

January 19, 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 T4 at Terauley TS  
Notification of Conditional Approval of Connection Proposal  
CAA ID Number: 2011-EX578***

Thank you for the information regarding the proposed replacement of T4 at Terauley 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, provided the requirements mentioned in the attached report are satisfied. 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 “Market Entry” process. To do so, please contact Market Entry at [market.entry@ieso.ca](mailto: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**” provided in the approval email 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 equipment is fully authorized to connect to the IESO-controlled grid.

For further information, please contact me via [connection.assessments@ieso.ca](mailto: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 is proposing to replace T4 at Terauley TS with a new unit due to end of life.

Terauley TS is a 2 DESN 110/14.2/14.2 kV transformer station on the 115 kV circuits C5E and C7E between Esplanade TS and Cecil TS.

The expected in-service date for the replacement T4 is December 1, 2012.

**2.0 TECHNICAL SPECIFICATIONS**

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

<b>Terauley TS</b>			
<b>Transformer</b>	<b>Existing T1, T2, T3</b>	<b>Failed T4</b>	<b>Replacement T4</b>
<b>Configuration</b>	Three phase	Three phase	Three phase
<b>Transformation (kV)</b>	110/14.2/14.2	110/14.2/14.2	110/14.2/14.2
<b>Winding Configuration</b>	Delta/wye/wye	Delta/wye/wye	Delta/wye/wye
<b>Thermal Rating</b>	75.0 MVA ONAN 100.0 MVA ONAF 125.0 MVA OFAF	75.0 MVA ONAN 100.0 MVA ONAF 125.0 MVA OFAF	75.0 MVA ONAN 100.0 MVA ONAF 125.0 MVA OFAF
<b>Continuous Thermal Rating (summer 35°C)</b>	125.0 MVA	125.0 MVA	125.0 MVA
<b>10-DAY Thermal Rating (summer 35°C)</b>	<b>T1:</b> 130.1 MVA <b>T2:</b> 136.6 MVA <b>T3:</b> 136.6 MVA	130.0 MVA	139.6 MVA
<b>15-MIN Thermal Rating (summer 35°C)</b>	<b>T1:</b> 133.8 MVA <b>T2:</b> 143.4 MVA <b>T3:</b> 143.4 MVA	N/A	144.4 MVA
<b>Positive Sequence Impedance (H-L)</b>	R, X = 0.457%, 18.22% ( <b>T1</b> ); R, X = 0.476%, 19.23% ( <b>T2</b> ) R, X = 0.480%, 18.22% ( <b>T3</b> ) on 37.5 MVA base	R = 0.47 % X = 16.94 % on 37.5 MVA base	R = 0.51 % X = 15.56% & 15.73% on 37.5 MVA base
<b>Impedance to Ground</b>	110 kV - Ungrounded 14.2 kV – 7.5 Ω	110 kV - Ungrounded 14.2 kV – 7.5 Ω	110 kV - Ungrounded 14.2 kV – 7.5 Ω
<b>Under-load tap-changer</b>	14.2 ± 2.84 kV 32 Steps	14.2 ± 2.84 kV 32 Steps	14.2 ± 2.84 kV 32 Steps
<b>Off-load tap-changer</b>	Not applicable	Not applicable	Not applicable

**Table 1 – Comparison of Existing and Replacement Transformers at Terauley 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 Terauley 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 10-Day Summer Transfer Capabilities**

The 10-DAY summer transfer capability for a DESN at Terauley TS is determined by removing the transformer with the highest 10-DAY thermal rating from service.

**4.1.1 10-Day Summer Transfer Capabilities for T1/T4 DESN**

The 10-DAY summer ratings of these two transformers at Terauley TS are listed in the table below.

<b>10-DAY Summer Thermal Ratings (35°C) for Transformers T1/T4 DESN at Terauley TS</b>		
<b>Transformer</b>	<b>Existing T1 &amp; T4</b>	<b>Existing T1 &amp; New T4</b>
<b>T1</b>	<b>O/S (130.1 MVA)</b>	<b>130.1 MVA</b>
<b>T4</b>	<b>130.0 MVA</b>	<b>O/S (139.6 MVA)</b>
<b>10-DAY Summer Transfer Capability (with highest rated transformer out of service)</b>	<b>130.0 MVA</b>	<b>130.1 MVA</b>

**Table 2 – 10-DAY Summer Thermal Ratings for T1/T4 DESN at Terauley TS**

For the T1/T4 DESN at Terauley TS, the existing 10-DAY summer transfer capability is 130.0 MVA. The 10-DAY summer transfer capability will increase to 130.1 MVA when the new T4 is put into service.

**4.1.2 10-Day Summer Transfer Capabilities for T2/T3 DESN**

The 10-DAY summer ratings of these two transformers at Terauley TS are listed in the table below.

<b>10-DAY Summer Thermal Ratings (35°C) for Transformers T2/T3 DESN at Terauley TS</b>	
<b>Transformer</b>	<b>Existing T2 &amp; T3</b>
<b>T2</b>	<b>O/S (136.6 MVA)</b>
<b>T3</b>	136.6 MVA
<b>10-DAY Summer Transfer Capability (with highest rated transformer out of service)</b>	<b>136.6 MVA</b>

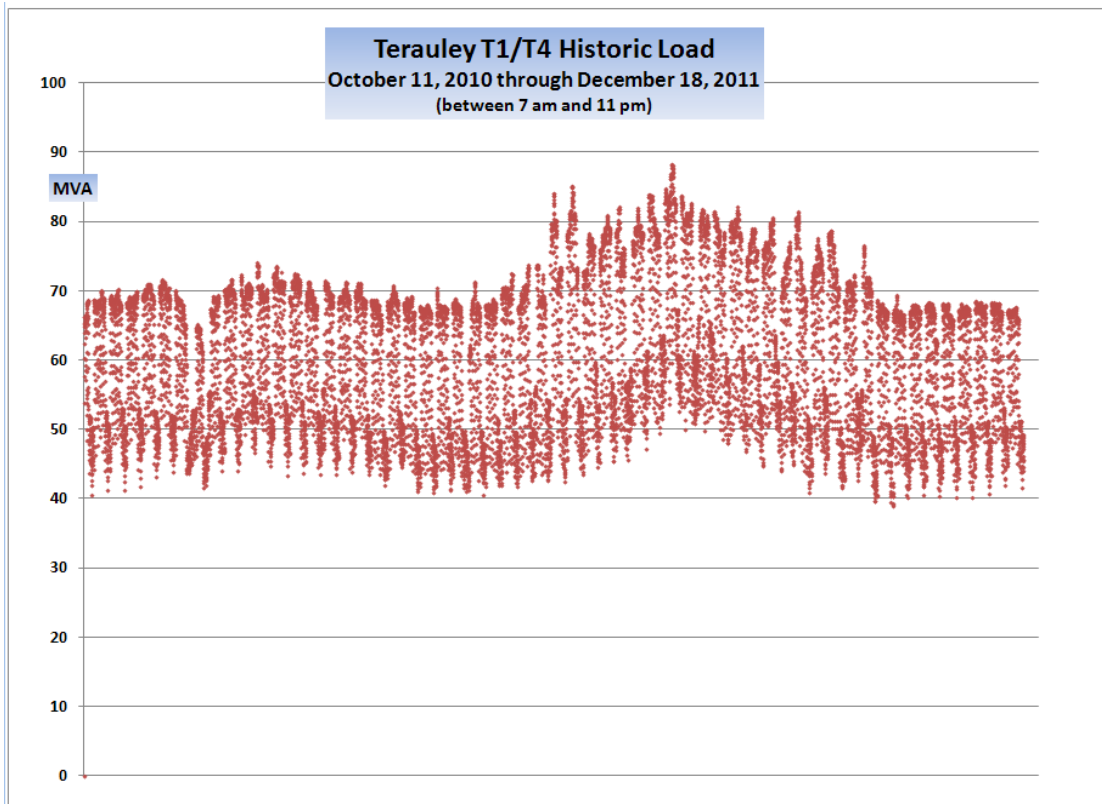
**Table 3 – 10-DAY Summer Thermal Ratings for T1/T4 DESN at Terauley TS**

For the T2/T3 DESN at Terauley TS, the existing 10-DAY summer transfer capability is 136.6 MVA. The 10-DAY summer transfer capability will not change when the new T4 is put into service.

**4.2 Peak Loads and Projections**

**4.2.1 T1/T4 DESN Load Projection**

Revenue meter information from October 11, 2010 through December 18, 2011 was used to evaluate the load on the T1/T4 DESN at Terauley TS. The peak load of 88.3 MVA on the T1/T4 DESN at Terauley TS occurred on July 21, 2011 at 11:00. Figure 1 shows the loading at the LV side of T1 and T4 during the daily on-peak hours, which are defined as 7 a.m. until 11 p.m.



**Figure 1 – T1/T4 DESN Load at Terauley TS**

This peak load is below the existing 10-DAY summer capability of 130.0 MVA and the new 10-DAY summer capability of 130.1 MVA for the T1/T4 DESN at Terauley TS.

The load on T1 and T4 at Terauley TS is projected to increase by 1% annually as shown in the table below.

Terauley TS T1/T4 Projected Peak Load Growth		
Year	Projected Peak Load (MVA)	10-DAY Summer Capability (MVA)
2011	88.3	130.0
2012	89.2	
2013	90.1	130.1
2014	91.0	
2015	91.9	
2025	101.5	

Table 4 – T1/T2 Projected Load Growth at Kent TS

The 10-Day summer transfer capability of the T1/T4 DESN at Terauley TS will not be exceeded in the foreseeable future.

**4.2.2 T2/T3 DESN Load Projection**

Revenue meter information from February 2, 2011 through December 18, 2011 was used to evaluate the load on the T1/T4 DESN at Terauley TS.

The peak load of 99.9 MVA on the T2/T3 DESN at Terauley TS occurred on July 21, 2011 at 14:00. Figure 2 shows the loading at the LV side of T2 and T3 during the daily on-peak hours, which are defined as 7 a.m. until 11 p.m.

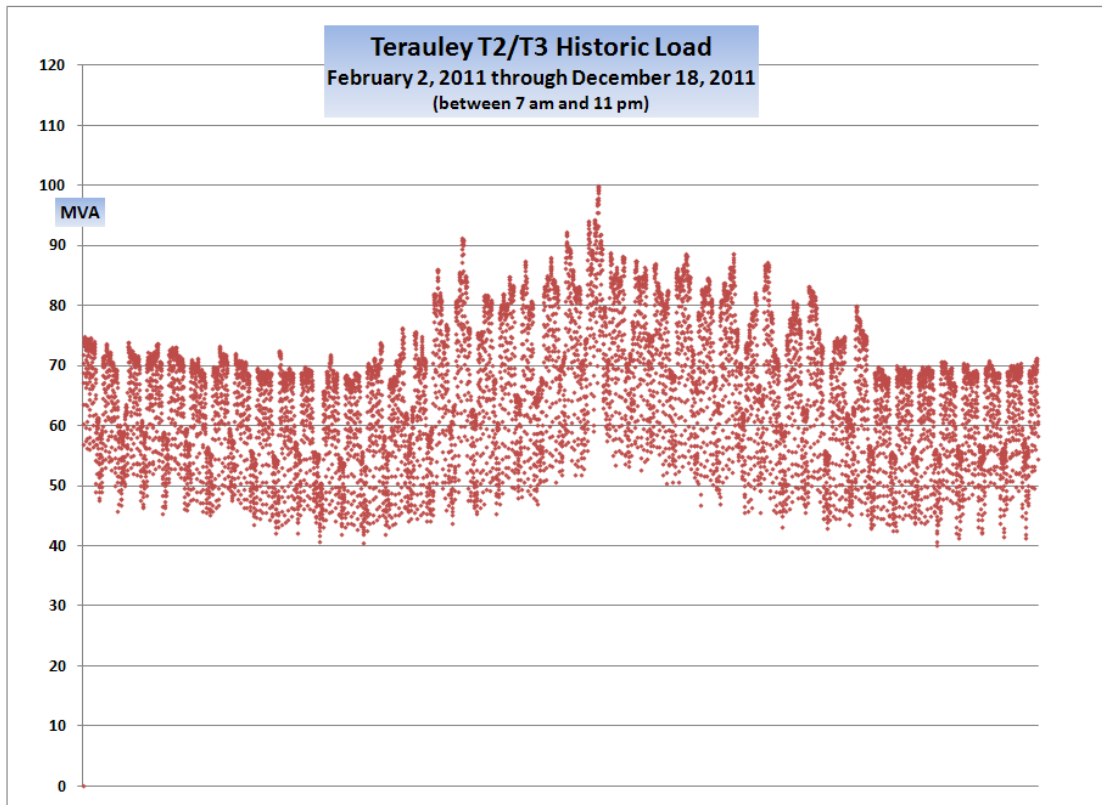


Figure 2 – T2/T3 DESN Load at Terauley TS

This peak load is below the existing 10-DAY summer capability of 136.6 MVA for the T2/T3 DESN at Terauley TS.

The load on T2 and T3 at Terauley TS is projected to increase by 1% annually as shown in the table below.

<b>Terauley TS T2/T3 Projected Peak Load Growth</b>		
<b>Year</b>	<b>Projected Peak Load (MVA)</b>	<b>10-DAY Summer Capability (MVA)</b>
2011	99.9	136.6
2012	100.9	
2013	101.9	
2014	102.9	
2015	104.0	
2025	114.8	

**Table 5 – T1/T2 Projected Load Growth at Kent TS**

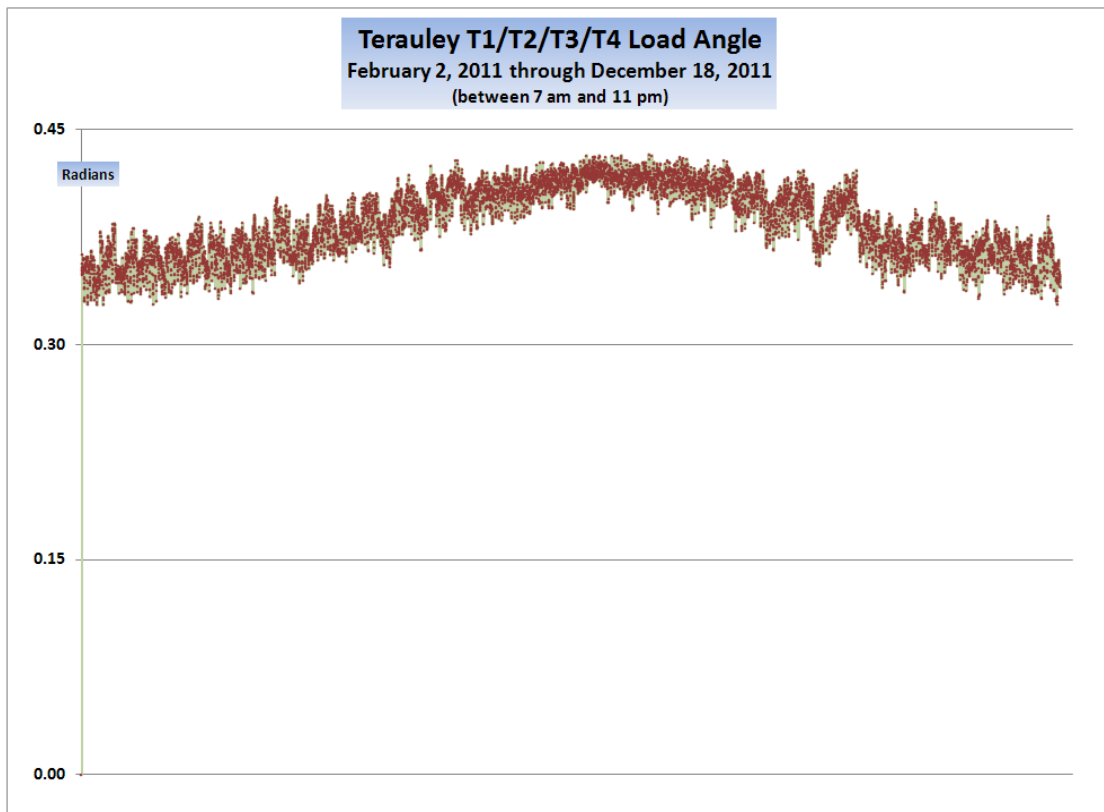
The 10-Day summer transfer capability of the T2/T3 DESN at Terauley TS will not be exceeded in the foreseeable future.

**4.3 Load Angle & Power Factor**

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 Terauley 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.

Revenue meter information from February 2, 2011 through December 18, 2011 was used to evaluate the load angle at Terauley TS. Figure 3 illustrates the load angle on the LV side of Terauley TS 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 Terauley TS.



**Figure 3 – Load Angle at Terauley TS**

Between February 2, 2011 and December 18, 2011, the load angle at Terauley TS was within the IESO required limits.

**4.4 Conclusions**

It can be concluded that the replacement of T4 at Terauley TS will not result in a material adverse impact on the reliability of the IESO-controlled grid.