Assessment of the Rationale for the East-West Tie Expansion

Third Update Report

Submitted to the Ontario Energy Board
(EB-2011-0140)

December 15, 2015

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Powering Tomorrow.

1.0 KEY FINDINGS/RECOMMENDATIONS

This update confirms the rationale for the East-West Tie ("E-W Tie") expansion project based on updated information and study results. Under the Reference assumptions, the E-W Tie expansion, which permits more effective utilization of provincial resources to meet electricity needs identified for northwestern Ontario ("the Northwest"), provides a net economic benefit of $1.1 billion compared to a local generation alternative. To test the robustness of this result against uncertainty in the assumptions, the IESO considered high and low sensitivities on a number of key parameters, of which forecast demand growth, discount rates, and capital and fixed costs for generation and transmission had the largest impacts. Based on the sensitivities tested, the net benefit of the E-W Tie project ranges from a break-even outcome associated with the Low demand forecast scenario, to $1.7 billion under high demand growth.

The E-W Tie expansion project continues to be the IESO's recommended alternative to maintain a reliable and cost effective supply of electricity to the Northwest for the long term. The IESO supports the continuation of development work in order to maintain the viability of the E-W Tie expansion project with a targeted in-service date by the end of 2020.

2.0 INTRODUCTION

The Ontario Government's Long-Term Energy Plans ("LTEP") have both anticipated the expansion of a new E-W Tie transmission line. The 2010 LTEP, published in November 2010, identified the E-W Tie as a priority transmission project,[1] and the government's subsequent 2013 LTEP, published in December 2013 focused on the unique needs of Northern Ontario and included the E-W Tie expansion project.[2] The E-W Tie expansion project is intended to increase the transfer capability into the Northwest by adding a new transmission line roughly parallel to the existing E-W Tie transmission line, which extends between Wawa and Thunder Bay.

The Minister of Energy's letter to the Ontario Energy Board ("Board") of March 29, 2011 was the impetus for the Board undertaking a designation process to select the most qualified and cost-effective transmitter to undertake development work for the E-W Tie project. Early in the proceeding (EB-2011-0140), the Board requested that the former Ontario Power Authority ("OPA")[3] provide a report documenting the preliminary assessment of the need for the E-W Tie expansion. In response, the OPA filed its original report in June 2011, titled "Long Term Electricity Outlook for the Northwest and Context for the East-West Tie Expansion" ("June 2011 Report").

[1] Ontario's 2010 Long-Term Energy Plan: Building Our Clean Energy Future, Figure 12, page 47.

[2] Ontario's 2013 Long-Term Energy Plan: Achieving Balance, page 52.

[3] On January 1, 2015, the Ontario Power Authority ("OPA") merged with the Independent Electricity System Operator ("IESO") to create a new organization that combined the OPA and IESO mandates. The new organization is called the Independent Electricity System Operator. Any assessments prior to January 1, 2015 were provided by the former OPA.

This report constitutes the Independent Electricity System Operator's ("IESO") third updated assessment of the rationale for the E-W Tie expansion project, as ordered by Board decisions Regarding Reporting by Designated Transmitter dated September 26, 2013 and January 22, 2015.[4] It builds upon and updates three previous E-W Tie reports prepared by the OPA: i) the original June 2011 Report; ii) the first update report, filed with the Board in October 2013, titled "Updated Assessment of the Rationale for the East-West Tie Expansion" ("October 2013 Report"); and iii) the second update report titled "Assessment of the Rationale for the East-West Tie Expansion" filed with the Board on May 5, 2014 ("May 2014 Report").

This report focuses on major changes that have occurred since the May 2014 Report and, based on these changes, provides an updated statement of the rationale for the E-W Tie expansion. This report also follows several additional filings with the Board in the E-W Tie proceeding, namely: i) the OPA's September 30, 2014 need update letter regarding the development schedule, including a recommendation and explanation of the rationale for revising the project's in-service date from 2018 to 2020; ii) the OPA's December 19, 2014 submission, titled "Context for Revised Development Schedule" filed with Upper Canada Transmission, Inc.'s ("UCT") December 19, 2014 response to the Board's October 29, 2014 letter requesting that UCT and the OPA collaborate to produce a revised development schedule for the E-W Tie based on the OPA's September 30th updated information; iii) the IESO's supporting letter of May 5, 2015 to UCT's May 15, 2015 filing with the Board provided to confirm that UCT's revised development schedule is consistent with the IESO's current information regarding the need for the E-W Tie expansion project.

In the filings referenced above, the OPA and IESO advocated that the additional time for development work afforded by the deferral of the in-service date from 2018 to 2020 be used to investigate potential cost savings for the project. To this end, UCT (o.a. NextBridge Infrastructure), the transmitter designated to develop the E-W Tie expansion project, requested that Parks Canada reconsider its decision regarding access to Pukaskwa National Park, but in June 2014 was denied that request. The IESO has also investigated the potential for cost savings from staging the project's implementation, and has refined the models and assumptions underlying this analysis, based on more detailed analysis and research.

The remainder of this report is organized as follows. Section 3 describes new activities undertaken to refine models and assumptions in preparing this update. Section 4 provides an updated conservation and demand forecast for the Northwest. It reflects changes since May 2014 and identifies major drivers for future electricity demand. Sections 5 and 6 analyze current and future internal and external resources that supply the Northwest and provide an update on Northwest capacity and energy supply needs. Section 7 provides an updated analysis of two alternatives to meet these needs: a case with no E-W Tie expansion, in which gas generation addresses the Northwest supply needs; and the E-W Tie expansion. Section 8 summarizes the IESO's recommendation.

[4] Board Decision and Order Regarding Reporting by Designated Transmitter dated September 26, 2013, page 4, and January 22, 2015, page 5.

3.0 ACTIVITIES UNDERTAKEN IN PREPARING THIS UPDATE

In the year since the OPA issued its letter deferring the E-W Tie expansion, the IESO has undertaken a variety of activities to investigate potential areas for cost savings, update system capability and Northwest operational needs, and refine and update the models and assumptions used in this assessment. These activities are introduced here, to provide context for the updated results and information presented in subsequent sections of this report.

Updated Transmission Cost Estimates

For this update, the IESO asked the respective transmitters to review the capital cost estimates for the new line and the station upgrades. Based on the most recent information, and accounting for Parks Canada's decision not to allow a route through Pukaskwa National Park, the previous planning estimate of $500 million for the line was confirmed by NextBridge Infrastructure.

For the station costs, Hydro One provided a revised estimate of approximately $150 million for the 650 MW E-W Tie expansion, up from the previous planning estimate of $100 million, reflecting more detailed design work than was previously available. This estimate accounts only for costs directly attributable to the E-W Tie project. Costs associated with a portion of the station upgrade work that would be required to enable the existing system to meet new NERC standards while maintaining system capability and operational requirements, regardless of whether the E-W Tie expansion goes ahead, was deducted from the station cost estimates.

Staging of Station Facilities

The IESO has identified a potential opportunity to defer costs by staging the installation of station facilities, while still maintaining reliability. This would involve an interim stage consisting of "twinning" the circuits, creating two "super-circuits", one carried by the existing E-W Tie line structures and the other on the new line. This interim stage would provide a westbound transfer capability of approximately 450 MW.

The interim stage would allow for approximately $100 million of the station facility costs to be deferred.

Refined Transmission System Limits

The IESO has continued to refine its studies of transmission system limits and interface capabilities, reflecting the most up-to-date available supply and demand information and application of new reliability criteria. These updated limits are reflected in updates to the capacity and energy models underlying the E-W Tie analysis.

Previously, the reported westbound capability of the existing E-W Tie was based on voltage and transient stability limitations. In this update, the westbound capability of the existing E-W Tie has been revised downward based on further study to assess thermal limitations on the existing system (see section 5.2). This means that the incremental capacity provided by the E-W Tie expansion is greater. It also has the effect of increasing the generation capacity requirements in the generation alternative, all else being equal, compared to the higher existing E-W Tie limit used in the May 2014 Report.

The transfer capabilities of transmission interfaces outside the Northwest have also been refined in this update. The eastbound limit on the interface between Wawa and Sudbury, and the southbound limit between Sudbury and southern Ontario, have both been modeled to more accurately reflect their current capabilities to export power under system peak conditions. In the generation alternative, this has the effect of reducing the effectiveness of Northwest generation in providing capacity to the rest of the province.

Refined Resource Assumptions

The IESO continually updates its assumptions and models by observing market trends and conducting research. Since the May 2014 Report was published, the IESO has updated its assumptions for natural gas-fired generation, with a particular emphasis on generation sited in the Northwest, through third party consultants, external resources, and past procurement experience.

New learning suggests that to provide reliable peak capacity in the Northwest, storing reserve fuel on-site, at a relatively small capital and operating cost increase, is more cost-effective than procuring “firm” Gas Delivery and Management (“GD&M”) services. Due to pipeline infrastructure, limited natural gas storage capacity in northern Ontario, and a mismatch in the commitment timeframes for gas and electricity, procuring “firm” service in the Northwest is expected to be more costly than the same level of GD&M service in southern Ontario. Having fuel on-site would allow a developer to procure “interruptible” GD&M services for natural gas as the primary fuel, but with a backup fuel supply in case service is interrupted. The onsite fuel could feasibly be diesel fuel oil, liquefied natural gas or compressed natural gas. Based on discussions with natural gas distribution companies about historical gas demand interruptions in the Northwest, the on-site fuel is expected to rarely be called upon.

In this update, the cost and technology assumptions for new-build natural gas-fired generation installed in the Northwest—i.e., the alternative to the E-W Tie assessed in this report—are based on this on-site reserve fuel strategy.

4.0 NORTHWEST CONSERVATION AND DEMAND

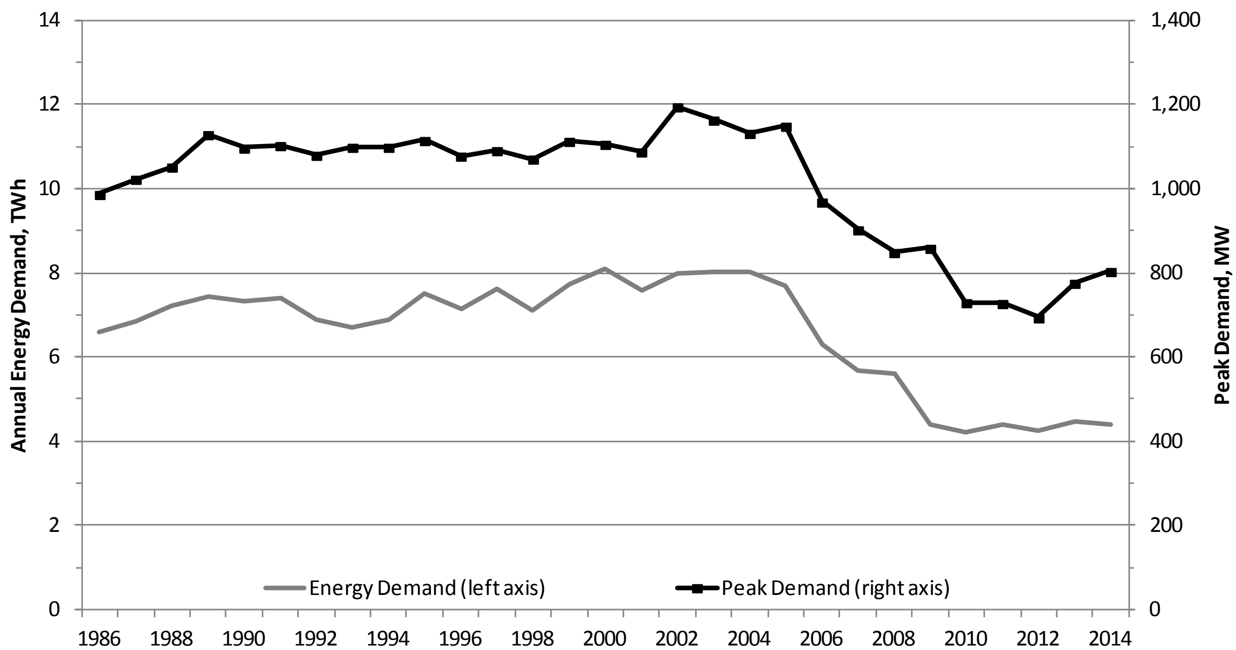
Throughout the planning and development of the E-W Tie expansion project, the IESO has maintained regular discussion with stakeholders and customers in the Northwest and continues to monitor developments that may affect electrical demand in the region. The forecast in this report reflects updated information and provides a range of demand scenarios based on the inherent uncertainty of industrial development in the region. As noted in the previous two need update reports, Northwest electrical demand is dominated by large, industrial customers and can fluctuate significantly in response to changing economic and market conditions. The Northwest is a winter-peaking region, in contrast to southern Ontario where electricity demand usually peaks during the summer months.

In this update, the demand forecast has increased marginally in magnitude, with growth occurring slightly later than in the May 2014 forecast, based on updated information of various developments.

4.1 Historical Northwest Demand

Historical electricity demand in the Northwest is presented in Figure 1 below. This update includes actual energy and demand data from 2014, which was not available when the May 2014 Report was prepared. The winter of 2014 saw an increase in demand in the Northwest driven by extreme temperatures and modest growth in the industrial sector. The Northwest electricity system performed well under the higher demand conditions of 2014, which included a winter peak of approximately 800 MW, and annual energy demand of almost 4.5 TWh.

Figure 1. Historical Northwest Electricity Demand



4.2 Drivers of Northwest Demand

The IESO continues to work together with interested parties to understand the drivers for demand in the Northwest, including engaging with stakeholders such as Common Voice Northwest, mining companies and industry associations, and carrying out discussions with the Ontario Ministry of Northern Development and Mines. The updated forecast reflects changes in the outlook for industry, as well as other developments in the Northwest.

In comparison to the May 2014 Report, drivers of Northwest demand that have changed include: more certainty in the development of several mining projects; updated information on the electricity requirements and timing associated with the TransCanada PipeLines Limited ("TCPL") proposed "Energy East" project; and consideration of recent plant closures in the pulp and paper sector.

Mining Sector

The IESO has continued to engage mining companies with developments in Ontario and review technical documents to understand the feasibility, timing and likelihood of various developments. Factors such as commodity prices, access to capital and environmental considerations act as indicators of potential growth in the sector. Several mining projects in the Fort Frances and Red Lake areas have advanced to construction or initial production phases and various other projects throughout the region have had success raising capital and advancing their feasibility and environmental assessments. On the other hand, several other projects have experienced set-backs due to factors such as low commodity prices and environmental hurdles. The demand forecast considers the latest available information on the location, size and stage of development of mining projects in the Northwest.

Pulp and Paper Sector

Ontario's pulp and paper sector has been in decline for over 10 years. This decline continued in 2014 with the closure of two Ontario plants, one in the Northeast and one in the Northwest. There is a potential for demand stabilization from the retrofitting of old pulp and paper facilities to produce other fibers such as Rayon, however a substantial recovery of the pulp and paper sector is considered unlikely.

TransCanada Energy East Pipeline

This updated forecast includes updated information on the electrical requirements of the Energy East pipeline project. Two demand forecasts were considered for this project—medium and high—reflecting the impacts on Northwest demand of two alternate connection options proposed by TCPL.

Other Forecast Components

Minimal or no change has been made for the remaining components of the Northwest demand forecast since the May 2014 Report:

- Forestry sector
- Connection of remote communities remains on track for 2020
- Natural growth in residential, commercial and other industrial sectors

The IESO remains engaged in working with local distribution companies ("LDC") to implement the Conservation First framework, consistent with the 2013 LTEP and the March 31, 2014 Conservation First Directive from the Ministry of Energy to the OPA. LDC progress towards meeting the conservation targets will continue to be tracked through Conservation and Demand Management ("CDM") Plans and evaluation, measurement and verification ("EM&V") activities, and the conservation assumptions for the Northwest will continue to be updated accordingly.

4.3 Northwest Demand Scenarios

An updated demand forecast for the Northwest was developed, taking into account the impacts of the various drivers described above. Consistent with the previous two update reports developed by the

OPA, the IESO has represented demand growth uncertainty in the region by developing three scenarios to explore the robustness and flexibility of transmission and supply options under a range of outcomes. Key aspects of the scenarios are as follows:

- **Reference Scenario.** In this scenario, mining sector demand considers proposed mines that have passed significant development milestones. Mining loads are assumed to persist for the expected lifetime of the proposed developments. This scenario assumes modest growth in the forestry sector in the short and medium term and does not assume recovery of the pulp and paper sector. This scenario assumes the Energy East pipeline will proceed to production in 2020 under the medium demand forecast for this project.
- **High Scenario.** This scenario considers the impact of stronger and faster development in the mining sector which could potentially be driven by factors such as increased commodity prices. This scenario also reflects the stabilization of the pulp and paper sector and assumes the high demand forecast for the Energy East pipeline conversion project.
- **Low Scenario.** This scenario describes a more restrained outlook in the mining sector, continuing decline in the pulp and paper sector, and it assumes that the Energy East pipeline conversion project does not proceed.

The demand assumptions for Remote Communities, residential, commercial and other industries (other than those mentioned above) are the same in each scenario.

The resulting Northwest peak and annual energy demand scenarios, net of savings from planned conservation, are shown in Figure 2 and Figure 3. The Reference demand scenario shows the Northwest forecast increasing quickly in the medium term, due to advancing mining developments which are expected to come online, followed by more gradual growth in the long term. The wide range between the High and Low scenarios reflects the uncertainty in the assumptions underlying the forecast.

For comparison, the Reference scenario prepared for the May 2014 Report is also included in Figures 2 and 3. The current Reference forecast has a slower near-term growth rate than the May 2014 Reference forecast but is higher than the May 2014 Reference forecast in the long term.

Figure 2. Northwest Net Peak Demand Forecast Scenarios

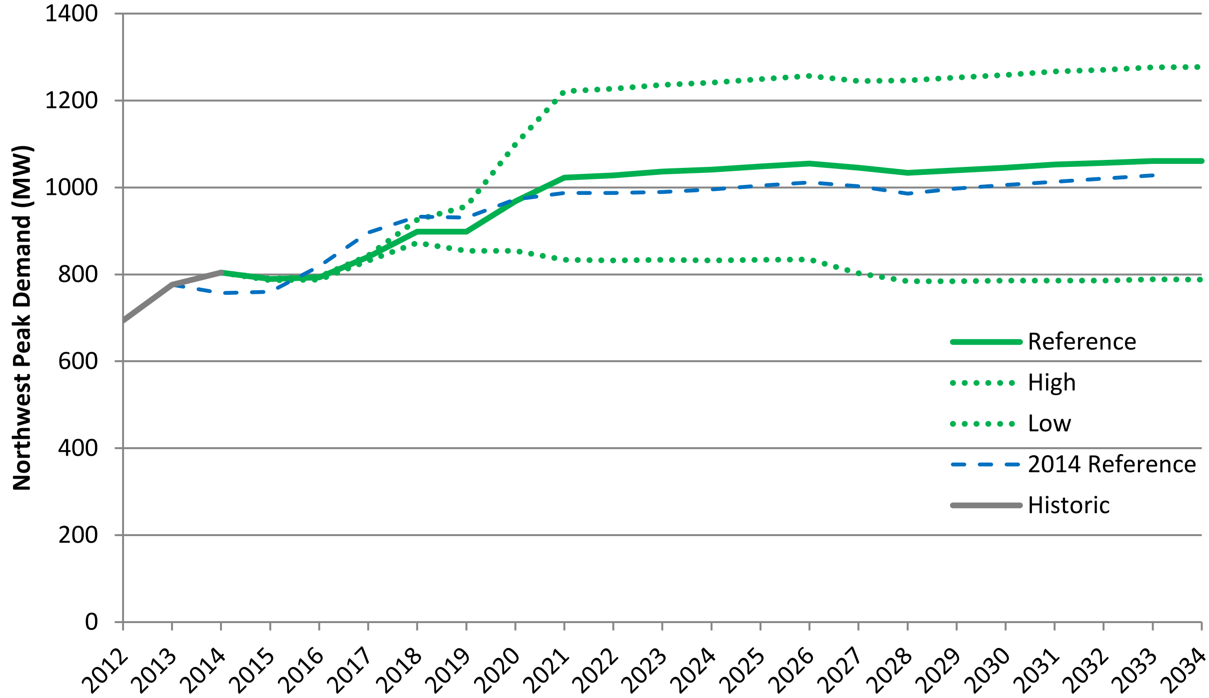
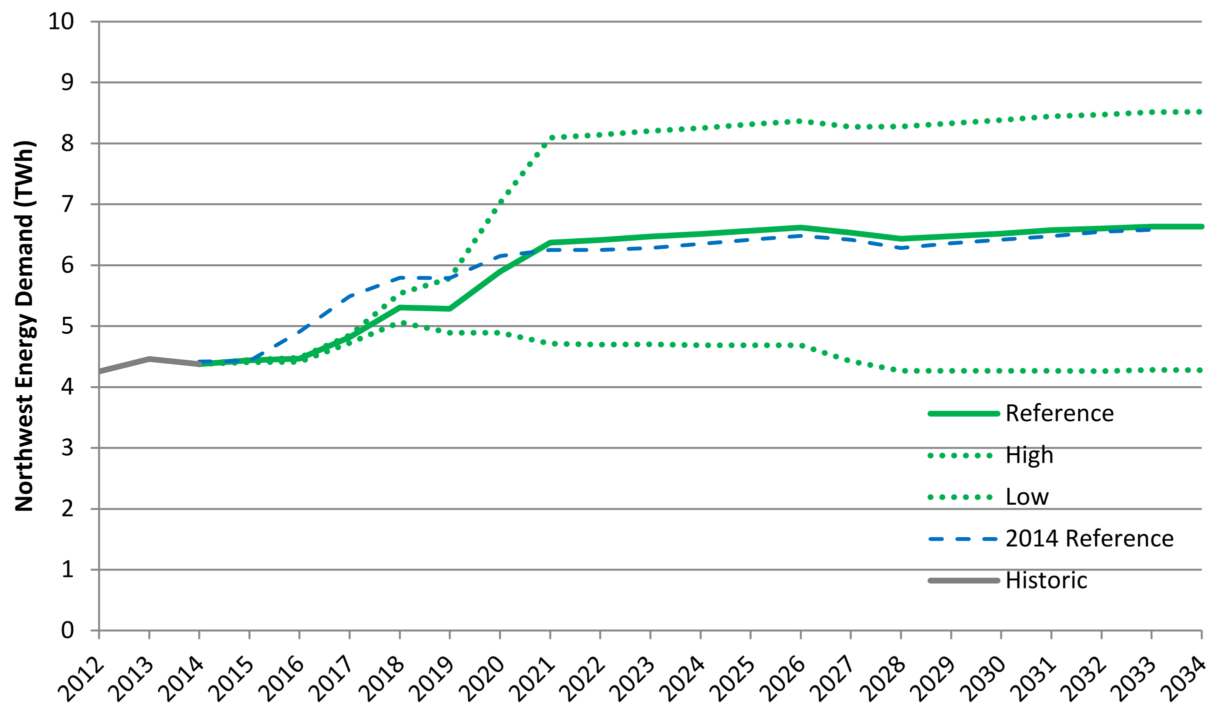


Figure 3. Northwest Net Energy Demand Forecast Scenarios



5.0 EXISTING RESOURCES TO SUPPLY NORTHWEST DEMAND

The Northwest relies upon both internal resources (generation located in the Northwest) and external resources (generation outside the Northwest accessed through existing ties) to meet its electricity supply and reliability requirements. An update on the Northwest supply outlook since the May 2014 Report is provided below.

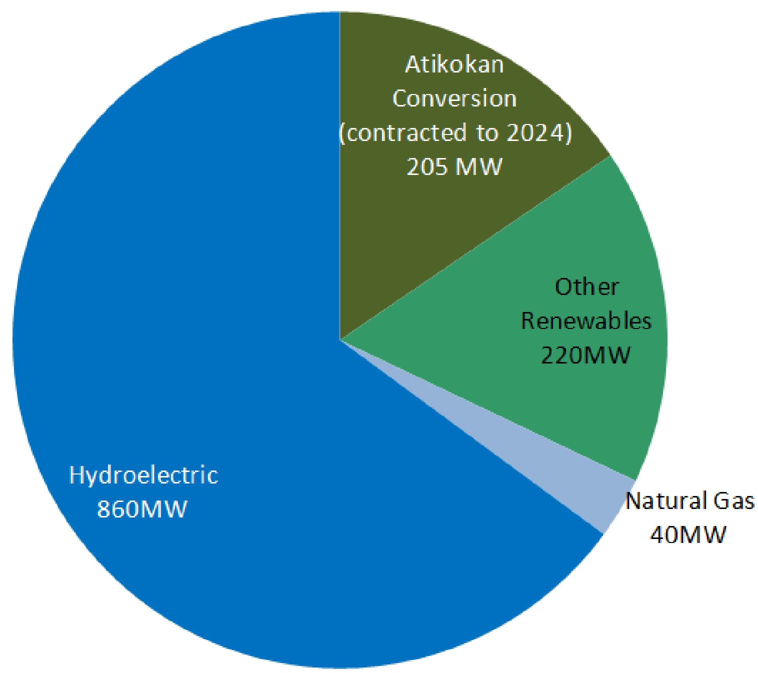
5.1 Internal Resources in the Northwest

The IESO has updated its assumptions regarding supply resources in the Northwest, where new information is available. The following changes have been made since the May 2014 Report:

- The 60 MW generator at Fort Frances, previously considered as embedded generation, has been removed from service as the operation has shut down.
- The rated capacities of the Atikokan Biomass Generating Station and the Thunder Bay Advanced Biomass Generating Station have been adjusted upward slightly based on updated contract and performance data.
- The maximum contracted hydroelectric capacity over the planning period has increased from 835 MW to 861 MW, due to projects that received contracts in the first phase of the Feed-in Tariff (“FIT”) program coming into service.
- The capacity contribution (expected available capacity during peak hours) of hydroelectric generation has been updated based on new data and ongoing model improvements. The May 2014 Report assumed a winter capacity contribution of around 32% during low water years; in this report, the winter capacity contribution during low water years has been increased to 45%.
- The expiration of wind and solar generation contracts has been accounted for in this update.
- Some small-scale distribution-connected solar and gas plants that began operation prior to 2014 are now included in the demand forecast as embedded loads; these resources have been removed from the supply side model.
- 40 MW of new hydroelectric and solar capacity contracted primarily through the FIT program have come into service since the previous analysis was completed.

The updated installed capacity of Northwest internal resources in the year 2020 is 1,325 MW and is shown by fuel type in Figure 4.

Figure 4. Northwest Internal Resources by Type in 2020 (Installed Capacity)



5.2 External Resources Supplying the Northwest

Additional supply is provided to the Northwest through the existing E-W Tie; a 230 kV double-circuit transmission line that extends between Wawa TS and Lakehead TS, linking the Northwest system to the rest of Ontario.

In the May 2014 Report, the westbound transfer capability of the E-W Tie was quoted as 240 MW. This represents the operational limit for transfers across the E-W Tie that will ensure that both transient and voltage stability will be maintained following a double-circuit contingency (fault) involving the E-W Tie.

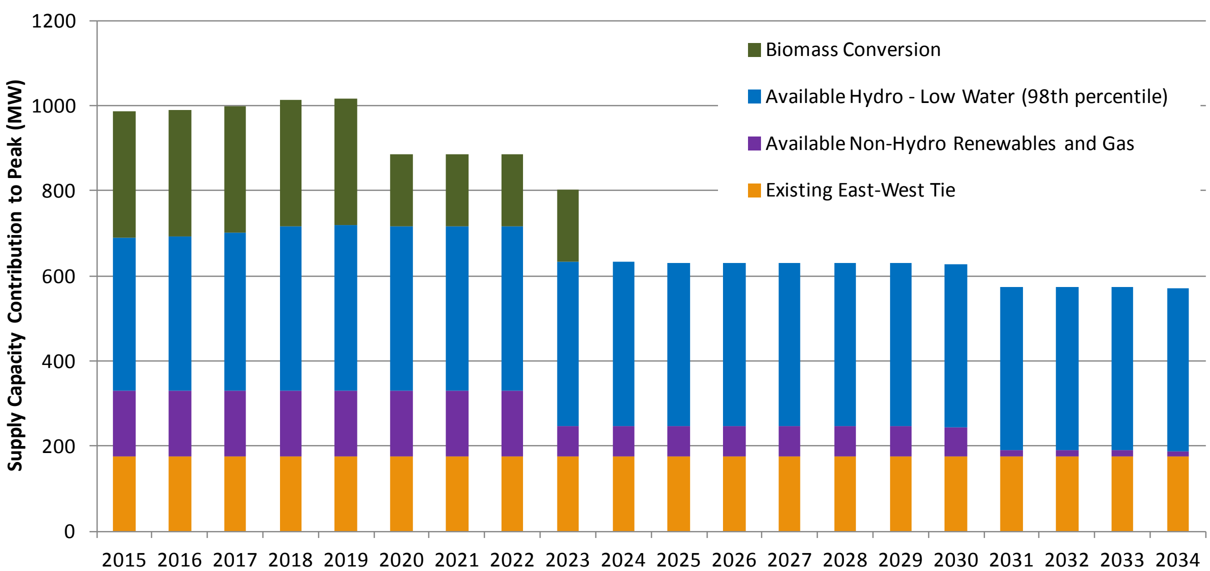
It has subsequently been recognized that following the loss of the double-circuit line between Marathon TS and Lakehead TS, the thermal rating of the parallel 115 kV single-circuit line can be more limiting under certain ambient conditions. Based on the ambient temperatures specified in the Ontario Resource and Transmission Assessment Criteria (“ORTAC”) that are to be used in planning studies, the maximum transfer that can occur across the E-W Tie will be limited to 175 MW during the winter period and 155 MW during the summer by the thermal rating of this 115 kV line. Since these latter values are more restrictive, they have been used in the analysis underlying this report.

5.3 Summary of Existing Resources

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

As Figure 5 indicates, available peak supply capacity is expected to be reduced at two points in the planning horizon: in 2020, corresponding to the expiry of the contract for Thunder Bay Advanced Biomass Generating Station; and in 2024, when the contract for Atikokan biomass operation expires.

Figure 5. Northwest Peak Supply Capacity under Low Water Conditions



6.0 THE NEED FOR ADDITIONAL SUPPLY FOR THE NORTHWEST

As described in previous reports, the forecast supply needs for the Northwest consist of both capacity and energy components. Based on the current outlook for Northwest demand and supply, and incorporating refined assumptions and models described in section 3, the IESO updated the assessment of the reliability and adequacy of the Northwest system. The updated capacity and energy requirements are described below.

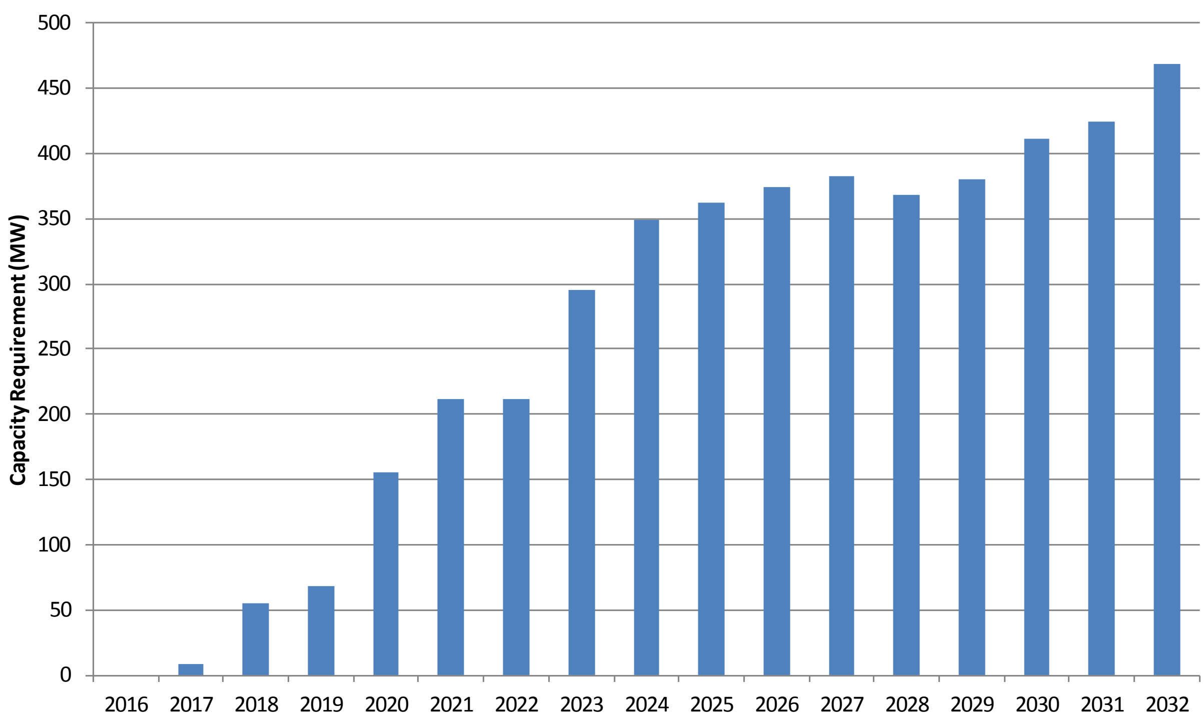
6.1 Expected Capacity Requirement

Consistent with the May 2014 Report, the IESO conducted a reliability assessment using a probabilistic approach to determine capacity requirements in the Northwest. As water conditions have a strong impact on overall supply availability in the Northwest, the probabilistic approach utilizes a range of water conditions.

The updated capacity need, based on the Reference peak demand scenario with no E-W Tie expansion, is shown in Figure 6. The capacity need increases from approximately 150 MW in 2020 to around 350 MW with the expiry of the Nipigon NUG and the Atikokan biomass contracts in 2023 and 2024 respectively. The need for additional capacity continues to climb gradually through the remainder of the planning period due to further load growth and the expiry of some smaller supply contracts, approaching 500 MW in the early 2030s.

As noted in the May 2014 Report, there is a small projected capacity need in the interim years before the E-W Tie expansion, based on assessment of planning criteria.[5] This need is lower than in the May 2014 Report due to the updated demand forecast as well as updated data and assumptions about hydroelectric availability during peak periods, and is associated with low-water years only. The IESO will continue to monitor this need and, if necessary, deploy short-term options to bridge the gap until the E-W Tie expansion comes into service.

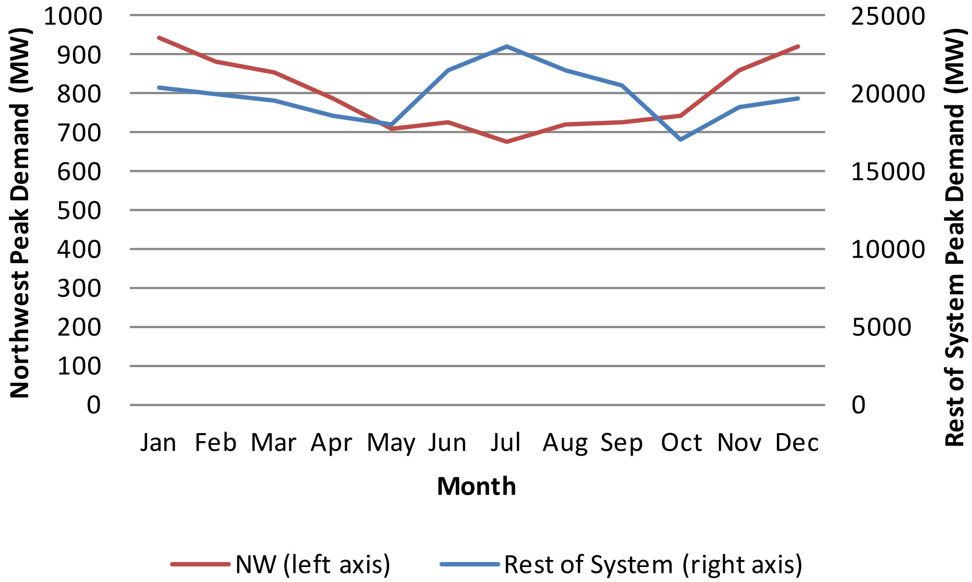
Figure 6. Expected Incremental Northwest Capacity Requirement under Reference Demand



As demand in the Northwest is winter-peaking, the incremental capacity requirements in the Northwest are greatest during the winter months. This is in contrast to southern Ontario, where peak demand requirements are highest during the summer months. This is demonstrated in Figure 7, using 2020 as an example year. This offset in capacity requirements enables the sharing of resources for capacity adequacy and increased system efficiency for energy arbitrage with the E-W Tie expansion.

[5] Assessment of the Northwest system based on operating criteria indicates that there is no capacity need prior to 2020.

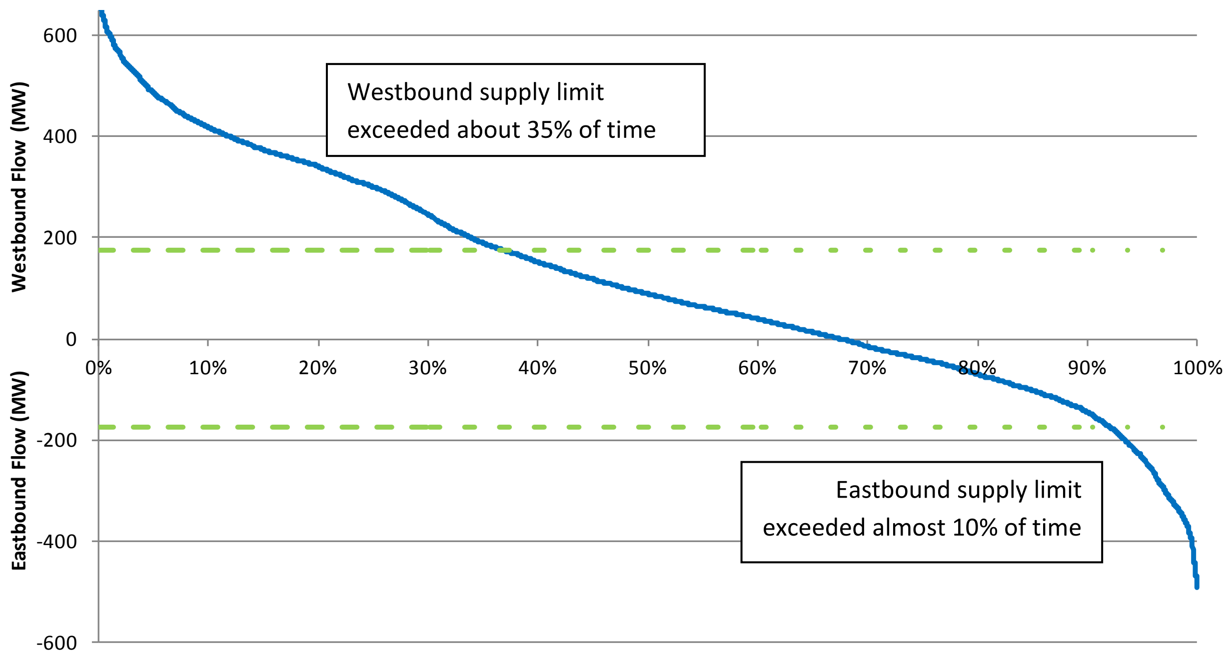
Figure 7. Timing of Demand in the Northwest vs. Rest of Ontario in 2020



6.2 Expected Energy Requirement

The expected energy requirement in the Northwest is defined by the energy demand forecast, as well as the supply capabilities of local generation and the existing E-W Tie. Figure 8 provides an updated forecast E-W Tie flow duration curve, for all hours of the year 2021, based on the latest Reference demand forecast and median water conditions. In this update, expected westbound flows exceed the existing E-W Tie capability approximately 35% of the time. This is based on application of the winter rating of 175 MW throughout the year. Applying the more restrictive limit of 155 MW during the summer months would likely result in a higher level of westbound congestion. Going eastbound, congestion is expected to occur just under 10% of time in 2021. The energy requirement is expected to grow with the demand forecast over the planning horizon.

Figure 8. Unconstrained Flow and Planning Limits on the Existing E-W Tie for the Year 2021



7.0 ANALYSIS OF ALTERNATIVES TO MEET NORTHWEST SUPPLY NEEDS

As in previous reports, two alternatives to meet the Northwest capacity and energy needs were evaluated based on the capacity needs identified for each of the demand scenarios: Reference, Low and High. The alternatives are broadly defined as follows:

(1) **No E-W Tie expansion.** In this alternative, all of the forecast capacity and energy needs are met through the addition of new gas-fired simple cycle gas turbine ("SCGT") generation in the Northwest, with the size of units and the timing of installation defined to meet the needs as they arise during the planning period. Under the Reference demand forecast, a total of 500 MW of generation is included.

(2) **E-W Tie expansion.** In this alternative, the E-W Tie expansion project provides a foundation for meeting the Northwest needs, with additional generation installed to meet any incremental supply requirements. In this update, a staged implementation of the E-W Tie expansion was adopted, with the interim 450 MW E-W Tie stage and the final 650 MW stage installed as required to meet the capacity needs throughout the study period. For the High growth forecast, a need for additional supply beyond the capability of the expanded E-W Tie emerges in the later years of the forecast; this supply is included in the analysis.

In both alternatives, local generation is assumed to consist of new-build natural gas-fired generation, utilizing on-site reserve fuel. For the reasons discussed in the May 2014 Report, continuing to operate the Atikokan and Thunder Bay conversions beyond their contemplated expiry dates was not assumed in the alternative analysis.

Another alternative that was not analyzed in this (or previous) updates is a potential firm import purchase from Manitoba. The existing intertie between Ontario and Manitoba has a capacity of about 300 MW. Currently, it is used for short-term economic trades between the two jurisdictions and there are no contractual obligations to provide firm capacity in effect. For imports to be a viable alternative, the Northwest system would need to be able to absorb the required capacity beyond the border and transfer it within the Northwest to where it is needed. Currently, without major system expansion, only about 150-200 MW can be accommodated before running into constraints on the transmission system between Kenora and Dryden. Moreover, utilizing the existing intertie for firm import purchases would reduce its availability for economic transactions that currently can assist in meeting operational needs.

7.1 Cost-Effectiveness Comparison of Generation and Transmission Alternatives

Consistent with previous E-W Tie expansion need update reports, an economic analysis of the two alternatives was conducted and their relative net-present-value (“NPV”) was compared. A sensitivity analysis was performed to test the robustness of the results under a variety of conditions. Among the sensitivities tested were the Reference, Low and High demand forecast scenarios, ranges in the cost of the generation alternative, and various other factors.

In addition to reflecting the updated capacity and energy needs, the economic analysis includes the refined assumptions identified in section 3.

Changes in assumptions since the May 2014 Report are as follows:

- The Reference demand forecast was updated as per the changes identified in section 4.3. Sensitivities to test the impacts of the updated Low and High demand growth scenarios on the NPV were performed.
- The updated existing supply resources described in section 5, including the updated westbound ratings for the existing E-W Tie, are reflected in the analysis.
- Eastbound constraints on the transmission interfaces between Wawa and Sudbury, and between Sudbury and southern Ontario, were included in the energy and capacity models based on refined studies of the capabilities of these interfaces.
- Additional study has identified that due to diversity in the demand profiles of the Northwest and the rest of Ontario (see section 6.1), fewer provincial resources are required to supply the Northwest in the E-W Tie expansion alternative.
- The transmission costs for the E-W Tie expansion are assumed to be $500 million for the line and $150 million for the stations (see section 3). A portion of the station costs is deferred consistent with the staged expansion of the E-W Tie included in this update.

- A better understanding of needs internal to the Northwest has influenced the SCGT technology type, sizing, and location, resulting in a net increase in capital costs for the "No E-W Tie expansion" alternative. A sensitivity of +/- 25% was assessed on the capital and ongoing fixed costs for generation.
- The study period extends from 2021, the first full year that the E-W Tie expansion would be in service, to 2050, when the first replacement decision is expected; this decision is associated with the generation alternative.
- Natural gas prices were assumed to be an average of $4.50/MMBtu throughout the study period. A sensitivity was performed with average gas prices of $8.50/MMBtu.
- The assessment is performed from a ratepayer perspective, and now includes all costs incurred by developers, which are passed on to ratepayers.[6]

The following assumptions remain unchanged from the May 2014 Report:

- The NPV of the cash flows is expressed in 2015$ CDN.
- The NPV analysis was conducted using a 4% real social discount rate. Sensitivities at 2% and 8% were performed.
- Median-water hydroelectric energy output was used for energy simulation in the economic analysis.
- The life of the station upgrades was assumed to be 45 years; the life of the line was assumed to be 70 years; and the life of the generation assets was assumed to be 30 years.
- New capacity in the Northwest and the rest of Ontario was added, as required, to satisfy reliability criteria. These capacity needs were determined as described in section 6.1. A sensitivity to determine the impact of adding 100 MW of gas-fired generation in the Northwest was performed.

Under the Reference assumptions, the E-W Tie expansion provides a net economic benefit of $1.1 billion compared to the no-expansion alternative. To test the robustness of this result against uncertainty in the assumptions, the IESO considered high and low sensitivities on a number of key parameters, of which forecast demand growth, discount rates, and capital and fixed costs for generation and transmission had the largest impacts. Based on the sensitivities tested, the net benefit of the E-W Tie project ranges from a break-even outcome associated with the Low demand forecast scenario, to $1.7 billion under high demand growth.

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[6] The previous analyses were completed from a societal perspective. Taxes and returns assumed to change hands within Ontario were therefore not included in the economic analysis.

The E-W Tie expansion would provide additional benefits, beyond meeting the reliability requirements of the Northwest: system flexibility, removal of a barrier to resource development, reduced congestion payments, reduced losses, and improved operational flexibility. These benefits are additive to the economic benefits and form an important part of the rationale for the project.

8.0 CONCLUSION AND RECOMMENDATION

The IESO's most recent analysis illustrates that the E-W Tie expansion is economic under a wide variety of conditions. On this basis, the IESO continues to recommend the E-W Tie expansion as the preferred alternative to maintain a reliable and cost-effective supply of electricity to the Northwest for the long term.

Based on the updated demand forecast, the timing of the needs is consistent with the 2020 in-service date recommended in the OPA's 2014 letter. Therefore, the IESO continues to recommend that project development proceed toward a targeted 2020 in-service date, and to support the continuation of development work to ensure the continued viability of the project.