



CONNECTION ASSESSMENT & APPROVAL PROCESS

ASSESSMENT SUMMARY

Applicant: Hydro One Networks Inc.

*Project: Installation of a 2nd 125MVar 128kV Capacitor Bank
at Leaside TS*

CAA ID No. 2003-EX141

***Long Term Forecasts & Assessments Department
Consistent Information Set Department***

Date: 14th August 2003

ASSESSMENT SUMMARY

HYDRO ONE NETWORKS Inc.

LEASIDE TS - Install a 2nd 125MVAr 128kV Capacitor Bank

1.0 GENERAL DESCRIPTION

An earlier Assessment Summary, reference CAA ID No. 2002-EX043 dated 18th June 2002, examined a proposal by Hydro One Networks Inc. to install the first 125MVAr capacitor bank at Leaside TS and to equip the existing 96MVAr capacitor bank SC11 with an IPO (independent pole operated) breaker.

The scheduled in-service date for this initial 125MVAr capacitor bank is 1st May 2004.

At that time Hydro One indicated that they planned to install a second 125MVAr capacitor bank at Leaside TS by 1st May 2006.

For the first 125MVAr capacitor bank Project, two new IPO breakers are to be purchased; one of which is to be used to replace the principal breaker on the existing 96MVAr capacitor bank, SC11. The breaker that is to be removed will then be used as the back-up breaker for the new 125MVAr capacitor bank.

Hydro One is proposing to use the same approach for the second 125MVAr capacitor bank so that when the Project is complete, both the new 125MVAr bank and the existing 96MVAr capacitor bank, SC12, will be equipped with an IPO principal breaker and a conventional back-up breaker.

The scheduled in-service date for the second 125MVAr capacitor bank has been advanced by one year to 1st May 2005.

2.0 PROPOSED FACILITIES

The new capacitor bank, SC14, rated at 125MVAr 128kV is to be connected to the idle position between the existing 115kV breakers L5L16 & KL5 at Leaside TS, through two series-connected breakers as shown in Diagram 1.

To minimise the effect on local customers of switching the new capacitor bank into service, an independent pole operated breaker is to be used as the principal breaker on the new capacitor bank.

Hydro One is also proposing to equip the existing 96MVAr capacitor bank, SC12, with an identical IPO breaker at the same time that the new capacitor bank is installed. This would allow the existing, conventional SC12SC breaker to be used as the back-up breaker for the new capacitor bank, to complement its new IPO principal breaker.

Series reactors rated at 3.5mH are to be installed on the new capacitor bank to limit the out-rush current from the individual capacitor banks due to close-in faults at Leaside TS. These are to be installed between the disconnect switch and the back-up breaker, as shown in Diagram 2.

The existing SC12 capacitor bank is already equipped with 1.0mH series reactors. These are either to be replaced with new 3.5mH series reactors or additional, complementary 2.5mH reactors are to be installed to provide a combined reactance of 3.5mH. The preferred location for the new 2.5mH or the replacement 3.5mH series reactors is between the disconnect switch and the back-up breaker. However, should space constraints preclude their installation in this location, then the preferred alternative would be between the two breakers.

In the event that the series reactors cannot be located at either of the positions above, then they would need to be installed either between the IPO Breaker and the SC12 capacitor bank, or in its neutral connection.

Each capacitor bank is to be equipped with surge arresters and these are to be located between the IPO breaker and the actual capacitor bank.

The new capacitor bank is to be connected to the idle position on the 115kV busbar at Leaside TS through a motor-operated disconnect switch, as shown in Diagram 2.

Specifications

- Capacitor Bank:

125MVA _r ±5% at 128kV ±1kV	
Maximum operating voltage	128kV
Configuration	Double Y ungrounded - fuseless
Symmetrical short-circuit rating	40kA (minimum)
Insulation level	550kV _{peak} BIL (minimum)

- Discharge Devices:

None required.
[Each capacitor unit is equipped with a 5-minute discharge resistor]

- Series Reactors:

Rating at 60Hz	3.5mH per phase <i>and</i> 2.5mH per phase, if the existing reactors are not to be replaced
Maximum operating voltage	127kV continuous 150kV for 5 minutes
Continuous current	700A rms
Symmetrical short-circuit rating	63kA for 12 cycles
Asymmetrical short-circuit rating	160kA _{peak}
Insulation level	550kV _{peak} BIL

- Circuit Breakers:

Type	SF ₆ - Independent pole operated (IPO), equipped with control units for synchronised closing.
Maximum operating voltage	128kV continuous
Rated interrupting capability	40kA symmetrical
Rated interrupting time	3-cycles (maximum)
Insulation level	550kV BIL
TRV across pole	310kV _{peak}

- Disconnect Switch:

Continuous current	700A (minimum)
Maximum operating voltage	127kV continuous 150kV for 5 minutes
Symmetrical short-circuit rating	63kA
Insulation level	550kV _{peak} BIL

3.0 ASSESSMENT

Existing 96MVar capacitor banks and the first 125MVar capacitor bank

The two existing 96MVar capacitor banks are connected directly to the *J* and *P* 115kV busbars at Leaside TS. With this arrangement, contingencies involving either of the 230kV circuits, C2L & C15L, or their associated transformers, T11 & T15, would result in the simultaneous loss of the associated capacitor bank. This would mean that at the very time voltage support could be required, one of the capacitor banks would be automatically removed from service.

Similarly, the connection of the first 125MVar capacitor bank, SC13, to the *E* 115kV busbar at Leaside TS would result in the loss of this capacitor bank for a C3L/T12 contingency.

Furthermore, a double-circuit contingency involving the 230kV circuits C2L & C3L would result in the simultaneous loss of the 96MVar capacitor bank, SC11, and the 125MVar capacitor bank, SC13.

However, the proposed interchange of the 230kV circuits C3L & C17L for the incorporation of the proposed Portlands Energy Centre Project would eliminate this latter situation.

Second 125MVar capacitor bank

The proposed connection of the second 125MVar capacitor bank to the idle position between breakers L5L16 & KL5 instead of a connection to the *K* busbar at Leaside TS would avoid similar problems to those associated with the location of the other three 115kV capacitor banks at Leaside TS.

The proposed connection arrangement is therefore acceptable to the IMO.

Voltage Change on Switching the Capacitor Bank

Based on the fault level at Leaside TS, the voltage change upon switching a 125MVar capacitor bank either in- or out-of-service is expected to be approximately 2%.

This would comply with the maximum limit of 4% for capacitor switching that is quoted in the Market Rules

Auto-Reclosure

All six of the 230kV circuits between Cherrywood TS and Leaside TS (C2L, C3L, C14L, C15L, C16L & C17L) are equipped with auto-reclosure from the Cherrywood TS end only, following a line fault.

Similarly, all six of the 115kV circuits between Leaside TS and Hearn TGS (H1L, H3L, H6LC, H7L, H8LC & H11L) are equipped for auto-reclosure from the Leaside TS end only, following a line fault.

There are no known problems associated with auto-reclosing any of these 230kV & 115kV circuits. Furthermore, the new capacitor bank at Leaside TGS is not expected to create any problems or affect the ability to deploy auto-reclosure on the 230kV & 115kV circuits in the Leaside sector.

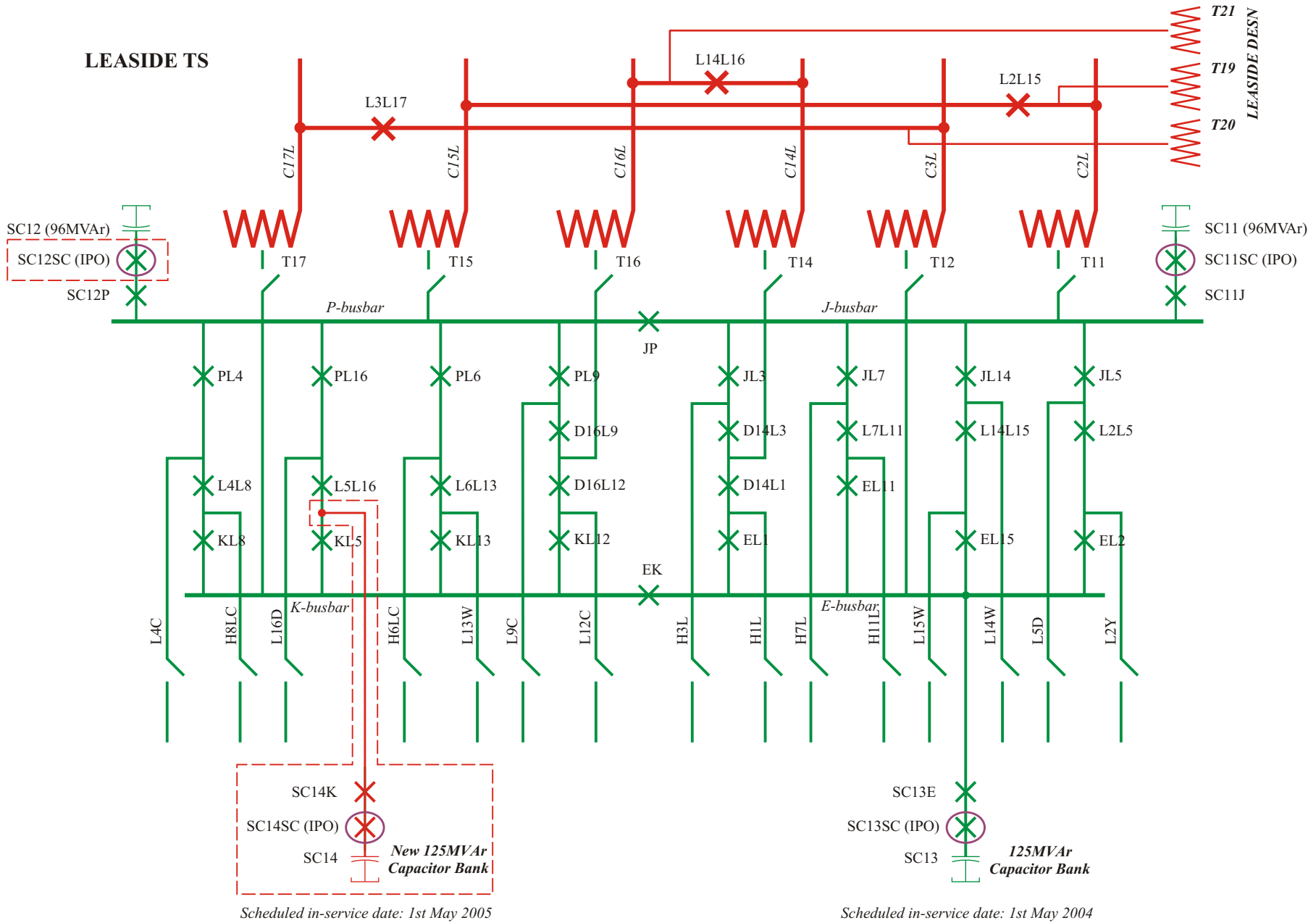
4.0 CUSTOMER IMPACT ASSESSMENT



Hydro One has notified the IMO that a Customer Impact Assessment will not be required for this Project since the switching transients when the IPO breaker is used to switch the new capacitor bank into service will be less than those for the existing installations.

Furthermore, Hydro One has indicated that they are not aware of any customer concerns associated with the switching of either of the existing 96MVAR capacitor banks that is performed using conventional breakers.

5.0 NOTIFICATION OF APPROVAL

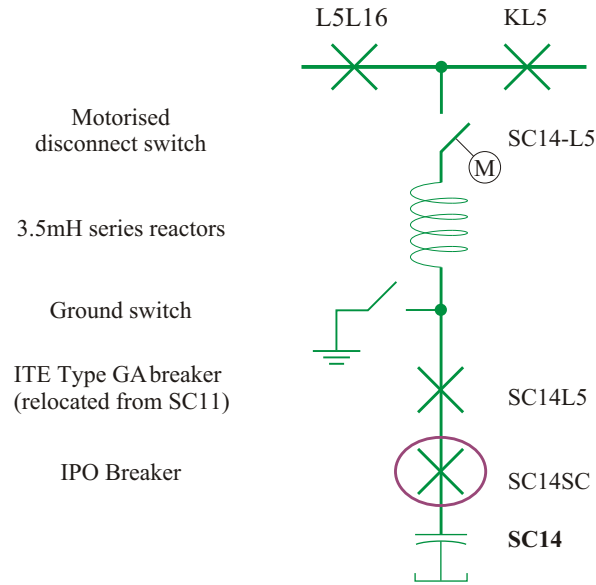
It is therefore recommended that a Notification of Approval of the Connection Proposal be issued.



-  Independent Pole Operation (IPO) Breaker
-  Work included in this Project

2nd 125MVar 128kV Shunt Capacitor Bank at Leaside TS

2nd 125MVar Shunt Capacitor Bank Installation: SC14



Existing 96MVar Shunt Capacitor Bank Installation: SC12

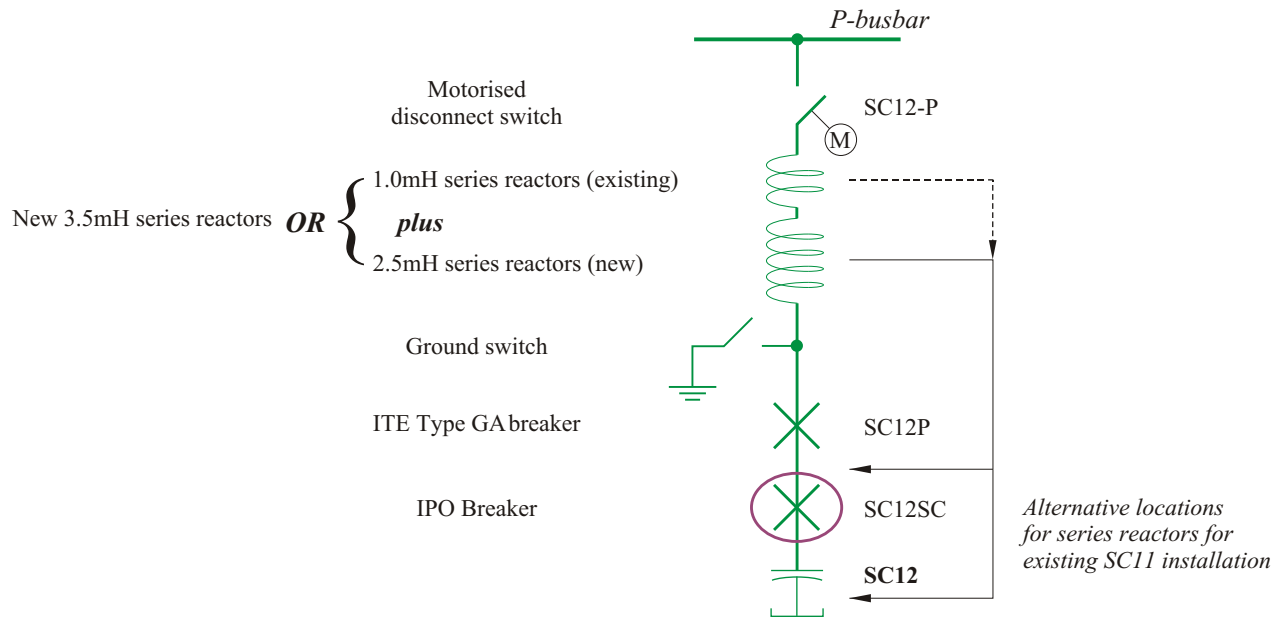


DIAGRAM 2

12th August 2003