EB-2007-0050
Chris Pappas - Interrogatories for Hydro One – 25 & 26, Part 7
March 20, 2008

Preamble:

The following are excerpts from two IESO documents. These concern the relationship between Nanticoke retirement and Bruce refurbishment and, therefore, this Bruce to Milton Transmission Build. The nature of the following suggests that the OPA can better reply to this than HONI.

FROM:

THE ONTARIO RELIABILITY OUTLOOK

MARCH 2007 VOLUME 2 ISSUE 1

Increasing climate change concerns will continue to point to the need to reduce the use of coal-fired generating facilities, which are planned to be shut down as soon as reliability allows. In 2006, generation from coal-fired facilities was down three per cent from the previous year with a corresponding reduction in emissions. The deferral of the planned shutdown of Ontario's four coal-fired generating stations has largely addressed the concern over future supply needs, identified by the IESO last June. As new facilities come into service and CDM activities progress, reliance on coal to meet demand in Ontario can continue to decline.

Transmission

New transmission facilities, particularly in southwestern Ontario, remain a priority for the IESO over the next decade. Major transmission projects are required to deliver additional electricity from the Bruce area, to enable the planned expansion of hydroelectric capability in the northeast and to increase the capability to supply Toronto load. Without new transmission facilities, the IESO will eventually be forced to operate existing facilities near their maximum capabilities, with little margin for unexpected events and requiring complex arrangements to do routine maintenance on critical facilities. A new 500 kV line out of the Bruce area is required as soon as possible to accommodate additional generation expected from new projects and refurbished Bruce nuclear units. Some short-term solutions are available to minimize potential congestion that could begin with the planned restart of Bruce Unit 2 in 2009.

FROM:
10 YEAR OUTLOOK
An Assessment of the Adequacy of Generation and Transmission Facilities to Meet Future Electricity Needs in Ontario
From January 2006 to December 2015

IESO_REP_0245v2.0
10-Year Outlook

5.1 System Aspects of the Coal Replacement Plan
In order to preserve grid reliability while implementing the coal replacement program, it is important that replacement generation have suitable operating characteristics, be sited in appropriate locations and that necessary enhancement to transmission infrastructure be undertaken. These requirements are discussed in more detail below.

5.1.1 Location

The location of replacement generation is important to maintaining the capability of the Ontario power system. Reactive power support in critical locations is needed in order to maintain adequate voltages throughout the system, particularly in the Greater Toronto, Golden Horseshoe and the Kitchener Waterloo Guelph areas where a significant portion of the load is concentrated.

Without voltage support, the ability of the system to transfer energy would be reduced and the ability to supply energy to loads would be lessened. Nanticoke Generating Station is particularly important in this regard. Under peak load conditions, a minimum of six Nanticoke units are currently required to be in service to ensure reliable system operation. Without these units in service, reductions in the output of the Bruce nuclear generating station would be necessary.

In the event that all units at Nanticoke are shut down, and equivalent replacement voltage support is not available, the allowable output from the Bruce generating station would be significantly restricted and the feasibility of returning Units 1 and 2 to service would be jeopardized. This is described in more detail in Section 5.1.6.

The flow eastward on transmission lines into Toronto could also be restricted by substantial amounts, depending on the availability of Nanticoke generation or equivalent replacement generation sources. This could require the operation of other more expensive generation east of

this interface and, under peak load conditions, could result in load interruptions in the Toronto area.

The permissible flow eastward on the transmission lines from southwestern Ontario can be reduced in the order of about 1,000 MW (25 %) in the absence of any Nanticoke units. This could significantly restrict imports from Michigan, thus increasing electricity prices and degrading the adequacy of supply.
Ontario's ability to import and export energy is an essential element of secure and reliable interconnected system operation, and provides large financial benefits to Ontario market participants and rate payers. The ability to import and export energy is dependent on where replacement supply is located. Replacement generation ideally should be located so that the existing import and export capability is not reduced. If replacement resources are located such that they utilize transmission capability that is normally required to deliver imported power, there could be a decrease in the supply available for Ontario consumers, and degradation in overall

system reliability. Some offset of import capability with new resources internal to Ontario may be acceptable. Where practical this should be avoided by locating the replacement supply near the load, near existing generation sites or on transmission paths that do not connect the major tie lines to the load centre in the Greater Toronto Area.
The capability of the Ontario power system can only be maintained with the addition of replacement capacity in the right amounts in the most effective locations. Generation investment in the right locations will take advantage of existing transmission lines and facilitate the continued operation of the remaining non coal generation.

5.1.6 System Requirements Associated with the Shutdown of Nanticoke

Located in Haldimand County, the Nanticoke coal - fired generating station can supply almost 4,000 MW of capacity – enough to meet approximately 20 per cent of Ontario's peak demand on a spring or fall day. The shutdown of the station is particularly complex due to a number of factors, including the growing demand for power in the Greater Toronto Area (GTA) and the need to supply that demand from power sources outside the area. Nanticoke also provides reactive power to support the heavy power flows from those areas to the GTA as shown in Figure 5.2.

Supply to the GTA remains a critical concern. Current GTA demand is about 10,000 MW or 40% of Ontario's total demand and is expected to increase by approximately 1,500 MW in the next decade. This is compounded by a lack of generation within the area to supply the forecasted increase in demand. As a result, and until additional sources of supply or demand - side initiatives become available within the GTA, the load must be supplied by generation outside the area. The Nanticoke station provides both energy and capacity to help supply the GTA in addition to providing reactive power to support the transfer of power from southern Ontario supply located some distance from the GTA.

Reactive power, a pre - requisite to the reliable operation of a power system, has been cited as a root cause of the August 14, 2003 blackout. After careful study, experts determined that a severe shortage of reactive power in northern Ohio, caused by power plant and transmission line failures, lead to the blackout. Produced by generators and consumed by most loads, reactive power is an inherent part of transmitting power over long distances. The longer the distance and the greater the amount of power traveling over that distance, the more reactive power which must be produced by generators to support those power flows.

Currently Nanticoke supplies the greater part of the reactive power needed to transport power to consumers in south - central Ontario and the western GTA, including Brantford, greater Hamilton, Burlington, Guelph, Cambridge, Kitchener - Waterloo, Milton, and parts of Oakville, Mississauga and Brampton. This

includes the reactive power needed to support transmission of the Nanticoke station's own energy production to the GTA as well as increasing amounts of power produced at the Bruce GS and in southwest Ontario. As power flows from these areas increase, the importance of Nanticoke to reliable operation increases. In addition, Nanticoke units contribute to the voltage control requirements of the grid, especially immediately following disturbances or system events that redirect power along the transmission circuits that connect to the Nanticoke plant. Following a disturbance or system event, the Nanticoke generators automatically provide additional reactive power to the system to support the increased power flows resulting from the event, thus preventing a system collapse.

Reactive power and voltage control capability cannot be supplied over long distances. These capabilities will continue to be required locally from Nanticoke until it can be replaced, either at Nanticoke, from generation located within the major load centres such as the GTA, or by other system developments that reduce the need for reactive power and voltage control at Nanticoke.

It must be recognized that the system requirements associated with the shutdown of Nanticoke are significantly affected by the need to incorporate additional Bruce units.

These system requirements address the need for reactive power from Nanticoke and include the following;

• Installation of generation in proximity to the large GTA demand. Location of generation close to the load reduces the need for Nanticoke in two ways; first, less energy needs to be transported long distances to the GTA, and second, reactive power needs of the system are met by the local generation.

• Installation of series compensation in the 500 kV lines serving Bruce and Nanticoke. This form of compensation reduces the need for reactive power to support the large power flows to support the GTA, and reduces the need for post - contingency voltage support
• Installation of shunt capacitors in southwestern Ontario. This form of compensation can provide blocks of reactive power to support voltage and to free reactive capability of generating units. The continuously variable reactive power of generating units is necessary to fine tune voltage in steady state and to regulate voltage following contingencies. The inherent voltage regulation of shunt capacitors is very poor. It is unlikely that these measures will eliminate the need for dynamic voltage support from the Nanticoke site. The most effective means to provide this capability while meeting the government's policy to cease burning coal at Nanticoke is to convert several units to synchronous condenser operation. In this mode of operation the generator remains connected to the system with full capability to provide reactive power to the system. The steam side of the generating unit may be decommissioned as it is not required in this mode. A minimum of two units are anticipated to be required. The precise requirements will be defined in the near future as the requirements of the coal replacement plan are refined. A combination of these alternatives has been incorporated into the coal replacement plan.

The first document cited above [ORO March 2007] avoids mention of the serious issues raised, regarding transmission from the Bruce, by the earlier 10 Year Outlook document.

It is clear from the latter that the refurbished Bruce units cannot be employed unless there is, first, complete replacement of generation and reactive power in the Nanticoke and GTA areas, at least 4000 MW, if Nanticoke is to be retired. In fact, without this, no other, further Bruce units can be brought into action. Large generation cannot simply be dropped in anywhere.

Grids are complex. Power does not flow according to market desires, or to those of men, but by the laws of physics. It is like water. It will spill where it will. Our job is not merely leading it, but constraining it.

With a little further thought, it is also clear that Pickering, Darlington and Lennox [natural gas], are situated much better than Bruce, in this regard.

In HONI's presentation at the Technical Conference in October 2007, they indicated that power flows from west to east were problematical while those from east to west are preferable.

HONI claims that the Intervenors are limited to considering this application in isolation from other transmission projects around Ontario and from generation. Yet, their driver, OPA, has made claims of need for this project not only for the contracted refurbishment, but for near future generation builds at the Bruce. There is talk of another 4000 MW. There is talk of four more reactors. There is talk of twelve more reactors. Given the information regarding Nanticoke it is impossible to see how Nanticoke can be retired in light of its necessary role as an anchor for any further generation at the Bruce.

Refurbishment of units at Pickering may have been the more appropriate decision. They are certainly much closer to demand, thus at less or no risk of conditions such as SSR. Also, their proximity to demand leads to less line losses than transmission from the Bruce.

Generation and transmission from the east would not have interfered with the Nanticoke phase out as with the Bruce. This may have allowed an earlier committed effort for many new, smaller, generation installations in and around the GTA, from Nanticoke to the GTA and in the other major demand centres throughout Southern Ontario.

Interrogatory No. 25
Ref. 1) APPENDIX A to Procedural Order No. 5 IN THE MATTER OF Leave to Construct Application by Hydro One Networks EB-2007-0050 DATED February 25, 2008

Issue Number: 1.0 Project Need and Justification
Issue Number: 1.1
1.1 Issue: Has the need for the proposed project been established?
Issue Number: 1.3
1.3 Issue: Have all appropriate project risk factors pertaining to the need and justification (including but not limited to forecasting, technical and financial risks) been taken into consideration in planning this project?
Issue Number: 1.4
1.4 Issue: Is the project suitably chosen and sufficiently scalable so as to meet all reasonably foreseeable future needs of significantly increased or significantly reduced generation in the Bruce area?
Issue Number: 2.0 Project Alternatives
Issue Number: 2.1
2.1 Issue: Have all reasonable alternatives to the project been identified and considered?
Issue Number: 2.2
2.2 Issue: Has an appropriate evaluation methodology been applied to all the alternatives considered?
Issue Number 2.3
2.3 Issue For all of the considered alternatives, does the evaluation methodology utilized include a cost benefit comparison as well as a comparison of all quantitative and qualitative benefits?
Issue Number: 2.4
2.4 Issue:
a) Have appropriate evaluation criteria and criteria weightings been utilized in the evaluation process for the alternatives and the proposed project and what additional criteria/weightings could be considered?
b) Have appropriate comparisons been carried out on all reasonable alternatives with respect to reliability and quality of electricity service, including stability and transient stability levels, voltage performance and Loss of Load Expectation projections under normal and post-contingency conditions?
c) Do the alternatives meet the applicable standards for

reliability and quality of electricity service?
Issue Number: 2.5
2.5 Issue: Is the proposal a better project than the reasonable alternatives?
Issue Number: 2.6
2.6 Issue: Are the project's rate impacts and costs reasonable for:
• the transmission line;
• the station modifications; and
• the Operating, Maintenance and Administration requirements.
Issue Number: 4.0 Reliability and Quality of Electricity Service
Issue Number: 4.1
4.1 Issue: For the preferred option, does the project meet all the requirements as identified in the System Impact Assessment and the Customer Impact Assessment?
Issue Number: 4.2
4.2 Issue: Does the project meet applicable standards for reliability and quality of electricity service?
Issue Number: 4.3
4.3 Issue: Have all appropriate project risk factors pertaining to system reliability and quality of electricity service been taken into consideration in planning this project?

<u>Request</u>
Provide the reasons why thyristor controlled series capacitors, other FACTS devices and, in fact, more effort to install reactive power on the existing lines and in the south should not be undertaken instead of the transmission build, given the situation described in the IESO document regarding Nanticoke.

Interrogatory No. 26
Ref. 1) APPENDIX A to Procedural Order No. 5 IN THE MATTER OF Leave to Construct Application by Hydro One Networks EB-2007-0050 DATED February 25, 2008
Issue Number: 1.0 Project Need and Justification
Issue Number: 1.1
1.1 Issue: Has the need for the proposed project been

established?
Issue Number: 1.3
1.3 Issue: Have all appropriate project risk factors pertaining to the need and justification (including but not limited to forecasting, technical and financial risks) been taken into consideration in planning this project?
Issue Number: 1.4
1.4 Issue: Is the project suitably chosen and sufficiently scalable so as to meet all reasonably foreseeable future needs of significantly increased or significantly reduced generation in the Bruce area?
Issue Number: 2.0 Project Alternatives
Issue Number: 2.1
2.1 Issue: Have all reasonable alternatives to the project been identified and considered?
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2.2 Issue: Has an appropriate evaluation methodology been applied to all the alternatives considered?
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<u>Request</u>

Provide an explanation of how, exactly, the retirement of Nanticoke will proceed given the refurbishment of the two reactors and the installation of this transmission build.