Thank you for the information regarding the proposed replacement of T1 at Keith TS. The IESO has concluded that the proposed changes will not result in a material adverse impact on the reliability of the integrated power system. The IESO is therefore pleased to grant **conditional** approval as detailed in the attached expedited System Impact Assessment report. Please note that any material changes to your proposal may require a re-assessment by the IESO and may nullify your conditional approval.

You may now initiate the IESO's **Facility Registration/Market Entry** process. To do so, please contact Registration & Compliance Support at market.entry@ieso.ca as soon as possible prior to your expected energization date. The SIA report, attached hereto, details the requirements that your company must fulfill during this process, including demonstrating that the equipment *as installed* will not be materially different from the equipment *as approved* by the IESO. The document entitled [Market Entry: A Step-by-Step Guide](#) describes the key steps in the Market Entry process.

When your company has successfully completed the IESO's **Facility Registration/Market Entry** process, the IESO will provide you with a **final approval**, thereby confirming that the facility is fully authorized to connect to the IESO-controlled grid.

For further information, please contact me via connection.assessments@ieso.ca.

Yours truly,

Michael Falvo
Manager – Market Facilitation
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cc: IESO Records

**Final Report - Expedited System Impact Assessment
Hydro One Networks Inc.**

1.0 GENERAL DESCRIPTION & PROPOSED MODIFICATIONS

Hydro One Networks Inc. is proposing to replace T1 at Keith TS with a new unit due to end of life. Transformer T1 at Keith TS is a 110/28.4 kV transformer.

The expected in-service dates will be communicated to the IESO.

2.0 TECHNICAL SPECIFICATIONS

The technical specifications of the existing and replacement transformer are given in the following table.

Keith TS		
Values for replacement equipment specified at the time of order. Actual values are to be provided prior to in-service dates.		
Transformer	Existing T1	Replacement T1
Configuration	Three phase	Three phase
Transformation (kV)	110/28.4	110/28
Winding Configuration	Wye/Delta	Wye/Zed
Thermal Rating	25.0 MVA ONAN 33.3 MVA ONAF 41.7 MVA OFAF	25.0 MVA ONAN 33.3 MVA ONAF 41.7 MVA ODAF
Continuous Thermal Rating (winter 10°C)	41.7 MVA	41.7 MVA
10-DAY Thermal Rating (winter 10°C)	60.0 MVA	To be provided
15-MIN Thermal Rating (winter 10°C)	79.0 MVA	To be provided
Positive Sequence Impedance (H-L)	R = 0.236 X = 6.99% on 25.0 MVA base	R = to be provided X = to be provided on xx MVA base
Impedance to Ground	HV – solidly grounded LV – ungrounded	LV – to be provided HV – to be provided
Under-load tap-changer	28.4 ± 2.84 kV 16 Steps	110 ± 22 kV 16 Steps
Off-load tap-changer	Tap 1: 121.0 Tap 2: 118.25 Tap 3: 115.5 Tap 4: 112.75 Tap 5: 110.0	Not applicable

Table 1 – Comparison of Existing and Replacement T1 at Keith TS

3.0 REQUIREMENTS

Hydro One must notify the IESO as soon as it becomes aware of any changes to the assumptions made in the connection assessment. The IESO will determine whether these changes require a re-assessment.

Reactive Power Requirements

The Market Rules require that Hydro One have the capability to maintain a power factor (pF) within the range of 0.9 lagging and 0.9 leading as measured at the defined metering points at Keith TS.

Monitoring Requirements

The Market Rules (Chapter 4 section 7.4) require that the transmitter shall provide the IESO on a continual basis with on-line monitored quantities as specified in Appendix 4.16. For this proposed project, the IESO will continue to require the operating quantities associated with the new transformer.

Among other things, end to end telemetry testing must be completed by the applicant along with the IESO to ensure that standards are met and sign conventions are understood.

Provided that the TSC requirements are satisfied, the IESO does not have additional requirements.

4.0 ASSESSMENT & CONCLUSIONS

4.1 Peak Loads

Operational meter information from September 20, 2010 through September 20, 2012 was used to evaluate the load on T1 at Keith TS. The peak load of 13.98 MVA on T1 occurred on October 3, 2011 at 7:00. The figure below shows the loading at the LV side of T1 during the daily on-peak hours, which are defined as 7 a.m. until 11 p.m.

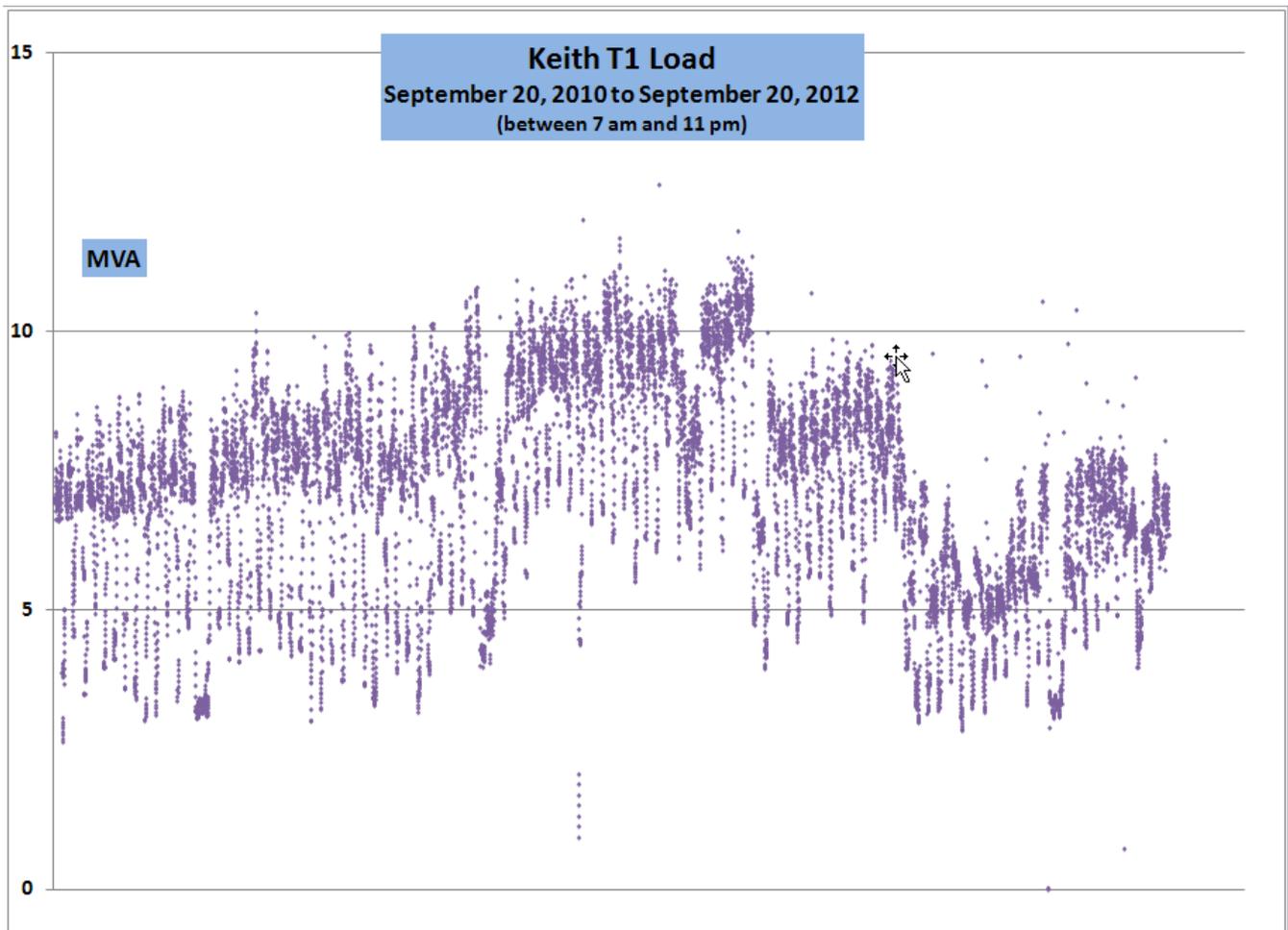


Figure 1 – T1 Load at Keith TS

For the T1 transformer at Keith TS, the existing continuous winter capability is 41.7 MVA. The continuous winter capability will remain the same when the new T1 is put into service.

With the current continuous winter capability of T1, there is a spare capacity of 27.7 MVA when compared to the peak load. Assuming that the new T1 continuous winter capability remains equal to the existing T1 continuous winter capability, T1 is not expected to exceed its continuous winter capability in the near future.

4.2 Load Angle & Power Factor

The Market Rules require that the proponent have the capability to maintain a power factor (pF) within the range of 0.9 lagging and 0.9 leading as measured at the defined metering point at Keith TS. This power factor range translates into a load angle range of ± 0.45 radians. All the points above 0.45 radians indicate a lagging power factor below 0.9. All points below -0.45 radians indicate a leading power factor below 0.9.

Operational meter information from September 20, 2010 through September 20, 2012 was used to evaluate the load angle on T1 at Keith TS. The figure below illustrates the load angle on the LV side of T1 during the daily on-peak hours, which are defined as 7 a.m. until 11 p.m.

There are no low voltage shunt capacitors at Keith TS providing reactive support.

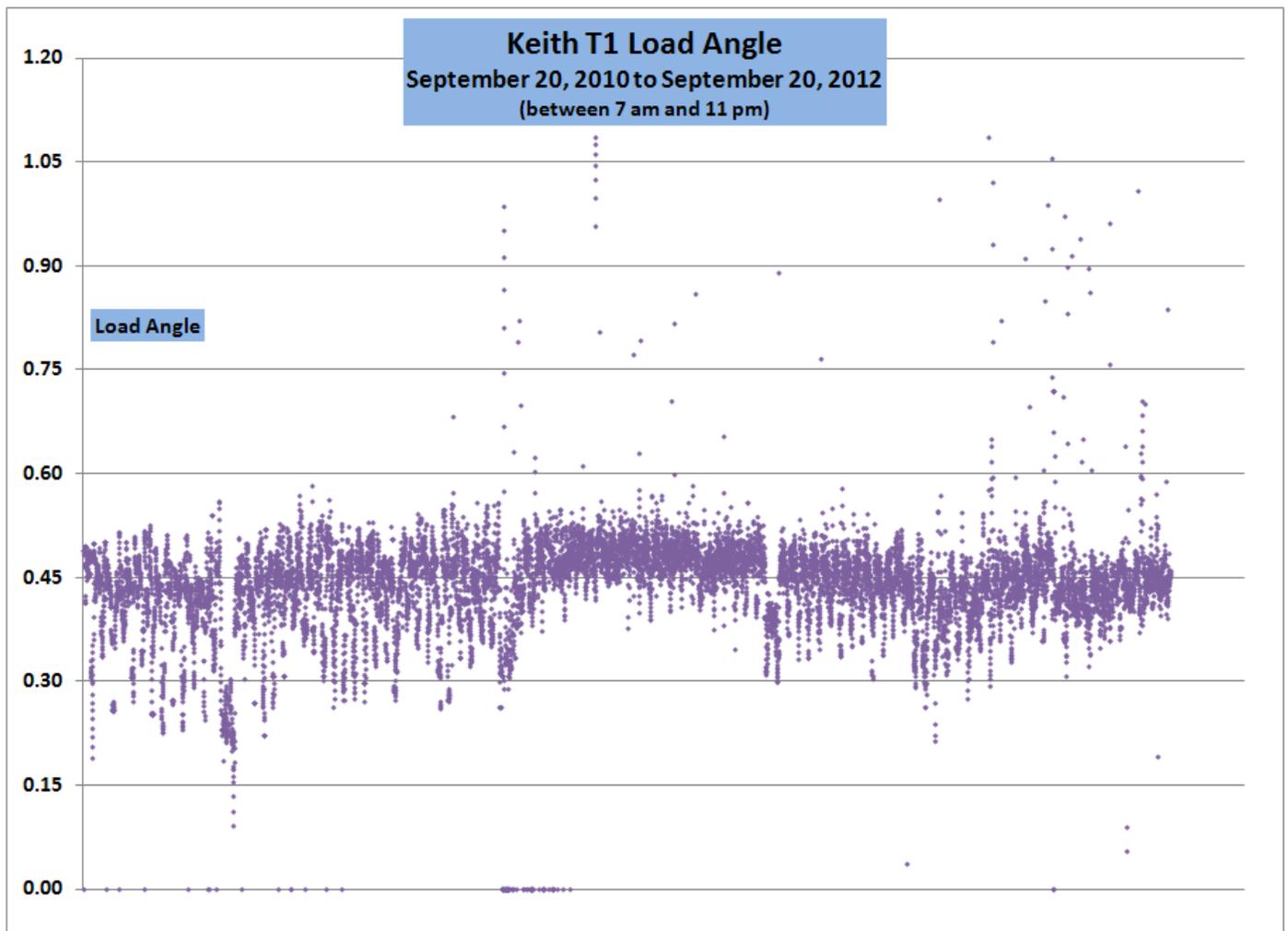


Figure 2 – Load Angle on T1 at Keith TS

Between September 20, 2010 and September 20, 2012, the highest load angle on T1 at Keith TS of 1.086 occurred on May 19, 2012 at 11:00 when the load was 9.49 MVA.

The lowest observed power factor on the low voltage side and the corresponding power factor as calculated on the high voltage side of T1 are shown in the table below.

Date	Time	P Total (MW)	Q Total (MX)	LV Power Factor (observed)	HV Power Factor (calculated)
May 19, 2012	11:00	4.43	8.40	0.466	0.456

To maintain the power factor in the range of 0.9 lagging to 0.9 leading at the defined meter point, 7 MX of reactive compensation would be required on the LV side of T1 at Keith TS.

The IESO requires that Hydro One implements correction measures as soon as practical, either in cooperation with the load, or by installing power factor correction devices at this station.

4.3 Conclusions

It can be concluded that the replacement of T1 at Keith TS with a new transformer will not result in a material adverse impact on the reliability of the IESO-controlled grid provided that all requirements in this report are met.