

Final Draft Report

Assessment Summary

Hydro One Networks Inc.



Stayner TS SC2B Shunt Capacitor Retirement

CAA ID Number: 2007-EX339

1.0 General Description

As part of the Essa x Stayner 230 kV transmission re-enforcement, Stayner TS SC2B is scheduled to be retired on April 2009. Capacitors SC1B and SC3Y will remain at Stayner TS.

An assessment of the re-enforcement (CAA-ID 2005-190) was completed and released on October 18, 2006. The assessment contained in the SIA was originally performed with SC2B out of service to obtain conservative results. Voltage declines on the IESO controlled grid were found to be minimal for the various contingencies that were assessed.

2.0 Proposed Modification

Table 1 shows the various reactive outputs of the low voltage capacitors at Stayner TS at its rated voltage. The retirement of capacitor SC2B will result in a reduction of approximately 22 MX (rated at 44kV) in reactive compensation at the station.

Table 1: Stayner TS Capacitor Data

Capacitor	Rated kV *	Output (MVar) *
SC1B	46	21.6
SC2B	44	21.6
SC3Y	46	21.6

Note: * Capacitor data taken from Hydro One Secure Operations Website.

3.0 Assessment

Table 2 shows the pre-contingency voltages at Stayner TS for (1) SC1B, SC2B and SC3Y capacitors in service and (2) SC1B and SC2Y in capacitors in-service under 2010 coincident peak loads.

Table 2: Pre-Contingency Voltages at Stayner TS

		Stayner 230 kV	Stayner 115 kV	Stayner 44 kV
1	SC1B, SC2B, SC3Y I/S	245.8	124.0	45.85
2	SC1B, SC3Y I/S	244.6	123.5	45.18

Results show that with only two Stayner TS capacitors in service, all Stayner bus voltages are still within IESO criteria. It should also be noted that the differences in pre-contingency voltages with three capacitors versus two in service were found to be insignificant for the conditions assessed.

The IESO allows a voltage change ΔV on a single capacitor switching to be no more than 4%. A switching study was carried to investigate the effect of the two remaining capacitors, SC1B and SC3Y on the voltage changes at Stayner TS. The study was performed for two scenarios:

- SW1 – switching of SC3Y in service when SC1B is out-of-service
- SW2 – switching of SC3Y in service when SC1B is in-service

The results of this study are summarized in **Table 3**.

Table 3: SC3Y and SC1B Switching Study

Bus	SW1			SW2		
	Pre (kV)	Post (kV)	$\Delta V\%$	Pre (kV)	Post (kV)	$\Delta V\%$
Stayner 44 kV	44.1	45.2	2.5	45.2	46.3	2.4
Stayner 230 kV	242.3	243.5	0.5	243.5	244.7	0.5

The study shows that the steady state voltage changes are within IESO criteria.

Figure 1 shows a plot of the Stayner TS load angle in radians from August 1, 2006 to August 1, 2007. It can be seen that the majority of the time, the load angle is negative, meaning power factor is leading (reactive power injected to the system).

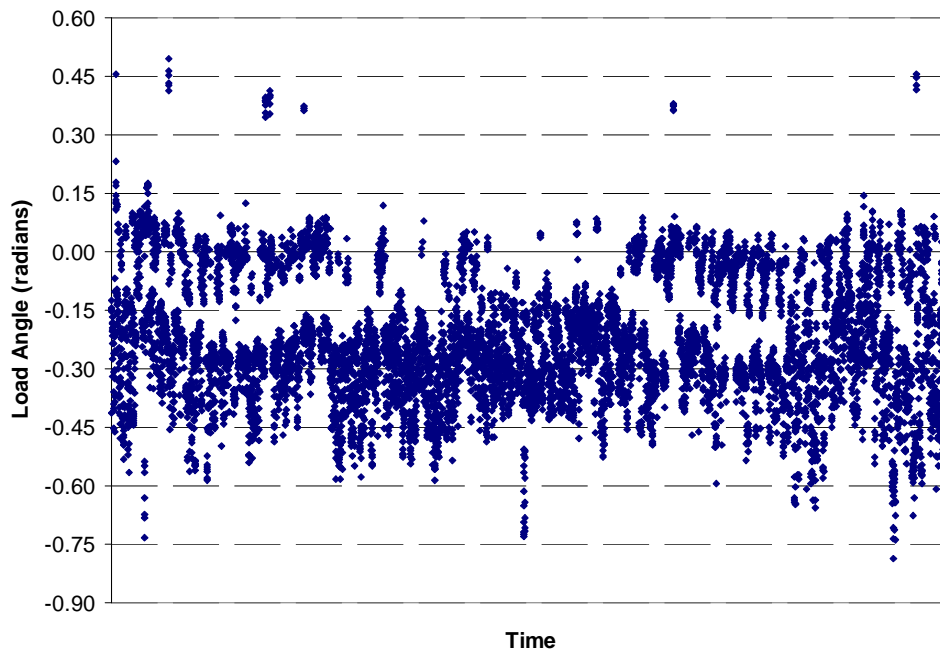


Figure 1: Power Angle at Stayner TS

The IESO requires that wholesale customers and distributors connected to the IESO-controlled grid shall operate at a power factor within the range 90% lagging to 90% leading as measured at the defined meter point.

Historical records indicate that the power factor at Stayner TS corresponding to the hottest summer in the local area (2006) was 0.92 lagging, gross of any reactive compensation. Based on this power factor and

forecasted Stayner TS summer loads obtained from the original Essa x Stayner 230 kV Transmission SIA report (CAA ID 2005-190), load flow studies summarized in **Table 4** indicate that with SC1B and SC3Y in-service, the power factor on the HV side of the Stayner TS transformers will still meet IESO requirements.

Table 4: Power Factor Analysis for Stayner TS (with SC1B and SC3Y in service)

Stayner TS	2009	2014	When Design Capacity Reached *
P _{load} (MVA)	107.1	114.5	175
P _{load} at 0.92 pf (MW)	98.53	105.3	161
Q _{load} at 0.92 pf (MVar)	41.97	44.97	68.59
Q _{load} +Q _{transformer_loss} (MVar)	8.8	13.4	52
Power factor at HV side	0.996	0.992	0.952

*Note: Design Capacity is assumed to be equal to the 10 day LTR. Hydro One has provided a 10 day LTR of 175 MVA.

4.0 Conclusions

The retirement of Stayner TS SC2B shunt capacitor will not have a material adverse effect on the IESO-controlled grid provided it is retired coincident with the coming of service of the new 230 kV lines from Essa to Stayner.

5.0 Requirements

- De-registration of the SC2B shunt capacitor will need to be completed during the Facility De-registration process.
- The proponent 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.

6.0 Notification of Approval

This expedited System Impact Assessment concludes that the retirement of Stayner TS SC2B shunt capacitor coincident with the coming of service of the new 230 kV lines from Essa to Stayner is not expected to have a material adverse effect on the IESO-controlled grid. It is therefore recommended that a Notification of Conditional Approval of the Connection Proposal be issued, subject to the requirements detailed above.