

Assessment of the Rationale for the East-West Tie Expansion

Second Update Report

May 5, 2014



ONTARIO
POWER AUTHORITY 

1 1.0 EXECUTIVE SUMMARY

2 The East-West Tie (“E-W Tie”) expansion project continues to be the OPA’s recommended alternative to
3 maintain a reliable and cost effective supply of electricity to the Northwest for the long term.

4 This report provides the Ontario Power Authority’s (“OPA”) second updated assessment of the rationale
5 for the E-W Tie expansion project, as ordered by the Ontario Energy Board (“Board”). It builds upon and
6 updates two previous OPA E-W Tie reports: i) the OPA’s original June 2011 Report, titled “Long Term
7 Electricity Outlook for the Northwest and Context for the East-West Tie Expansion” (“June 2011
8 Report”); and ii) the OPA’s first need update report, submitted to the Board in October 2013, titled
9 “Updated Assessment of the Rationale for the East-West Tie Expansion” (“October 2013 Report”).

10 Changes in this update include: a more moderate outlook for electricity demand growth in Ontario’s
11 Northwest (“the Northwest”), with assessments of higher and lower demand scenarios; increased
12 capability of the existing E-W Tie; and refinements to the cost assumptions for gas-fired generation in
13 the Northwest.

14 Under the Reference assumptions, the E-W Tie expansion results in a net benefit of approximately
15 \$220 million when compared with a no-expansion alternative. Based on the sensitivities tested, the
16 E-W Tie expansion ranges from a net benefit of over \$700 million to a net cost of approximately
17 \$350 million, associated with the Low demand forecast.

18 The E-W Tie expansion would provide additional benefits, beyond meeting the reliability requirements
19 of the Northwest: system flexibility, removal of barriers to resource development, reduced congestion
20 payments, reduced losses, and improved operational flexibility. These benefits are additive to the
21 economic benefits and form an important part of the rationale for the project. The OPA expects to
22 provide a more detailed discussion of these benefits in its final assessment of needs and alternatives, as
23 supporting evidence in a Leave to Construct application for the E-W Tie expansion.

24 2.0 INTRODUCTION

25 The E-W Tie expansion continues to be the OPA’s recommended alternative to maintain a reliable and
26 cost-effective supply of electricity to the Northwest for the long term.

27 The Ontario Government’s 2010 Long-Term Energy Plan (“2010 LTEP”), published in November 2010,
28 identified the E-W Tie expansion as a priority transmission project needed for maintaining system
29 reliability, enabling renewable energy connections and accommodating increasing electricity demand in
30 the Northwest. The new E-W Tie would expand the existing E-W Tie, a transmission line running
31 between Wawa and Thunder Bay. On March 29, 2011, the Minister of Energy wrote to the Board to

1 express the government’s interest in the Board undertaking a designation process to select the most
2 qualified and cost-effective transmitter to develop the E-W Tie project.

3 In response to the Minister’s letter, the Board initiated a process to designate a transmitter to
4 undertake development work for the E-W Tie project. The Board requested that the OPA provide a
5 report documenting the preliminary assessment of the need for the E-W Tie expansion. In response, the
6 OPA provided the June 2011 Report. The Board then proceeded with the designation process, which
7 concluded on August 7, 2013, when the Board issued its Phase 2 Decision and Order, identifying Upper
8 Canada Transmission Inc. (o/a “NextBridge Infrastructure”) as the designated transmitter. In its decision,
9 the Board also ordered the OPA to provide two further need updates, one in the early stages of
10 NextBridge Infrastructure’s development schedule and one at the mid-point. The OPA committed to
11 providing these need update reports to the Board by October 8, 2013 and May 5, 2014, respectively. On
12 September 26, 2013 the Board issued a Decision and Order which requires the OPA to file its need
13 update reports by these dates.

14 Since the filing of the October 2013 Report, the Government of Ontario has released its 2013 Long-Term
15 Energy Plan (“2013 LTEP”), published on December 2, 2013. The 2013 LTEP continues to identify the
16 E-W Tie expansion as an important source of electricity supply for Northwestern Ontario.

17 This report constitutes the second need update report (i.e. May 5, 2014) requested by the Board. It
18 builds upon and updates the June 2011 Report and October 2013 Report. It focuses on major changes
19 that have occurred since the October 2013 Report and, based on these changes, provides an updated
20 statement of the need for the E-W Tie expansion.

21 Section 3 of this report provides an updated conservation and demand forecast for the Northwest. It
22 reflects changes since October 2013 and identifies major drivers for future electricity demand.
23 Sections 4 and 5 analyze current and future internal and external resources that supply the Northwest
24 and provide an update on Northwest capacity and energy supply needs. Section 6 provides an updated
25 analysis of two alternatives that would form the backbone of an integrated plan for reliable electricity
26 supply to the Northwest: a case with no E-W Tie expansion, in which gas generation addresses the
27 incremental Northwest supply needs; and the E-W Tie expansion with additional resources as needed to
28 address remaining supply gaps. Section 7 concludes with the OPA’s recommendation.

29 **3.0 NORTHWEST CONSERVATION AND DEMAND**

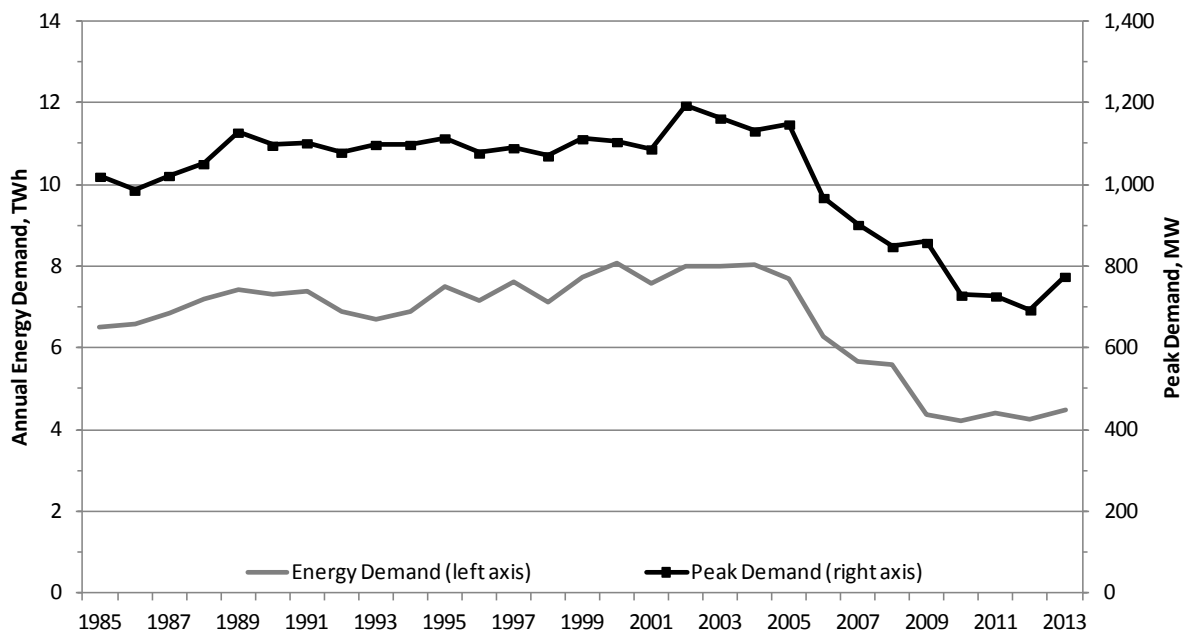
30 Since the October 2013 Report, the OPA has maintained regular discussion with stakeholders and
31 customers in the Northwest and has continued to monitor activities which may affect electrical demand
32 in the region. The updated forecast presented in this report reflects updated information and provides a
33 range of electrical demand forecasts that are based on scenarios of industrial development. As noted in
34 the OPA’s previous two need update reports, Northwest demand is dominated primarily by large,

1 industrial consumers, and can therefore fluctuate significantly in response to changing economic and
2 market conditions. This forecast was developed to capture this fluctuation in order to develop
3 economically prudent options to serve demand and maintain grid reliability.

4 3.1 Historical Northwest Demand

5 Historical electricity demand in the Northwest is presented in Figure 1 below. This update includes
6 finalized actual energy and demand data from 2013, which was not available when the October 2013
7 Report was prepared. The winter of 2013 saw an increase in demand and energy consumption in the
8 Northwest, driven primarily by the residential sector due to a combination of extreme temperatures and
9 economic factors, as well as modest growth in the industrial sector. The same pattern is expected for
10 the winter months of 2014 based on preliminary data. The Northwest electricity system has performed
11 well under the higher load conditions of 2013 and 2014.

12 **Figure 1. Historical Northwest Electricity Demand**



13

14 3.2 Drivers of Northwest Demand

15 The OPA continues to work together with interested parties to understand the drivers for demand in the
16 Northwest, including engagement with stakeholders such as Common Voice Northwest, mining
17 companies and an industry association, and discussions with the Ontario Ministry of Northern

1 Development and Mines. The updated forecast reflects changes in the outlook for industry, as well as
2 other developments in the Northwest.

3 In comparison to the October 2013 Report, drivers of Northwest demand that have changed include:
4 more gradual and moderate expansion in the mining sector; updated scenarios for TransCanada
5 PipeLine's ("TCPL") proposed "Energy East" project; and a slower recovery of the pulp and paper
6 industry.

7 **Mining sector and Ring of Fire**

8 To produce an informed update to the Northwest load forecast, the OPA engaged a number of mining
9 companies with developments in Ontario and reviewed available technical documents to understand
10 the feasibility, likelihood and timing of various mining developments, which are reflective of factors such
11 as commodity prices, and access to capital and human resources. The result is a more gradual and
12 moderate outlook for mining development in the Northwest compared to the expectations underlying
13 the October 2013 forecast. Nonetheless, growth in the mining sector continues to account for the vast
14 majority of the forecast demand growth in the Northwest.

15 **Pulp and Paper sector**

16 Since the October 2013 Report forecast was prepared, electricity consumption in the pulp and paper
17 sector has continued to decline. This trend, coupled with the expectation of more behind-the-meter
18 generation installations by pulp and paper customers, combine to produce a relatively flat outlook for
19 this sector, with potential for modest growth in the long term.

20 **TransCanada Energy East Pipeline**

21 This updated forecast considers current information on the effects of the Energy East pipeline project on
22 Northwest electrical demand. As there are uncertainties in the demand from pumping stations in the
23 Northwest, a range of outcomes was considered.

24 **Other forecast components**

25 Minimal or no change has been made to the assumptions for the remaining components of the
26 Northwest demand forecast since the October 2013 report:

- 27 • forestry sector
- 28 • connection of remote communities
- 29 • residential, commercial and other industrial sectors
- 30 • conservation

31 The OPA is engaged in ongoing work with local distribution companies to develop a Conservation First
32 framework, consistent with the 2013 LTEP and the March 31, 2014 Conservation First Directive from the

4/14

Ontario Power Authority

1 Ministry of Energy to the OPA, and will continue to update the conservation assumptions for the
2 Northwest accordingly in future need assessments.

3 **3.3 Northwest Demand Scenarios**

4 An updated demand forecast for the Northwest was developed, taking into account the impacts of the
5 various drivers described above. Consistent with the October 2013 Report, the OPA developed three
6 demand scenarios to explore the robustness and flexibility of transmission and supply options under a
7 range of outcomes. Key aspects of the scenarios are as follows:

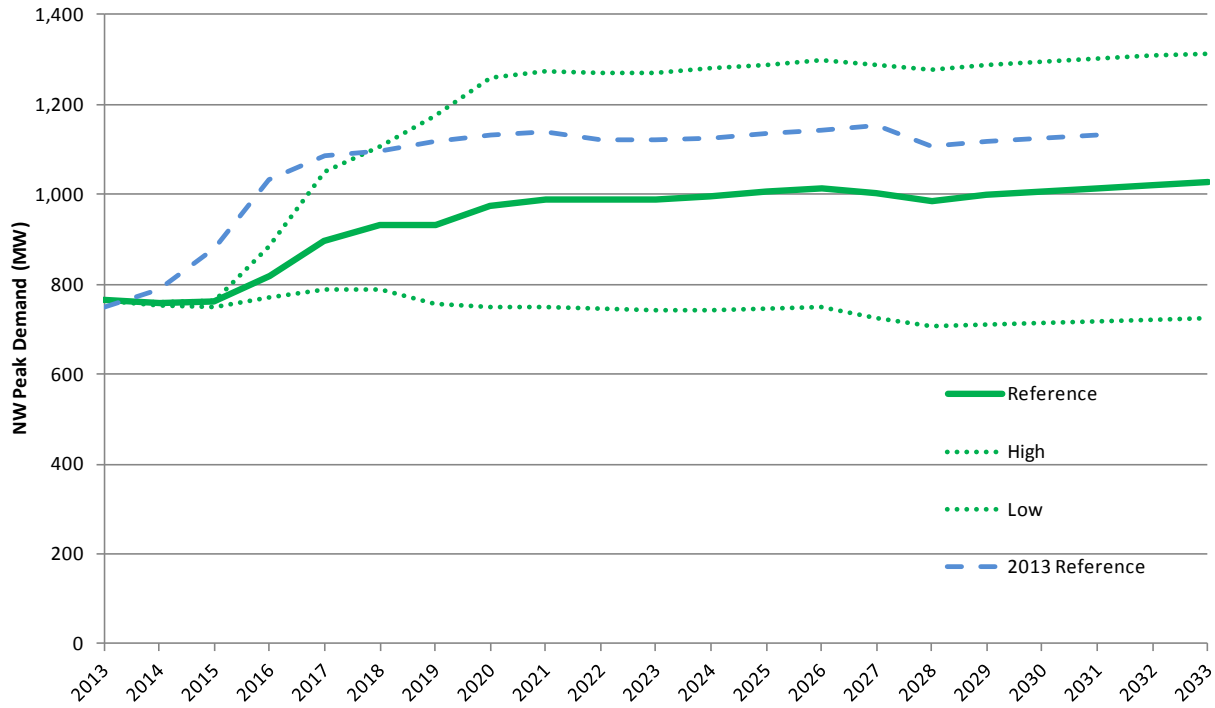
- 8 • **Reference scenario.** In this scenario, mining sector demand includes proposed mines that have
9 passed significant development milestones, as well as a portion of additional proposals. Mining
10 loads are assumed to persist for the expected lifetime of the proposed developments. This
11 scenario includes a relatively flat outlook for the pulp and paper industry, with some moderate
12 growth occurring in the long term, as well as moderate growth in forestry sector in the short
13 and medium term. Residential and commercial sector demand growth is consistent with the
14 economic/demographic view of this scenario. This scenario assumes a likely scenario for Energy
15 East demand.
- 16 • **High Scenario.** This scenario assesses stronger development of the mining and forestry sectors
17 and also reflects moderate growth in the pulp and paper sector beginning in the short term.
18 Higher residential and commercial sector growth is also forecast, consistent with these higher
19 levels of industrial activity. This scenario assumes a maximum demand scenario for the Energy
20 East project.
- 21 • **Low Scenario.** This scenario describes the impact of a more restrained outlook in the mining
22 sector, continued decline of electricity demand in the pulp and paper industry, and moderately
23 declining demand in the forestry sector. This scenario assumes that the Energy East project does
24 not proceed. Residential and commercial sector demands are the same as in the Reference
25 scenario.

26 The demand assumptions for Remote Community connections and other industrial sectors (other than
27 mining, forestry, pulp and paper) are the same in all three scenarios. Conservation varies across the
28 scenarios in accordance with the different gross demand levels.

29 The resulting Northwest peak and annual energy demand scenarios, net of savings from planned
30 conservation, are shown in Figure 2 and Figure 3. The Reference demand scenario shows the Northwest
31 forecast increasing quickly in the midterm, due to advanced mining developments which are expected
32 to come online, with more gradual growth in the long term, driven primarily by expected future growth
33 in the mining sector. The wide range between the High and Low scenarios reflects uncertainty in the
34 assumptions underlying the forecast.

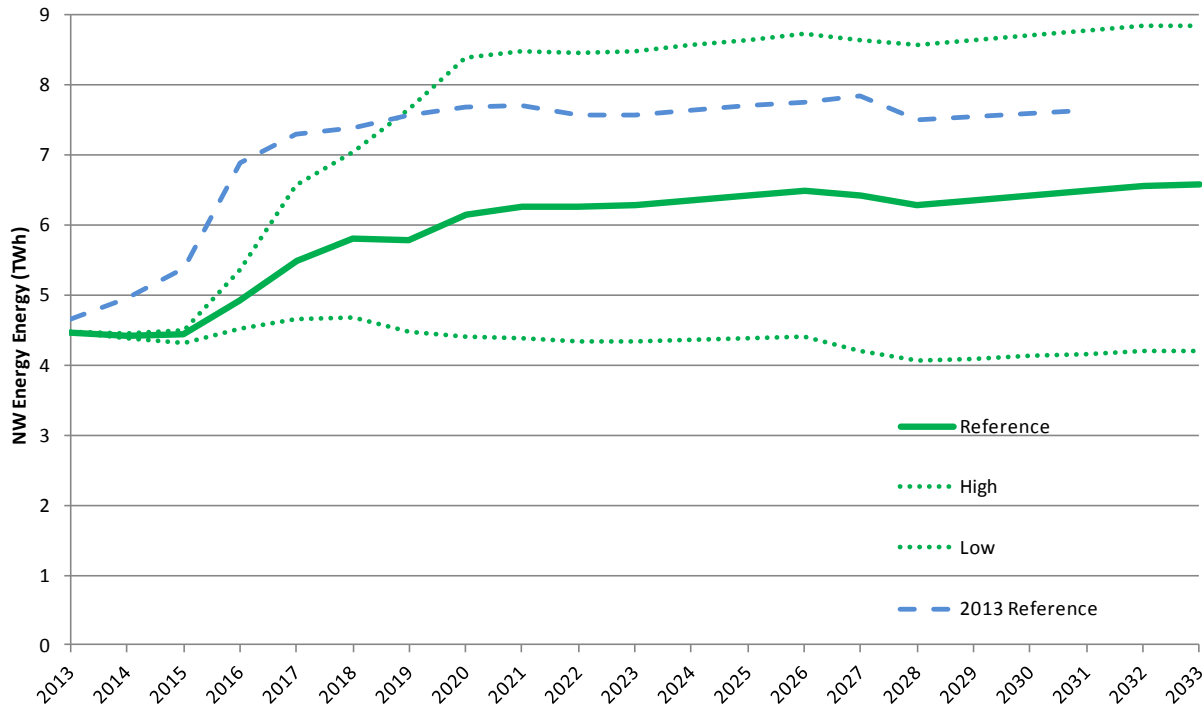
1 For comparison, the reference scenario prepared for the October 2013 Report is also included in
 2 Figures 2 and 3. The current Reference case forecast is lower than the October 2013 forecast. It
 3 increases more slowly, and the long-term outlook is reduced by approximately 125 MW and 1.25 TWh.
 4 The current Reference forecast is of similar magnitude to the low October 2013 scenario.

5 **Figure 2. Net Northwest Peak Demand Forecast Scenarios**



6

1 **Figure 3. Net Northwest Energy Demand Forecast Scenarios**



2
3 **4.0 EXISTING RESOURCES TO SUPPLY NORTHWEST DEMAND**

4 The Northwest relies upon both internal resources (generation located in the Northwest) and external
5 resources (generation outside the Northwest accessed through existing ties) to meet its electricity
6 supply requirements. An update on the Northwest supply outlook since the October 2013 Report is
7 provided below.

8 **4.1 Internal Resources in the Northwest**

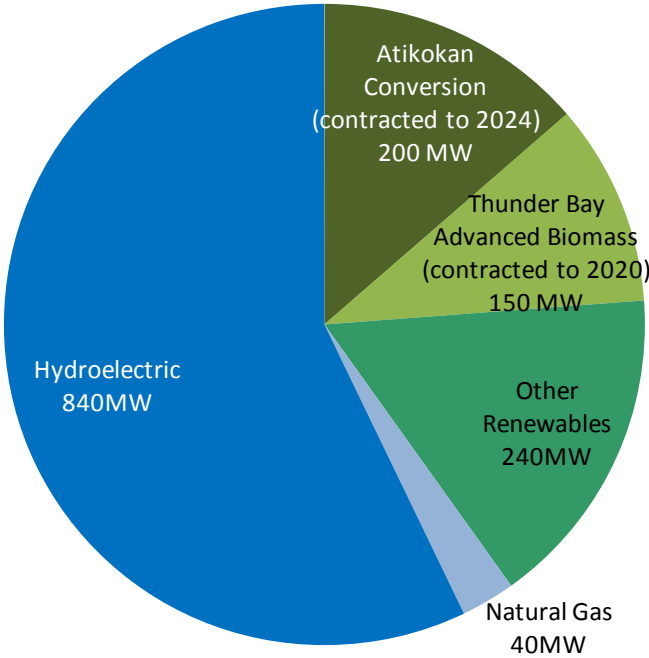
9 The OPA has updated its assumptions regarding supply resources in the Northwest, where new
10 information is available. The following changes have been made since the October 2013 Report:

- 11 • The availability of the Thunder Bay Generating Station (“Thunder Bay GS”) has been updated to
12 reflect the decision to convert one of the units to operate using advanced biomass fuel
13 beginning in 2015. Consistent with the Ministerial Directive to the OPA dated December 16,
14 2013, Thunder Bay GS is assumed to operate for five years with a rated capacity of 150 MW.
15 Given the timeframe of the conversion, it does not have a large impact on the E-W Tie project.
- 16 • A 60 MW generator at Fort Frances is not included as a resource in this update. It is an
17 embedded generation facility and its output is accounted for in the customer’s net load.

- 30 MW of non-hydroelectric renewables (wind, solar and biomass) have come into service since the previous analysis was completed, bringing the total installed capacity of non-hydroelectric renewables to 170 MW. An additional 70 MW of contracted renewables is expected to come into service over the next several years.

The updated installed capacity of Northwest internal resources in the year 2015 is shown in Figure 4.

Figure 4. Northwest Internal Resources by Type in 2015 (Installed Capacity)



4.2 External Resources Supplying the Northwest

Additional supply is provided to the Northwest through the existing E-W Tie, a double-circuit transmission line that links Ontario’s Northeast at Wawa TS to the Northwest at Lakehead TS. To date, the westbound E-W Tie transfer capability used by the OPA in its planning studies has been 175 MW. This limit was based on the prevailing System Control Order (“SCO”), a technical document developed and used by the Independent Electricity System Operator (“IESO”) to govern system operation.

Recently, the IESO updated the Northwest SCO, with the new version coming into effect in the fall of 2013. Under the new SCO, the westbound transfer capability of the existing E-W Tie has increased to 240 MW. This change effectively provides an additional 65 MW of existing resources supplying the Northwest. The eastbound limit for the existing E-W Tie was also updated to 155 MW. This represents a

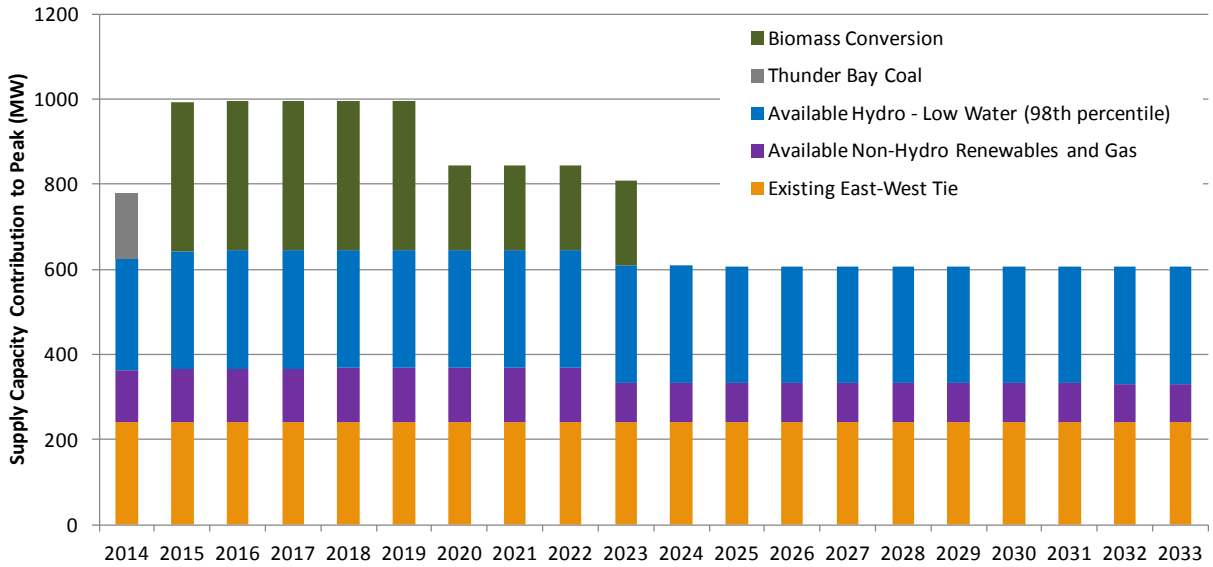
1 decrease of 20 MW compared to the previous limit. These changes are recognized in the technical and
2 economic analysis described in this report.

3 **4.3 Summary of Existing Resources**

4 The existing internal and external resources assumed to be available to supply the Northwest in this
5 planning analysis are shown in Figure 5. The figure reflects the available capacity of internal resources to
6 meet Northwest peak demand under low water conditions. It also includes the westbound capability of
7 the existing E-W Tie.

8 As Figure 5 indicates, available peak supply capacity is expected to be reduced at two points in the
9 planning horizon: in 2020, corresponding to the expiry of the contract for Thunder Bay GS advanced
10 biomass; and in 2024, when the contract for Atikokan biomass generation expires.

11 **Figure 5. Northwest Supply Capacity under Low Water Conditions**



13 **5.0 THE NEED FOR ADDITIONAL SUPPLY FOR THE NORTHWEST**

14 As described in the 2011 and 2013 Reports, the Northwest’s forecast supply needs consist of both
15 capacity and energy components. Based on the current outlook for Northwest demand and supply, the
16 OPA updated the assessment of the reliability and adequacy of the Northwest system. The updated
17 capacity and energy requirements are described below.

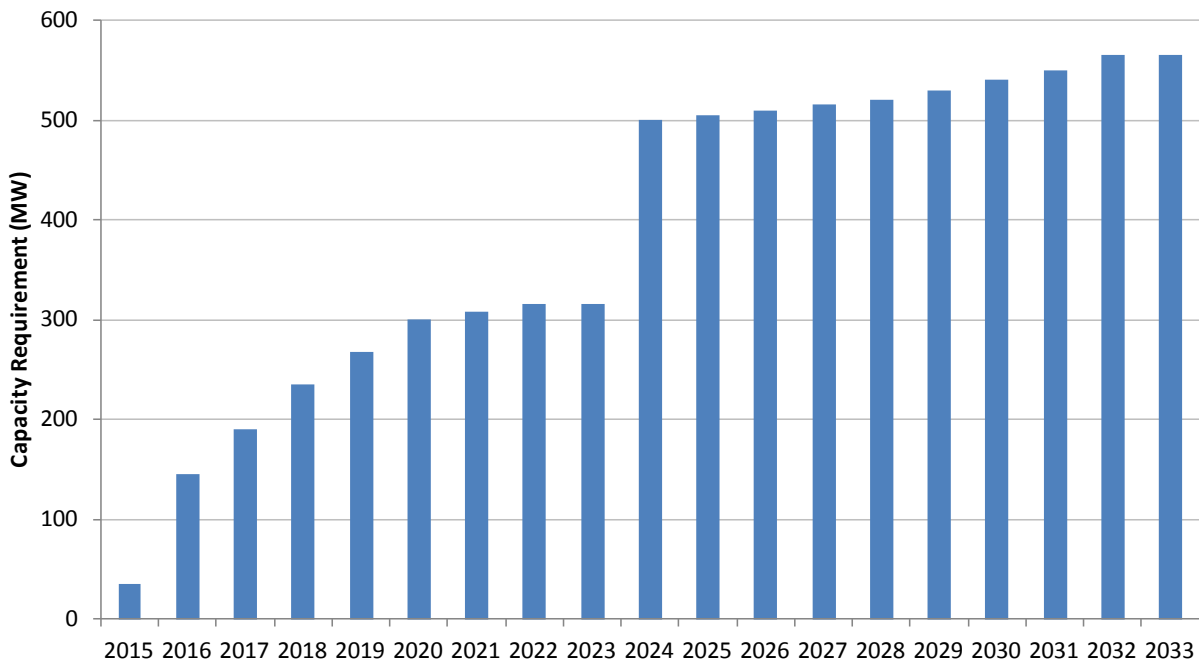
1 **5.1 Expected Capacity Requirement**

2 Consistent with the October 2013 Report, the OPA conducted a reliability assessment using a
3 probabilistic approach to determine capacity requirements in the Northwest. As water conditions have a
4 strong impact on overall supply availability in the Northwest, a range of water conditions was analyzed.

5 The updated capacity shortfall, based on the Reference peak demand scenario and assuming no E-W Tie
6 expansion or additional generation development, is shown in Figure 6. Between 2018 and 2023, the
7 Northwest capacity shortfall is expected to be in the 200-300 MW range. With the expiry of the Atikokan
8 biomass contract in 2024, the shortfall increases to around 500 MW, and then continues to climb
9 gradually with continued forecast load growth.

10 As noted in the October 2013 Report, a capacity shortfall in the interim years before the E-W Tie
11 expansion would come into service is forecast. The shortfall is still expected to begin in 2015, however,
12 with the lower Reference demand forecast and the advanced biomass operation of Thunder Bay GS, the
13 expected interim capacity need is now smaller than in the October 2013 Report. The OPA and IESO will
14 monitor the situation in the coming years and, if needed, deploy measures to address the supply gap.
15 The OPA has issued a Request for Information which may provide additional information on resources
16 that could address this gap.

17 **Figure 6. Expected Incremental Northwest Capacity Requirement**

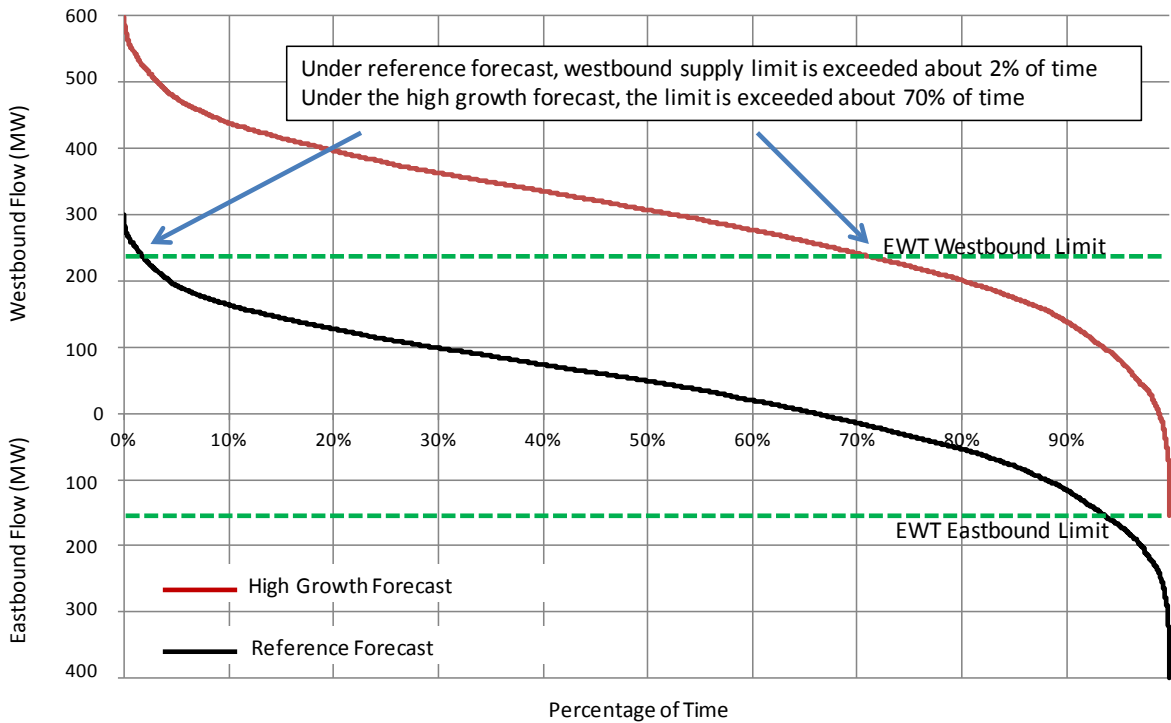


18

1 **5.2 Expected Energy Requirement**

2 The expected energy requirement in the Northwest is defined by the demand forecast, as well as the
3 supply capabilities of local generation and the existing E-W Tie. Figure 7 provides an updated illustrative
4 duration curve based on assumptions consistent with the curve provided in the October 2013 Report:
5 Reference forecast demand, median water conditions, in the year 2020. For comparison, a similar curve
6 based on the High demand forecast is also included. For the Reference demand forecast, the expected
7 westbound flow exceeds the E-W Tie capability about 2% of the time, indicating a lower energy
8 requirement than was reported in the October 2013 Report. This is due not only to the lower demand
9 forecast, but also the increased capability of the existing E-W Tie. Under the High forecast, the
10 westbound flow is exceeded about 70% of time. It should also be noted that in both cases the energy
11 requirement grows with the load forecast over the planning horizon.

12 **Figure 7. Unconstrained Flow and Planning Limits on the Existing E-W Tie for the Year 2020**



13

14 **6.0 ANALYSIS OF ALTERNATIVES TO MEET NORTHWEST SUPPLY NEEDS**

15 As in the October 2013 report, two alternatives to meet the Northwest capacity and energy needs were
16 evaluated. Both reflect variations on an integrated plan for the Northwest, and are defined in terms of

1 the primary “backbone” around which the system in the Northwest would be planned. The alternatives
2 are defined as follows:

3 (1) **No E-W Tie expansion.** In this alternative, all of the forecast capacity and energy needs are met
4 through the staged addition of new gas-fired generation in the Northwest. In the Reference
5 scenario, this involves the installation of a total of 565 MW of gas-fired generation by the end of
6 the planning period.

7 (2) **E-W Tie expansion.** In this alternative, the E-W Tie expansion project provides a foundation for
8 meeting the Northwest’s needs, with additional generation installed to meet any incremental
9 supply requirements that arise by the end of the planning period. The new line would bring the
10 combined transfer capability of the E-W Tie interface from 155 MW to 650 MW eastbound and
11 from 240 MW to 650 MW westbound. In the Reference scenario, a minor need for additional
12 supply beyond the capability of the expanded E-W Tie emerges in the later years of the forecast;
13 the cost of this supply is included in the analysis.

14 In both alternatives, local generation is assumed to consist of new-build natural gas-fired generation.
15 Continuing to operate the Atikokan and Thunder Bay conversions beyond their contemplated expiry
16 dates was not assumed in the alternative analysis as these resources would be more costly than new-
17 build gas generation due to: the expected need for additional capital investment to sustain their
18 operation; higher operating costs; higher fuel costs for continued biomass operation; and location
19 considerations.

20 In the June 2011 and October 2013 Reports, the OPA compared these two alternatives in terms of their
21 cost-effectiveness and other benefits. Based on the updated outlook for the Northwest, the cost-
22 effectiveness analysis has been revised and is described below.

23 The other benefits discussed in the June 2011 Report – system flexibility, removing barriers to resource
24 development, reduced congestion payments, reduced losses, and improved operational flexibility – are
25 still applicable. As there has been no change to these benefits, which are largely qualitative (or in some
26 cases difficult to quantify), an update is not provided in this report.

27 **6.1 Cost-Effectiveness Comparison of Generation and Transmission Alternatives**

28 Consistent with the October 2013 Report, an economic analysis of the two alternatives was conducted
29 and their relative net-present-value (“NPV”) was compared. A sensitivity analysis was also performed to
30 test the impact of a variety of factors on the result.

31 In addition to reflecting the updated capacity and energy needs, the economic analysis includes refined
32 assumptions for natural gas-fired generation costs to reflect the expectation of higher costs in the
33 Northwest.

12/14

Ontario Power Authority

1 Changes to the economic analysis assumptions since the October 2013 Report are as follows:

- 2 • The updated Reference demand forecast was used in the Reference case. Sensitivities to test
3 the impacts of the updated Low and High load growth scenarios on the NPV were performed.
- 4 • The updated existing supply resources described in Section 4, including the updated eastbound
5 and westbound ratings for the existing E-W Tie, are reflected in the analysis.
- 6 • Higher costs of building and operating a natural gas-fired generating facility in the Northwest are
7 assumed in the current analysis. Factors contributing to higher costs include: longer
8 transportation distances for equipment and construction materials, a shorter construction
9 season, and more limited access to gas management facilities. Furthermore, facilities built in the
10 Northwest would likely be sized smaller to meet local requirements and therefore be unable to
11 take advantage of economies of scale. All costs, including capital, fixed operations and
12 maintenance (“FOM”), and gas delivery and management (“GD&M”) are subject to these factors
13 and there is a wide range over which they can vary, depending on how and where the facilities
14 are ultimately built. The GD&M costs are a particular challenge to estimate since dispatchable
15 gas-fired generators have not previously been constructed in the Northwest, and the
16 understanding of these costs is evolving. In the October 2013 Report, a higher GD&M cost for
17 Northwest gas-fired generation was used, but capital and FOM costs were assumed to be
18 equivalent to the South. In this analysis, a mid-range assumption consisting of 25% premiums on
19 capital and FOM costs and a 100% premium on GD&M costs, relative to a similar gas-fired
20 power plant in southern Ontario, was adopted for the Reference case. A range of sensitivities
21 from 25% to 100% cost premiums on all three cost factors was also evaluated.

22 The remaining economic analysis assumptions remain unchanged from the October 2013 Report:

- 23 • The study period extends from 2018 to 2062 in order to capture the full lifetime of the station
24 upgrades associated with the E-W Tie expansion. For planning purposes, the expanded E-W Tie
25 was assumed to come into service by early 2018. The life of the station upgrades was assumed
26 to be 45 years, and 70 years for the line.
- 27 • The NPV of the cash flows is expressed in 2015\$CDN.
- 28 • Median-water hydroelectric energy output was used for energy simulation purposes.
- 29 • New capacity in the Northwest and the rest of Ontario was added, as required, to satisfy
30 reliability criteria. These capacity needs were determined as described in Section 5.1. A
31 sensitivity to determine the impact of adding 100 MW of gas-fired generation in the Northwest
32 was performed.

- 1 • The NPV analysis was conducted using a 4% real social discount rate. Sensitivities of 2% and 6%
2 real discount rates were performed.
- 3 • For planning purposes, capital cost estimates of \$100 million for the E-W Tie station facilities
4 and \$500 million for the line were used. As costs are expected to be refined through project
5 development work, the OPA employed the same cost estimates used in the June 2011 and
6 October 2013 Reports in this update.
- 7 • Natural gas prices were assumed to be an average of \$5.50/MMBtu throughout the study
8 period. A sensitivity was performed with average gas prices of \$8.50/MMBtu.

9 Under the Reference assumptions, the E-W Tie expansion results in a net benefit of approximately
10 \$220 million when compared with the no-expansion alternative. Based on the sensitivities tested, the
11 E-W Tie expansion ranges from a net benefit of over \$700 million to a net cost of approximately
12 \$350 million, associated with the Low demand forecast.

13 The E-W Tie expansion would provide additional benefits, beyond meeting the reliability requirements
14 of the Northwest: system flexibility, removal of barriers to resource development, reduced congestion
15 payments, reduced losses, and improved operational flexibility. These benefits are additive to the
16 economic benefits and form an important part of the rationale for the project. The OPA expects to
17 provide a more detailed discussion of these benefits in its final assessment of needs and alternatives, as
18 supporting evidence in a Leave to Construct application for the E-W Tie expansion.

19 **7.0 CONCLUSION AND RECOMMENDATION**

20 Since the October 2013 Report was published, the major developments affecting Northwest electricity
21 demand and supply include a more modest load forecast outlook, an increase in the rating of the
22 existing E-W Tie, and the conversion of Thunder Bay GS to advanced biomass operation. In addition, this
23 analysis has factored in an assessment of the potential region-specific costs associated with natural gas-
24 fired generation. These factors combine to indicate a wider range in the estimated economic benefit of
25 the E-W Tie expansion, with the majority of sensitivities resulting in a positive net benefit. The OPA
26 continues to recommend the E-W Tie as the preferred alternative to maintain a reliable and cost-
27 effective supply of electricity to the Northwest over the long term.