CONNECTION ASSESSMENT & APPROVAL PROCESS

Connection Assessment Report for LV Shunt Capacitor Installations

Connection Applicant: Hydro One Networks Inc.

CAA ID 2002-EX019

Final Report

Prepared by
Consistent Information Set Department &
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1.0 Project Description

Hydro One Network Inc. has submitted a connection assessment application for installation of six new low voltage shunt capacitors connected at 28.8 kV voltage at various transformer station locations. The shunt capacitors are configured double-wye ungrounded and rated at 29.2 kV as follows:

- One 21.6 Mvar shunt capacitor bank at Clarke TS,
- One 21.6 Mvar shunt capacitor bank at Oakville TS,
- One 10.8 Mvar shunt capacitor bank at Centralia TS,
- Two 10.8 Mvar shunt capacitor banks at Strathroy TS, and
- One 10.8 Mvar shunt capacitor bank at Wanstead TS.

Each bank is connected to the 28.8 kV bus via a disconnect switch, a current limiting reactor of 0.377 ohms and a synchronizing breaker. A diagram of the proposed connection for each shunt capacitor is shown in Figure 1.

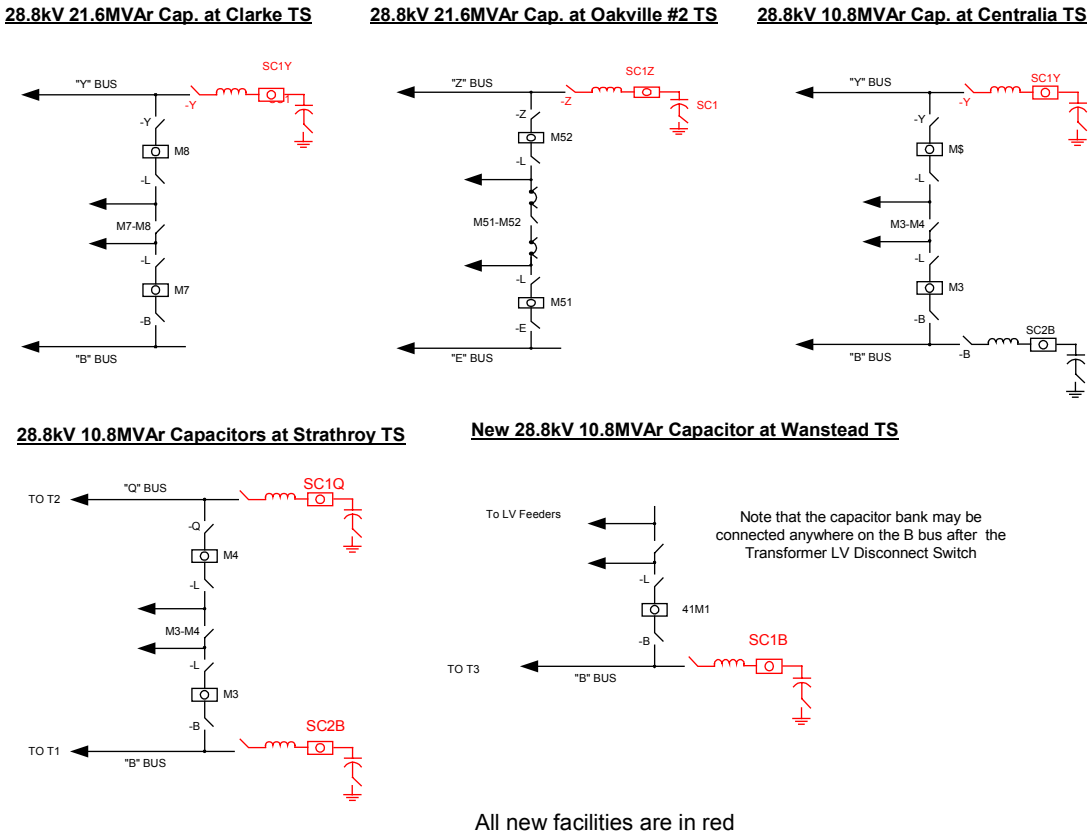

Figure 1. Proposed Connection Arrangements

The synchronizing breakers are vacuum type, with a continuous rating of 1200 A and an interrupting capability of 25 kA. It is assumed that the breakers are ganged-pole breakers, hence no special features are provided for synchronized opening or closing.

Hydro One has indicated that the series reactors (1mH per phase) were sized to ensure that the in-rush currents do not exceed the breakers' interrupting capability.

2.0 Assessment

Hydro One has submitted the results of studies which justify the need for installing shunt capacitors at these locations due to low voltage and/or load power factor concerns.

The normal three phase fault short circuit levels at the various stations are as follows:

Clarke TS– 740 MVA
Oakville TS – 600 MVA
Centralia TS – 740 MVA
Strathroy TS – 366 MVA
Wanstead TS – 248 MVA

The connection assessment for each shunt capacitor installation are summarized below.

- Clarke TS

The 21.8 Mvar shunt capacitor at Clarke TS is required during periods of heavy station load or transmission outage. This capacitor bank will be operated manually and only when the switching in service of the shunt capacitor will not result in excessive voltages at Talbot TS.

The Market Rules require that the voltage change upon switching of a capacitor bank not exceed 4%. Calculations, using the system short circuit levels provided by Hydro One, show that the switching of this low voltage capacitor will generate a voltage change of about 3%.

- Oakville TS

The 21.8 Mvar shunt capacitor at Oakville TS is required for load power factor correction.

Auto switching capability will be provided for this capacitor based on timed maximum and minimum voltage levels. The complete auto switching capability is to be provided with the Facility Registration information.

The Market Rules require that the voltage change upon switching of a capacitor bank not exceed 4%. Calculations, using the minimum system short circuit levels provided by Hydro One, show that the switching of this low voltage capacitor could generate a voltage change of up to 3.6%.

- Centralia TS:

Presently, under summer peak load conditions and with one critical element out of service the voltage is below the 113 kV level that is required by the Market Rules, and the addition of a 10.8 Mvar shunt capacitor bank will bring the voltage to acceptable levels.

Auto switching capability will be provided for this capacitor bank based on timed maximum and minimum voltage levels. The complete auto switching capability is to be provided with the Facility Registration information.

The Market Rules require that the voltage change upon switching of a capacitor bank not exceed 4%. Calculations, using the minimum system short circuit levels provided by Hydro One, show that the switching of this low voltage capacitor could result in a voltage change of up to 3.8%.

- Strathroy TS and Wanstead TS

The three 10.8 Mvar shunt capacitors proposed for installation at these stations are required to accommodate the area projected load growth until about 2006 while maintaining pre-contingencies voltages above 113 kV.

Auto switching capability will be provided for these capacitors based on timed maximum and minimum voltage levels. The complete auto switching capability is to be provided with the Facility Registration information.

The Market Rules require that the voltage change upon switching of a capacitor bank not exceed 4%. The calculations carried out using the minimum system short circuit levels provided by Hydro One, show that at Strathroy TS the switching of capacitor bank could yield a voltage change of about 3%. At Wanstead TS the capacitor switching must be performed only when the system voltage is 28 kV or lower in order to meet the Market Rules requirement for 4% voltage change.

3.0 Conclusions

The proposed installations of these low voltage capacitor banks are expected to increase the transmission system operating voltages to levels required by the Market Rules and are not likely to have any adverse impact on the reliability of the IMO-controlled grid

It is required that the switching of the LV capacitor bank at Wanstead TS be restricted to ensure that the 4% change in voltage is not exceeded.

4.0 Notification of Approval

It is thus recommended that notification of approval be granted subject to possible operating restrictions imposed on the operation of the Wanstead TS LV capacitor bank.