# APPENDIX B

## Provost to Edgerton and Nilrem to Vermilion Transmission Reinforcement

## 2016 Long-term Outlook

## Load and Generation Forecasts

# 1 Introduction

1.1 Load and generation forecasts are an essential input to the AESO's transmission planning process. This document describes the forecast used in the Provost to Edgerton and Nilrem to Vermilion (PENV) Transmission Reinforcement planning studies ("Planning Studies") described in the *Provost to Edgerton and Nilrem to Vermilion (PENV) Transmission Reinforcement Planning Studies Report*.

1.2 The forecasts in this document are a subset of the corporate forecasts published separately by the AESO.[1]

1.3 The Planning Studies focus on the PENV area where transmission reinforcement is needed but due to interconnections with neighbouring planning areas, the studies consider the broader Central East Sub-region. The Central East Sub-region consists of the following AESO planning areas: Lloydminster (13), Cold Lake (28), Wainwright (32), Battle River (36), Provost (37), Hanna (42), and Vegreville (56). The PENV area is a subset of the Central East Sub-region that excludes the Cold Lake (28) and Hanna (42) planning areas. Accordingly, the information and data presented in this document provides load growth forecasts in the Central East Sub-region and the PENV area, and related generation forecasts over the 20-year planning horizon.

1.4 Load and generation data for the Central East Sub-region and PENV area are from the 2016 LTO Reference Case. The 2016 LTO Reference Case

[1] The AESO updates its corporate load and generation forecast annually. The AESO's latest corporate load forecast and associated forecast scenarios released May 2016, are found in the 2016 Long-term Outlook, also referred to as the 2016 LTO. This forecast is available online on the AESO forecasting page found at: http://www.aeso.ca/downloads/AESO_2016_Long-term_Outlook_WEB.pdf

represents the AESO's current forecast of long-term load growth and generation development for the broader Central Planning Region.[2]

Details and clarifications around the use of the forecast, for the purpose of assessing the Central East Sub-region transmission adequacy and planning for respective transmission system reinforcement in this region, are included within this document.

## 2 Historical Load

2.1 Tables 2-1, 2-2, and 2-3 summarize historical load levels for the Central East Sub-region at its respective seasonal peak and minimum demands, and the corresponding PENV area loads at time of these Central East Sub-region peaks/minimums.

**Table 2-1: Historical Summer Peak Loads (MW)**

| Year | Central East Sub-region | PENV Area |
|---|---|---|
| 2010 | 811 | 359 |
| 2011 | 829 | 369 |
| 2012 | 897 | 387 |
| 2013 | 898 | 406 |
| 2014 | 926 | 399 |
| 2015 | 968 | 422 |
| 2016 | 993 | 407 |

[2] For additional information on the AESO's Reference Case forecast, refer to page 2, and Section 4.0 of the 2016 LTO.

**Table 2-2: Historical Winter Peak Loads (MW)[3]**

| Year | Central East Sub-region | PENV Area |
|---|---|---|
| 2010 | 950 | 428 |
| 2011 | 988 | 444 |
| 2012 | 1,010 | 437 |
| 2013 | 1,053 | 478 |
| 2014 | 1,113 | 472 |
| 2015 | 1,088 | 470 |

**Table 2-3: Historical Summer Minimum Loads (MW)**

| Year | Central East Sub-region | PENV Area |
|---|---|---|
| 2010 | 601 | 256 |
| 2011 | 617 | 267 |
| 2012 | 641 | 295 |
| 2013 | 648 | 279 |
| 2014 | 628 | 287 |
| 2015 | 571 | 264 |
| 2016 | 634 | 273 |

2.2 The summer peak load compound average annual growth rates (CAGR) for the Central East Sub-region and PENV area from 2010-2015 is 3.6 percent and 3.3 percent respectively. The winter peak load CAGR for Central East Sub-region and PENV over the same time period is 2.8 percent and 1.9 percent respectively. Load growth in the Central East Sub-region has been primarily driven by oilsands development within the Cold Lake area while load growth in the PENV area has been historically driven by pipeline pumping.

# 3 Load Forecast

3.1 The AESO's load forecast for the Central East Sub-region and PENV area is separated into two timeframes. In the first timeframe from 2015 to 2021,

[3] 2016 Winter Peak loads are not yet available.

summer peak load growth in the Central East Sub-region and PENV area is forecast to grow at CAGRs of 1.8 percent and 2.7 percent respectively. Winter peak CAGRs for Central East Sub-region and PENV area are 2.5 percent and 3.5 percent respectively. The load forecast over this period takes several factors into consideration including historical load growth and past projects, current load connection projects, and FortisAlberta Inc. and ATCO Electric Ltd. distribution facility owner substation-level forecasts for the area. It is forecast that the conditions that support area load growth will continue throughout the period. However, since load growth in the PENV area relates in large part to pipeline pumping which is subject to oil market conditions, the timing and rate of future load could deviate from the forecast such that some forecast growth during this period could be delayed beyond 2021.

3.2 The second timeframe is post-2021 where summer and winter peak load in both the Central East Sub-region and PENV area is forecast to grow at a CAGR of approximately 1 percent (2021 to 2037). The lower growth rates post 2021 reflects the absence of known load projects and conservative assumptions regarding future oilsands and pipeline development and expansion. Tables 3-1, 3-2, and 3-3 summarize the Central East Sub-region peak and minimum demands, along with the PENV area corresponding load at time of Central East Sub-region peak/minimum.

**Table 3-1: 2016 LTO**

**Seasonal Summer Peak Load (MW)**

| Year | Central East Sub-region | PENV Area |
|---|---|---|
| 2021 | 1,077 | 496 |
| 2027 | 1,141 | 523 |
| 2037 | 1,216 | 572 |

**Table 3-2: 2016 LTO**

**Seasonal Winter Peak Load (MW)**

| Year | Central East Sub-region | PENV Area |
|---|---|---|
| 2021 | 1,262 | 578 |
| 2027 | 1,342 | 618 |
| 2037 | 1,428 | 676 |

**Table 3-3: 2016 LTO**

**Seasonal Summer Light Load (MW)**

| Year | Central East Sub-region | PENV Area |
|---|---|---|
| 2021 | 753 | 327 |
| 2027 | 804 | 347 |
| 2037 | 857 | 384 |

3.3 The Keystone XL and Energy East pipelines, if approved, are planned to run through the Central East Sub-region. The load forecast for the Central East Sub-region and PENV area does not explicitly include either of these pipelines. However, the 2021 load forecast contains approximately 30 MW (including 10 MW in the PENV area) of generic planning load which could be shifted to accommodate one of the two announced pipelines.

3.4 There are limitations to using the load forecast for transmission planning purposes. These limitations derive from uncertainty around the timing of the specific load increases in the area, since load increases are caused by specific

industrial projects which are subject to changes and delays during implementation. As such, use of the load forecast should recognize that the forecast load increases are subject to change as new information becomes available from industrial project proponents.

# 4 Existing Generation

4.1 The Central East Sub-region contains the existing generating units shown in Table 4-1. Generation within the sub-region includes co-generation from oilsands developments, coal-fired units, and wind facilities. Total existing generation in the Central East Sub-region is 1,539 MW. Of this, Bull Creek Wind generation and Battle River coal generation, totaling 718 MW, reside in the PENV area.

**Table 4-1: Existing Central East Sub-region Generation**

| Existing Local Generation | | | |
|---|---|---|---|
| **Generators** | **Size (MW)** | **Planning Area** | **Type** |
| Primrose | 100 | Cold Lake | Co-generation |
| Mahkeses | 180 | Cold Lake | Co-generation |
| Foster Creek | 98 | Cold Lake | Co-generation |
| Nabiye | 195 | Cold Lake | Co-generation |
| Lindbergh | 16 | Cold Lake | Co-generation |
| Ghost Pine | 82 | Hanna | Wind |
| Halkirk Wind Power Facility | 150 | Hanna | Wind |
| Bull Creek | 29 | Provost | Wind |
| Battle River 3 | 149 | Battle River | Coal-fired |
| Battle River 4 | 155 | Battle River | Coal-fired |
| Battle River 5 | 385 | Battle River | Coal-fired |
| Total | 1,539 | | |

# 5 Generation Forecast

5.1 The AESO 2016 LTO forecasts generation development on a regional basis. The forecast for the Central Region assumes the development of gas-fired generation to replace retiring coal, and new wind generation attracted by wind resources suitable for development.

5.2 The 2016 LTO wind generation forecast assumes wind development supported through the Renewable Electricity Program (REP)[4] which is intended to encourage the development of 5,000 MW of renewable electricity generation capacity within the province by 2030. The eastern parts of the Central Region, including the Central East Sub-region contain wind resources suitable for development that are relatively more attractive than elsewhere in the region. The 2016 LTO includes a forecast of 836 MW of wind as early as 2022, increasing to 1,561 MW by 2030. However, timing, size and locations of future wind resources in the area will depend on many factors, including renewables support and transmission availability. As such, the AESO has not prepared a wind forecast specific to the PENV area or Central East Sub-region. The Planning Studies instead assessed the capability of each of the studied PENV transmission options to directly connect potential future wind generation. More information can be found in the planning report.

5.3 The government of Alberta recently announced a coal transition plan to end coal-fired emissions on or before December 31, 2030. The exact timing of the retirements is unknown at this time. The 2016 LTO makes the following assumptions with respect to retirement timing as shown in Table 5-3.

[4] https://www.aeso.ca/market/renewable-electricity-program/

**Table 5-3: Coal-fired Retirements Assumptions in the PENV Area**

| Unit | Assumed Retirement date by |
|---|---|
| Battle River 3 | Dec 31, 2019 |
| Battle River 4 | Dec 31, 2025 |
| Battle River 5 | Dec 31, 2028 |

The 2016 LTO Reference Case assumes 455 MW of combined cycle development in the PENV area after the retirement of the Battle River coal-fired units. The AESO recognizes the possibility that combined cycle developments in the PENV area could take the form of new greenfield developments or replacements for retiring coal-fired units at brownfield sites. It is also possible that one or more coal-fired units could be converted to gas-fired units. Given the uncertainty regarding the form of future gas-fired generation in the PENV area, as well as coal retirement timelines, sensitivities to critical assumptions are recommended.