

Description of Need and Rationale for “Oshawa Area” TS by 2015

1 Summary and Purpose

Pickering Generation Station (“GS”) is a critical local generation source for reliable supply of the eastern part of the Greater Toronto Area (East GTA), providing about 3,100 MW of capacity to the local area. A significant source of new transmission or generation capacity will be required to maintain reliable supply to electricity users in East GTA when Pickering GS retires.

Ontario Power Generation Inc. (“OPG”), who owns and operates Pickering GS, is considering extending the life of the nuclear station to 2020 however, there is a possibility it could be completely out of service by early 2015. The reliability consequence of Pickering GS retiring by 2015, without a new source of capacity in place, is the loss of about 750 MW of load within the East GTA, following a single contingency event. This level of load loss for a single contingency event is 5 times higher than the current planning criteria allows for planning transmission facilities in Ontario.

Installation of a new 500-230 kV Transformer Station (“TS”) called “Oshawa Area” TS is the only feasible solution to address retirement of Pickering GS and to mitigate the risk of early retirement. The solution was also outlined in the Ontario Power Authority (“OPA”) - 2011 IPSP Planning and Consultation Overview document dated May 2011 (pages 5-11)

<http://www.powerauthority.on.ca/sites/default/files/page/IPSP%20Planning%20and%20Consultation%20Overview.pdf> as well as in the Transmission Planning component of the IPSP 2011 Stakeholder Consultation Presentation (slides 38 and 39)

<http://www.powerauthority.on.ca/sites/default/files/page/Transmission%20Presentation.pdf>.

“Oshawa Area” TS also includes new switching facilities that provide improved load restoration capabilities to the Pickering, Ajax, Oshawa and Clarington areas. Existing supply facilities serving these areas are not capable of meeting existing load restoration requirements specified within the Ontario Resources and Transmission Assessment Criteria (“ORTAC”) document issued by the Independent Electricity System Operator (“IESO”). “Oshawa Area” TS would enable meeting the requirements specified in ORTAC.

Since there is some risk of inadequate supply by as early as 2015, the OPA believes that it is prudent to prepare for implementing “Oshawa Area” TS by the 2015 date for the following reasons:

1. The consequence of not being prepared would expose customers in the eastern portion of the GTA to an unacceptable level of risk to reliability by 2015 (exposure to about 750 MW of load rejection for a single contingency event).
2. Transmission facilities currently serving the Pickering, Ajax, Oshawa and Clarington areas are not currently capable of meeting load restoration criteria specified in ORTAC. “Oshawa Area” TS provides facilities which rectify this situation.

1 3. "Oshawa Area" TS is also the recommended solution for the scenario where the operation of
2 Pickering GS is extended to 2020. The cost impact of installing "Oshawa Area" TS in 2015 as
3 opposed to installing the station in 2020 is \$60 million. It is necessary to make expenditures
4 now to mitigate the reliability risks mentioned above given that a decision on the retirement
5 date of Pickering GS is still forthcoming.

6 To provide for the timely implementation of this recommended solution the OPA has requested that
7 Hydro One develop a flexible implementation plan. This implementation plan should be designed to
8 ensure that the 2015 in service date can be met to mitigate the risk to reliability should Pickering retire
9 in 2015, while at the same time providing appropriate technical and commercial off-ramps, to minimize
10 cost exposure should it be confirmed by OPG that at least 2 units will be available at Pickering beyond
11 the 2015 date and there is an opportunity to defer some expenditures for this project. Two letters from
12 the OPA to Hydro One on this subject are attached in Appendix 1.

13 The purpose of this document is to update the analysis that considered viable alternatives and provide
14 the rationale for the recommended solution to address the retirement of Pickering GS.

15 **2 System Needs**

16 **2.1 Supply sources for East GTA 230 kV system**

17 Pickering GS, which includes six units with total output capacity of 3,100 MW, is a critical local
18 generation source for supplying East GTA. Pickering GS reduces the required power transfers from the
19 500 kV bulk transmission system through the 500-230 kV autotransformers at Cherrywood TS (with four
20 autotransformers) and Parkway TS (with two autotransformers).

21 Information received from Ontario Power Generation Inc., who owns and operates Pickering GS,
22 indicates that there is a possibility that Pickering GS could be shut down completely by early 2015. OPG
23 is considering options to extend the operating life of Pickering GS to the year 2020. The extended
24 operation is not a certainty as it is dependent on the successful outcome of studies to confirm the
25 technical feasibility and obtaining the necessary approvals. The results of these studies and receipt of
26 approvals are not expected to be known before the latter part of this year or possibly next year.

27 System studies performed for the Ontario Power Authority by the IESO indicated that a minimum of
28 two Pickering units are required to be in service to maintain reliable supply for the area during peak load
29 periods. The existing six 500-230 kV autotransformers at Cherrywood TS and Parkway TS would not
30 have sufficient capacity to supply the load in East GTA reliably with less than two Pickering GS units in
31 operation.

32 The studies further indicated that, with no Pickering units in-service, loss of one of the four 500-230 kV
33 autotransformers at Cherrywood TS would result in a serious overload on one of the three remaining
34 autotransformers at Cherrywood TS. Load interruptions of about 750 MW would be required to reduce

1 the loading on the overloaded transformer to be within its equipment rating. This level of load loss is
2 five times higher than the current planning criteria allows for planning transmission facilities in Ontario.

3 Given the above circumstances, OPA believes that there is a possibility that the electricity users in East
4 GTA cannot be supplied reliably in 2015. A solution is therefore required to mitigate this risk.

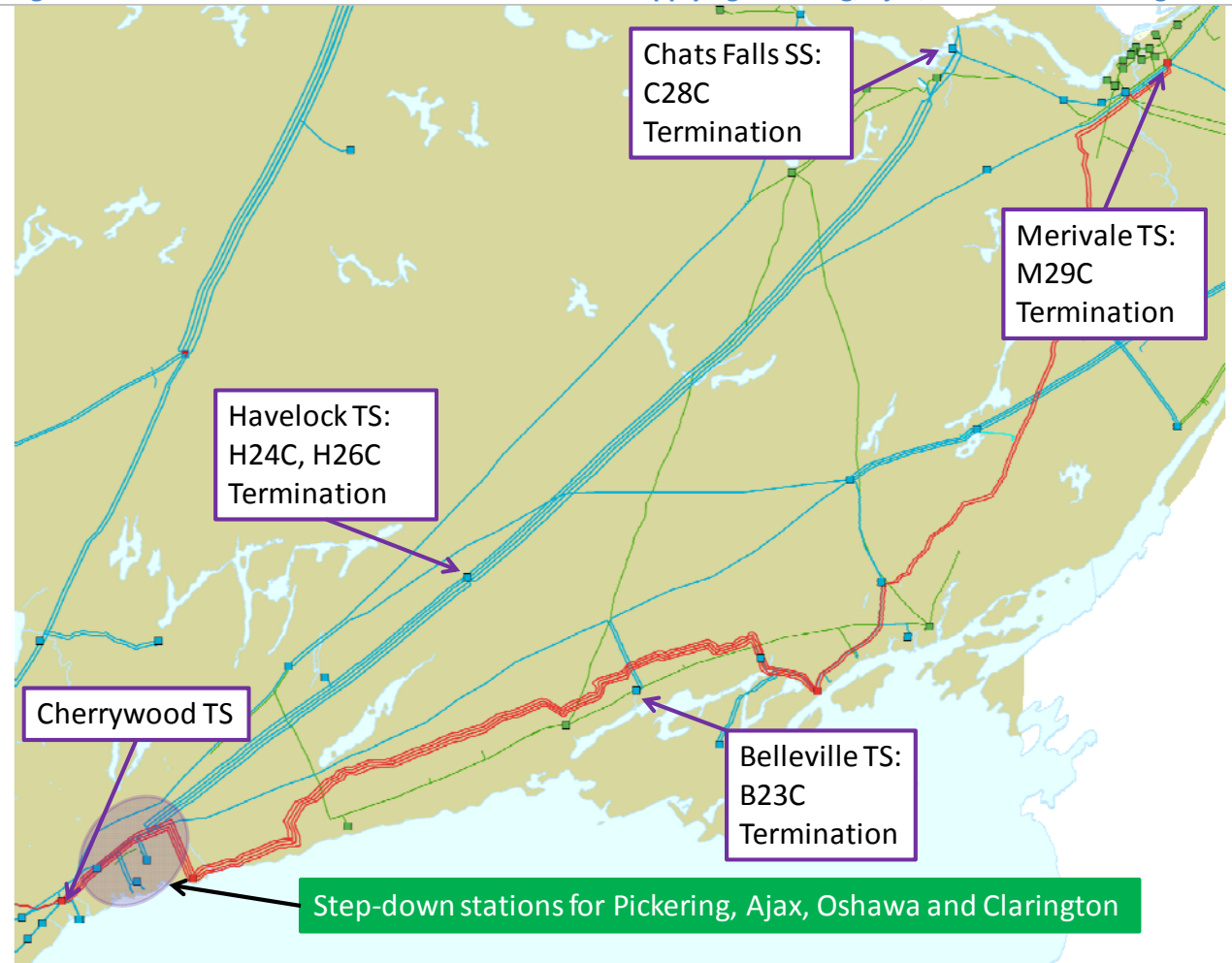
5 Even if the operating life of Pickering GS is extended, the solution to address Cherrywood TS 500-230 kV
6 autotransformer overloads is required by no later than year 2020 when Pickering GS would be retired.
7 In addition to the above mentioned need, Pickering GS also provides approximately 1,000 MVar of
8 reactive power to support the East GTA area system voltages. In the absence of Pickering GS, an
9 alternate source for this reactive power would also be required.

10 **2.2 Supply Reliability Needs of Pickering, Ajax, Oshawa and Clarington Areas**

11 The 230 kV step-down stations supplying Local Distribution Company loads east of Cherrywood TS (in
12 Pickering, Ajax, Oshawa and Clarington areas) are supplied by long 230 kV circuits emanating eastward
13 from Cherrywood TS. The total load supplied in this area is forecast to be about 750 MW with about
14 300 MW supplied by H24C and H26C circuits and about 450 MW supplied by M29C and B23C circuits.
15 These circuits are on a four circuit transmission line. The terminal stations to the east are far from the
16 area, as shown in Figure 1 below.

17 In the event of a permanent fault affecting either of these pair of circuits, it would not be possible to
18 supply load from the eastern end of these circuits due to the long distance involved. The existing
19 transmission facilities supplying the loads in this area are inadequate for the purpose of meeting the
20 IESO's load restoration criteria under ORTAC. New transmission or generation facilities are required to
21 provide the required reliable supply.

Figure 1: Terminal stations for transmission circuits supplying Pickering, Ajax, Oshawa and Clarington



Source: OPA

1

2 2.3 New Generation at Darlington

3 Ontario's Long-Term Energy Plan indicates that new nuclear generation totalling up to 2,000 MW at
4 Darlington will be needed by the early 2020's. Therefore, any alternatives that would meet the above
5 mentioned needs must also be compatible with the facilities required for the incorporation of new
6 nuclear units at Darlington GS. Previous system studies indicated that a new double circuit 500 kV
7 transmission line between Darlington GS and Cherrywood TS would be required for the incorporation of
8 new nuclear units at Darlington.

3 Alternative Solutions

3.1 Generation Alternatives

Installing new generation totaling 1,000 MW close to Cherrywood TS would be necessary to meet the required supply reliability in East GTA. The planning criteria within ORTAC requires that this 1,000 MW be comprised of at least two generating units (500 MW each), or a number of smaller units within the area. This multiple generating unit requirement provides the diversity needed to ensure supply reliability. To meet the need, these generation facilities are required to be installed prior to spring 2015, to address the early retirement of Pickering GS. There has been interest for generation projects in the area through the OPA's - Combined Heat & Power ("CHP") procurement program. However, the total amount of interest is about 300 MW and it is not sufficient to meet the need even if they could be installed by March 2015. The OPA has other generation procurement programs such as FIT, microFIT and CESOP with interest in the area, but the total amount would not be sufficient to meet the need, even when combined with the CHP interest.

Given that it will take longer than the 2015 need date to incorporate a sufficient amount of new generation in this area, the generation option has been determined to be infeasible.

3.2 Transmission Alternatives

Alternative 1: "Oshawa Area" 500-230 kV TS (the recommended solution)

Hydro One owns a property at the border of Oshawa and Clarington, north of Winchester Road / Concession 7 between Grandview Street and Enfield Road. This is a location where the 500 kV lines and the 230 kV lines in the area converge, and it has been planned for installation of 500-230 kV autotransformers and switching facilities for the long 230 kV circuits in the area. Figure 2 below shows the location of "Oshawa Area" TS. The following is a high level description of this alternative.

At "Oshawa Area" TS install:

- Two 500-230 kV, 750 MVA auto-transformers each connecting to one of the four 500 kV Bowmanville to Cherrywood circuits using 500 kV circuit breakers;
- Switching facilities for the existing five long 230 kV circuits emanating east from Cherrywood TS; and
- Two 230 kV - 150 MVAR shunt capacitor bank.

At Cherrywood TS install:

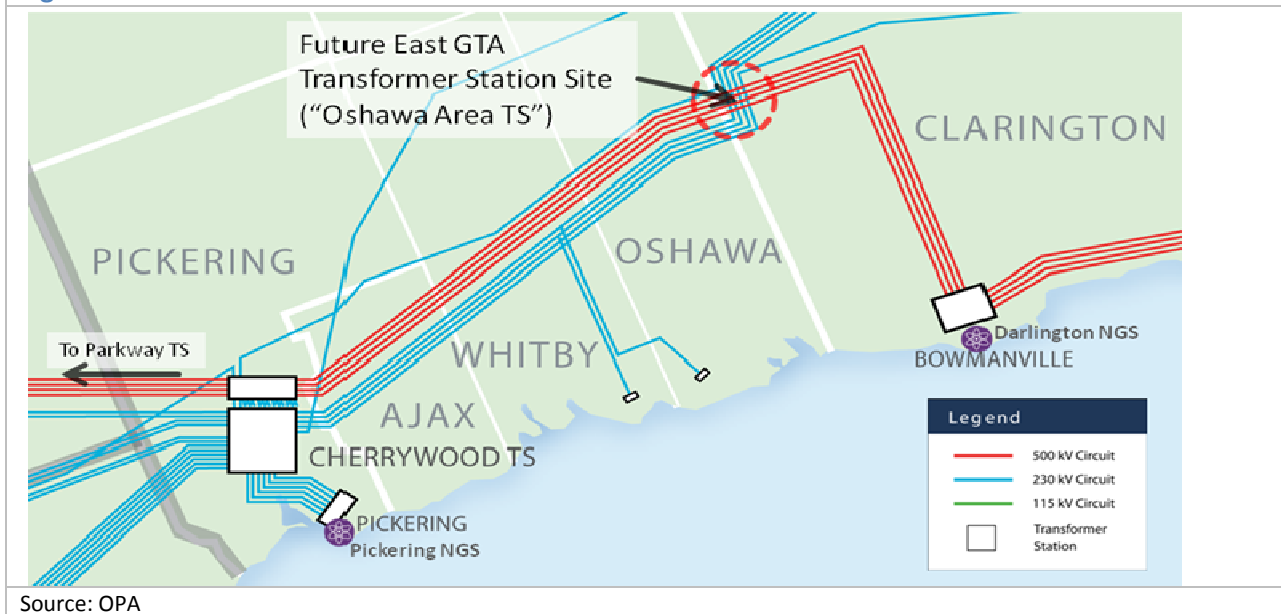
- Two 230 kV - 300 MVAR shunt capacitor banks.

This option would meet the 500-230 kV autotransformer capacity and reactive power requirements outlined in Section 2.1, as well as the regional supply reliability needs of the area.

In addition to meeting the required needs, this alternative provides the following additional benefits:

- 1 • The new transformer station would provide a new load supply point in an area where
2 growth is expected. This would reduce the reliance on Cherrywood TS as the only major
3 supply source for the East GTA.
- 4 • A new 500 kV double circuit line from Bowmanville SS (Darlington) west ward towards the
5 GTA is expected to be required for incorporation of Darlington B units. The “Oshawa Area”
6 TS would obviate the need for a 27 km line section between Cherrywood TS and “Oshawa Area”
7 TS. In addition, two circuits from the new 500 kV line between Bowmanville SS and
8 “Oshawa Area” TS would not require additional 500 kV circuit breakers at “Oshawa Area”
9 TS, whereas additional 500 kV breakers would be needed if these lines terminated at
10 Cherrywood TS.

Figure 2: Oshawa Area TS



Source: OPA

11
12 Alternative 2: Expand Cherrywood TS

13 There are four 500-230 kV autotransformers at Cherrywood TS, which are connected to two separate
14 230 kV switchyards. These two switchyards are not interconnected due to the fact that this connection
15 arrangement would exceed the short circuit levels of the major equipment. Studies conducted by the
16 IESO, at the OPA’s request, have confirmed that, given this connection arrangement, installing two
17 additional 500-230 kV autotransformers at Cherrywood does not help to alleviate the potential overload
18 situation under the criteria specified within ORTAC. The IESO studies indicate that the two switchyards
19 would need to be interconnected to be effective. Since the interconnection of the 230 kV switchyards
20 would result in short circuit levels beyond the capabilities of the existing 230 kV breakers, even when all
21 Pickering units are retired, this option is considered infeasible. The short circuit level would also be
22 higher than the capability of new 230 kV breakers even if the existing breakers could be replaced in
23 time.

1 In addition, the above facilities also do not address the regional supply reliability needs of Pickering,
2 Ajax, Oshawa and Clarington areas, outlined in Section 2.2. Four new transmissions circuits extending
3 east from Cherrywood TS would still be required to address the area supply reliability needs.

4 Alternative 3: Expand Parkway TS

5 Parkway 500-230 kV TS is located west of Cherrywood TS. There are currently two 500-230 kV
6 autotransformers at Parkway TS. IESO studies, conducted at the request of the OPA, have confirmed
7 that installing two additional 500-230 kV autotransformers at Parkway TS would not provide sufficient
8 reduction on the autotransformers at Cherrywood TS. Options were investigated to determine if
9 another solution could be found for reducing the loading on the Cherrywood 500-230 kV
10 autotransformers, given the significant impact (the loss of 3,100 MW of local generation within the East
11 GTA) when Pickering retires. It was found that the installation of four new 230 kV circuits connecting
12 Parkway TS to the existing 230 kV circuits between Richview TS and Cherrywood TS, on the Finch
13 transmission corridor, would be necessary to achieve the required loading relief on the 500-230 kV
14 autotransformers at Cherrywood TS.

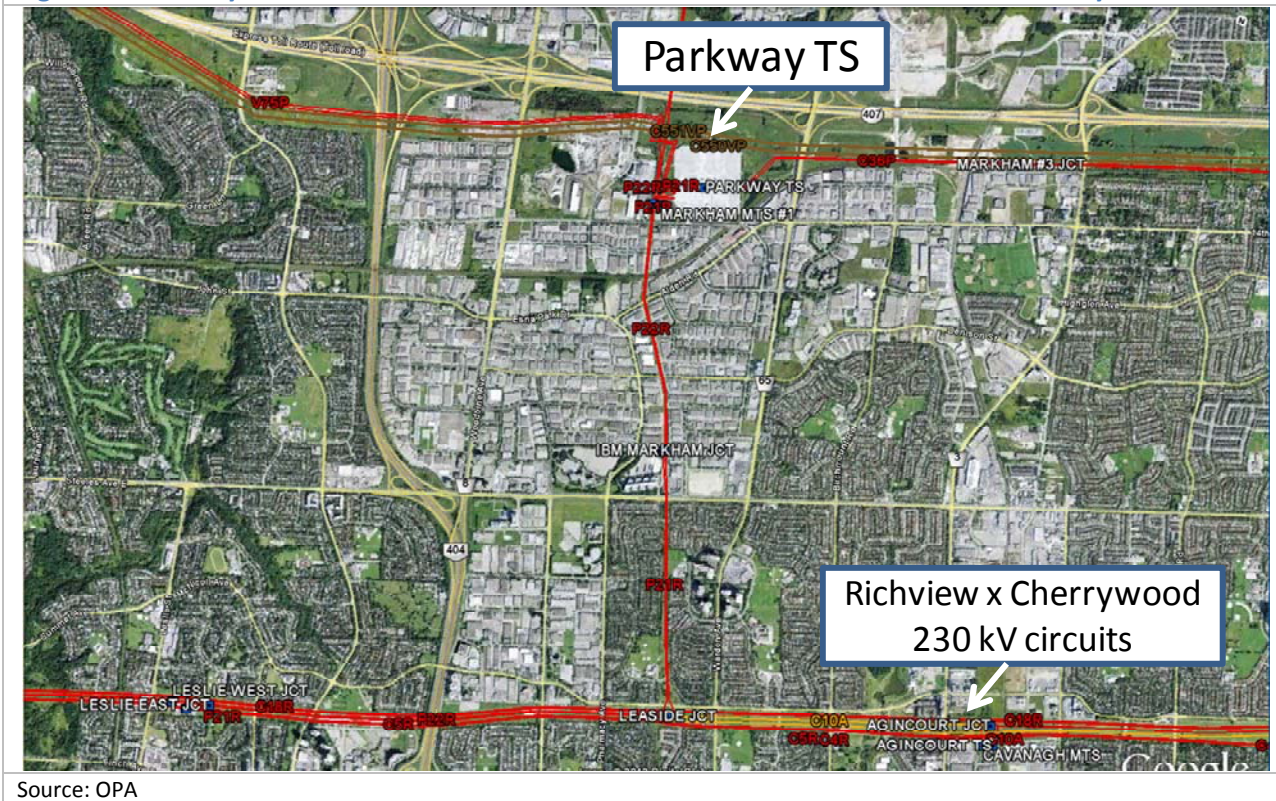
15 This alternative was determined to be infeasible from an implementation perspective for the following
16 reasons:

- 17 • The area where the four 230 kV circuits connections are to be located has been fully developed
18 for a number of years, as shown in Figure 3. It would be very difficult to obtain a new right of
19 way or expand the existing right of way for the four new 230 kV circuits. There is a significant
20 risk of not being able to obtain the necessary right of way in a timely manner.
- 21 • IESO studies indicate the improvement in the supply capability provided by this alternative is
22 significantly inferior to that from “Oshawa Area” TS.

23 In addition, the above facilities also do not address the regional supply reliability needs of Pickering,
24 Ajax, Oshawa and Clarington areas, outlined in Section 2.2. Four new transmission circuits extending
25 east from Cherrywood TS would still be required to address the area supply reliability needs.

26 Therefore, this option is not considered further.

Figure 3: Parkway TS and Finch 230 kV transmission line between Richview TS and Cherrywood TS



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2 4 Conclusion

3 The transmission Alternative 1 (installation of “Oshawa Area” 500-230 kV TS) is the recommended
4 alternative because it is the only alternative that meets all of the identified needs and can be
5 implemented in time to address the risk of early retirement of Pickering GS. Implementation of
6 “Oshawa Area” TS by 2015 represents an advancement of the project which would be required by 2020
7 assuming OPG is successful in extending the life Pickering GS.



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October 3, 2011

Mr. Carmine Marcello
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Dear Carmine:

Need for an implementation plan to incorporate additional 500-230 kV auto-transformation capacity in the east GTA by spring of 2015 given risk of early retirement of Pickering GS

Summary

The purpose of this letter is to recommend that Hydro One develop an implementation plan and initiate the necessary work for installing additional 500-230 kV autotransformer capacity within the east GTA by the spring of 2015. The implementation plan should be designed to provide sufficient flexibility to meet the possible need date of 2015, while minimizing costs to rate payers should a decision be made in 2012 to extend the life of Pickering GS beyond the spring of 2015. Extending the life of at least 2 generating units at Pickering beyond 2015 delays the need for the additional autotransformer capacity in the east GTA, for as long as the 2 generating units are available.

The preferred location for these transformation facilities is at a new 500-230 kV autotransformer station provisionally named "Oshawa Area" TS located on a property owned by Hydro One. The property is located at the border of Oshawa and Clarington, north of Winchester Road / Concession 7 between Grandview Street and Enfield Road. The need and timing for "Oshawa Area TS" was publically communicated during the IPSP - 2011 stakeholder consultation session conducted on May 31, 2011 (reference slides 38 to 41 of May 31, 2011 stakeholder presentation). No stakeholder comments were received on the information communicated.

Rationale

An implementation plan to incorporate additional autotransformer capacity within the east GTA is required because Pickering GS could be completely out of service by as early as the spring of 2015. Under this scenario, technical studies performed by the OPA and IESO indicate that the 500-230 kV autotransformers at Cherrywood TS would not have sufficient capacity to reliably supply load in the east GTA.

Ontario Power Generation Inc. (OPGI) is exploring extended operation of Pickering GS to 2020. However, the extended operation is not a certainty since it depends on the outcome of studies to confirm the technical feasibility as well as the conclusion of related commercial agreements and the receipt of required regulatory approvals. The results of these investigations are not expected to be known until sometime in 2012. Given the material impact to the reliable supply to the east GTA under the scenario of no generating units at Pickering GS and the lead time for incorporating 500-230 kV autotransformers at "Oshawa Area TS" the OPA considers it prudent for Hydro One to:

1. Develop an implementation plan to install "Oshawa Area" TS by the spring of 2015, with consideration for the decisions surrounding extended operation of Pickering GS and their timing.
2. Work with the OPA and the IESO to develop stop gap measures, such as installing additional 500-230kV autotransformation capacity at either Cherrywood TS or Parkway TS, should Hydro One's implementation planning work indicate that providing facilities at "Oshawa Area" TS has a significant risk of being delayed beyond spring 2015.

The implementation plan should be designed to provide sufficient flexibility to meet the possible need date of 2015, while minimizing costs to rate payers should a decision be made in 2012 to extend the life of Pickering GS to the year 2020. The OPA will continue working with Hydro One to achieve this balance by providing input on the minimum facilities required at the station in the near term. Hydro One should also utilize other risk mitigation techniques to minimize near terms costs, such as the use of technical and commercial off ramps, where they are deemed to be appropriate.

Background

Pickering GS, with two A units and four B units connected to the 230 kV system, provides critical local generation for reliable supply of the east GTA. System studies indicate that either a minimum of two Pickering units are required in service or additional autotransformer capacity in the east GTA is needed to maintain reliable supply for the area.

There are scenarios where Pickering GS is shut down as early as by the spring 2015. Since such scenarios have material impact to the reliable supply to east GTA, the OPA considers it prudent for Hydro One to begin work that will provide the 500 - 230 kV autotransformer capacity within the east GTA, to meet the spring 2015 need date.

Current information indicates that Pickering GS is not expected to operate beyond 2020 under the extended operation scenarios. Thus, the new autotransformer capacity is expected to be required by 2020 in any case.

The OPA will keep Hydro One apprised of the status of decisions related to the operating schedule of generating units at the Pickering GS which could have impact on the 2015 need date for additional 500-230 kV transformation capacity in the area.

Specifics of the Preferred Solution

The preferred solution to relieve the 500-230 kV Cherrywood autotransformers was outlined within the first Integrated Power System Plan (EB-2007-0707) in Exhibit E Tab 4 Schedule 1, which is attached for convenience. This solution remains valid and is composed of establishing a new 500-230 kV station within the east GTA, at the site known as "Oshawa Area TS". An alternative to install two additional

transformers are Cherrywood TS instead of “Oshawa Area TS” was determined technically infeasible due to short circuit capability limits of existing 230 kV equipment.

The need and timing for “Oshawa Area TS” was publicly communicated during the IPSP - 2011 stakeholder consultation session conducted on May 31, 2011.

Installation of “Oshawa Area TS”, which includes 500-230 kV transformation facilities, provides the required relief to the Cherrywood TS 500-230 kV auto-transformers and a new supply point in an area that is experiencing significant growth. This new bulk system station would also improve supply reliability to the area by providing a new switching point for several long 230 kV circuits emanating east from Cherrywood TS. The new bulk station also reduces the reliance on Cherrywood TS, which is currently the only major supply source for the east GTA.

The OPA is working with the IESO to refine the station facility requirements, including reactive compensation needs, and will provide further details as soon as they become available.

Conclusion

Given the information currently available on the status of the units at Pickering GS and the need to ensure reliable service in the east GTA, the OPA believes that it is prudent for Hydro One to develop an implementation plan and initiate the work necessary to ensure “Oshawa Area” TS can be available by the spring of 2015. The implementation plan should provide flexibility, where possible, to minimize costs should the life extension of Pickering GS proceed.

The OPA recognizes that the timelines to build Oshawa Area TS are challenging and will work with Hydro One and the IESO to establish a staged approach where feasible for providing the minimum facilities needed to mitigate the near-term risk, while minimizing costs.

The OPA is prepared to provide evidence in support of the need, rationale and prudence associated with this request. Please feel free to contact us should you require any clarification or additional information.

Yours truly,



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cc. Kim Warren, the IESO



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January 11, 2012

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Dear Carmine:

Update on the need for "Oshawa Area" TS to address potential early retirement of Pickering GS

This is further to our letter of October 3, 2011 outlining the need for Hydro One Networks to develop an implementation plan to incorporate additional 500-230 kV auto-transformation capacity at "Oshawa Area" TS by the spring of 2015.

Based on our discussions at the Hydro One - Transmission Steering Committee meeting of November 23, 2011 and recent work that has been completed by the OPA working with Hydro One Networks, the Independent Electricity System Operator (IESO) and ongoing discussions with Ontario Power Generation (OPG), the following is a summary of the status of key factors related to the subject project:

- Pickering GS has a license that allows it to operate only until March 2015. The current outlook for the number of in-service units at Pickering is 6 currently, 5 after May 2014, 4 after November 2014 and none after March 2015. Thus, if this outlook holds, by spring of 2015, additional 500-230 kV auto-transformation capacity would be required. There is work underway that explores the possibility that the plant can continue to operate until mid 2019, and there are significant technical, economic and regulatory issues yet to be concluded before this can be counted on. This letter is to prepare the system for a March 2015 end of life in case that becomes the outcome.
- An assessment has been made to "manage" the life of the last 4 units at Pickering GS for an additional 14 months beyond the end of life date. Although economic assessments conducted by the OPA show this to be economically viable if the life were continued to 2019, at this point they do not support this option for a 2015 end of life date. The OPA assessment results for the 2015 end of life date hold true even with the potential deferral of the additional 500-230 kV auto-transformer capacity required in the area, taken into account.
- OPA continues to work with OPG to pursue a number of proposals around Pickering. The merits of the options depend on a large number of factors that are subject to change. This work is done in a broader context of integrated planning.

- OPA understands that, barring any major unforeseen approvals issues, Hydro One is capable of meeting a spring 2015 in service date for "Oshawa Area" TS, as outlined in the attached single line diagram.
- OPA also understands that to meet a spring 2015 in-service date, Hydro One may need to incur or commit substantive expenditures in the 2012 - 2013 period, which the company will seek to recover in an appropriate regulatory proceeding. Hydro One will check with OPA on status and outlook before major expenditures are made.
- Joint studies with Hydro One Networks, the IESO and the OPA confirm that stop gap measures such as adding 500-230 kV autotransformers at Cherrywood TS or Parkway TS are of limited effectiveness and need not be pursued further. The effective option is Oshawa Area TS.

In light of these circumstances, the OPA recommends that Hydro One continue to work toward the objective of incorporating additional 500 / 230 kV auto-transformation capacity at "Oshawa Area" TS for a spring 2015 in service date.

Going forward, the OPA also recommends the following actions:

- OPA will make Hydro One aware of changes that it believes will affect the need date for "Oshawa Area" TS, as soon as the information becomes available.
- Hydro One will inform OPA before any major expenditure is undertaken, so that the expenditure decision can be assessed with the best information available at that time.
- OPA will provide the necessary evidence to support the need, scope and timing for the Oshawa Area TS project.

The above process will ensure the best available information is factored into decisions affecting costs to Ontario rate payers, while addressing the reliability risk to electricity users from potential early retirement of Pickering GS

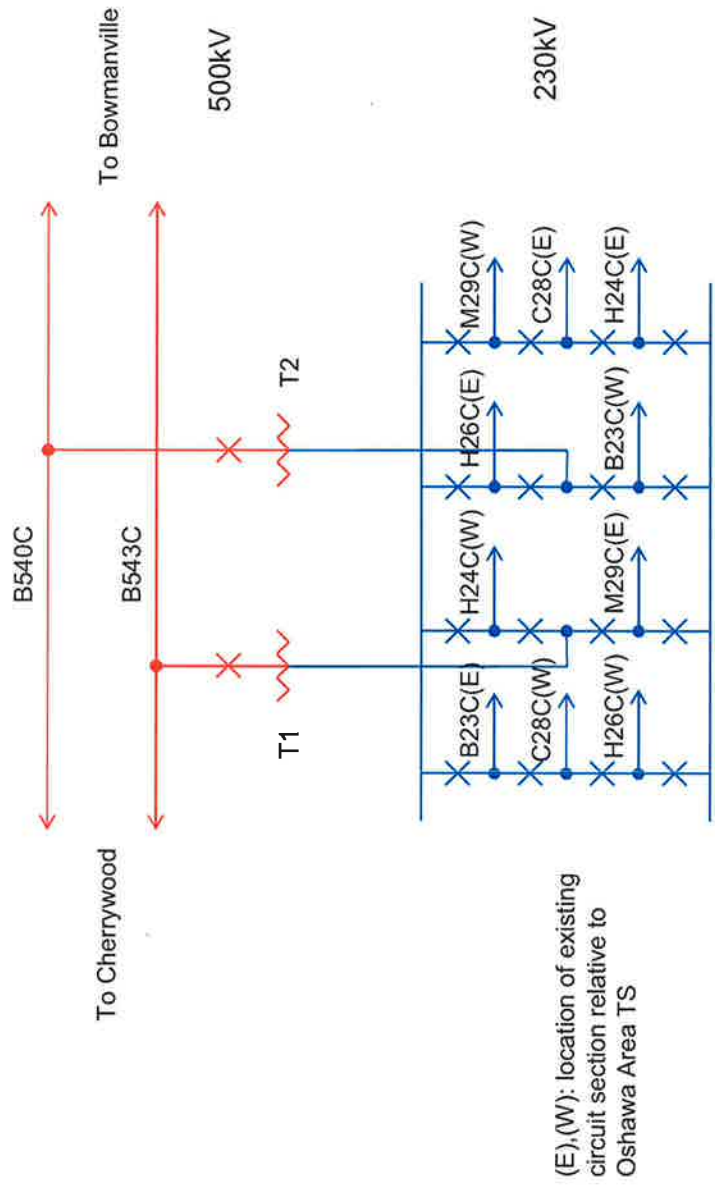
I look forward to continuing our effective working relationship on this project.

Yours truly,



Amir Shalaby
Vice-President, Power System Planning
Ontario Power Authority

cc: Kim Warren, Independent Electricity System Operator



“Oshawa Area” TS: Single line diagram

