**In the Matter of the Need for the Vauxhall Area Transmission Development**

**And in the matter of the *Electric Utilities Act*, S.A. 2003, c. E-5.1, the *Alberta Utilities Commission Act*, S.A. 2007, c. A-37.2, the *Hydro and Electric Energy Act*, R.S.A. 2000, c. H-16, the Regulations made thereunder, *and Alberta Utilities Commission Rule 007***

# Needs Identification Document for the Vauxhall Area Transmission Development

**Date:** November 15, 2022

**Classification:** Public

**Alberta Electric System Operator**

Calgary Place, 2500, 330 - 5th Avenue SW Calgary, AB T2P 0L4

Phone: 403-539-2450 | Fax: 403-539-2949

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# PART A - APPLICATION

# 1. Introduction

## 1.1 Application

Pursuant to Section 34(1) of the *Electric Utilities Act* (Act), the Alberta Electric System Operator (AESO) applies to the Alberta Utilities Commission (Commission) for approval of this *Vauxhall Area Transmission Development Needs Identification Document* and for approval of a specific and limited exception under Section 15(2) of the *Transmission Regulation* (TReg) (Application).

## 1.2 Application Overview

Congestion[1] is occurring in real-time in the AESO planning areas of Vauxhall (Area 52) and Medicine Hat (Area 4), within the AESO South Planning Region.[2] The curtailment of generation is required to mitigate Category A thermal criteria violations on the existing 138 kilovolt (kV) transmission lines 610L (between Taber 83S and Fincastle 336S substations) and 879L (between Bowmanton 244S substation and 138 kV transmission line 879AL).

This Application describes the need to increase the capacity on the 138 kV transmission system to remove thermal criteria violations observed under normal operating conditions (Category A) and thereby allow for the unconstrained dispatch of all anticipated in-merit electricity in the Study Area.[3] The AESO, in accordance with its transmission system planning responsibilities, submits this Application to the Commission for approval having determined that its Preferred Transmission Development is required to meet the needs of Alberta and is in the public interest.

This Application also includes a request for approval under Section 15(2) of the TReg of a specific and limited exception to the AESO's duties under Section 15(1)(f) of the TReg.

## 1.3 AESO Directions to the Transmission Facility Owner

Pursuant to Section 39 of the Act and Section 14 of the TReg, the AESO directed the legal owner of the transmission facilities (TFO), in this case, AltaLink Management Ltd., in its capacity as general partner of AltaLink, L.P. (AltaLink), to assist the AESO in preparing this Application.[4]

[1] "Congestion" refers to the condition when the transmission system cannot accommodate all in-merit generation because the resulting power flows would contravene reliability standards and/or ISO rules and in-merit generation is curtailed to maintain the reliable operation of the AIES.

[2] The AESO Planning Regions map is available on the AESO website.

[3] Study Area is defined in Section 2.1 of this Application.

[4] The directions are described in more detail in the following sections of this Application and in Part C, note v.

# 2. Vauxhall Area Transmission System and Forecast

## 2.1 Introduction

The AESO performs system planning studies to assess the transmission system and to ensure the safe, reliable, and economic delivery of electricity wherever and whenever it is needed. The system planning studies in the Planning Report[5] conducted for this Application assessed the need for transmission development along the 138 kV path from Bowmanton 244S substation to Taber 83S substation (Study Area) to remove thermal criteria violations observed under normal operating conditions (Category A) and allow for the unconstrained dispatch of all anticipated in-merit electricity in the Study Area. The Study Area is located in the AESO planning areas of Vauxhall (Area 52) and Medicine Hat (Area 4) (Study Region), in the AESO South Planning Region.

## 2.2 Existing Vauxhall Area Transmission System

The Planning Report includes an assessment of the transmission system in the Study Area to confirm its generation integration capability and to determine the required transmission development to remove the Category A thermal criteria violations and enable generation connection in the Study Area. The Study Area transmission system is shown in Figure 1 and described below.

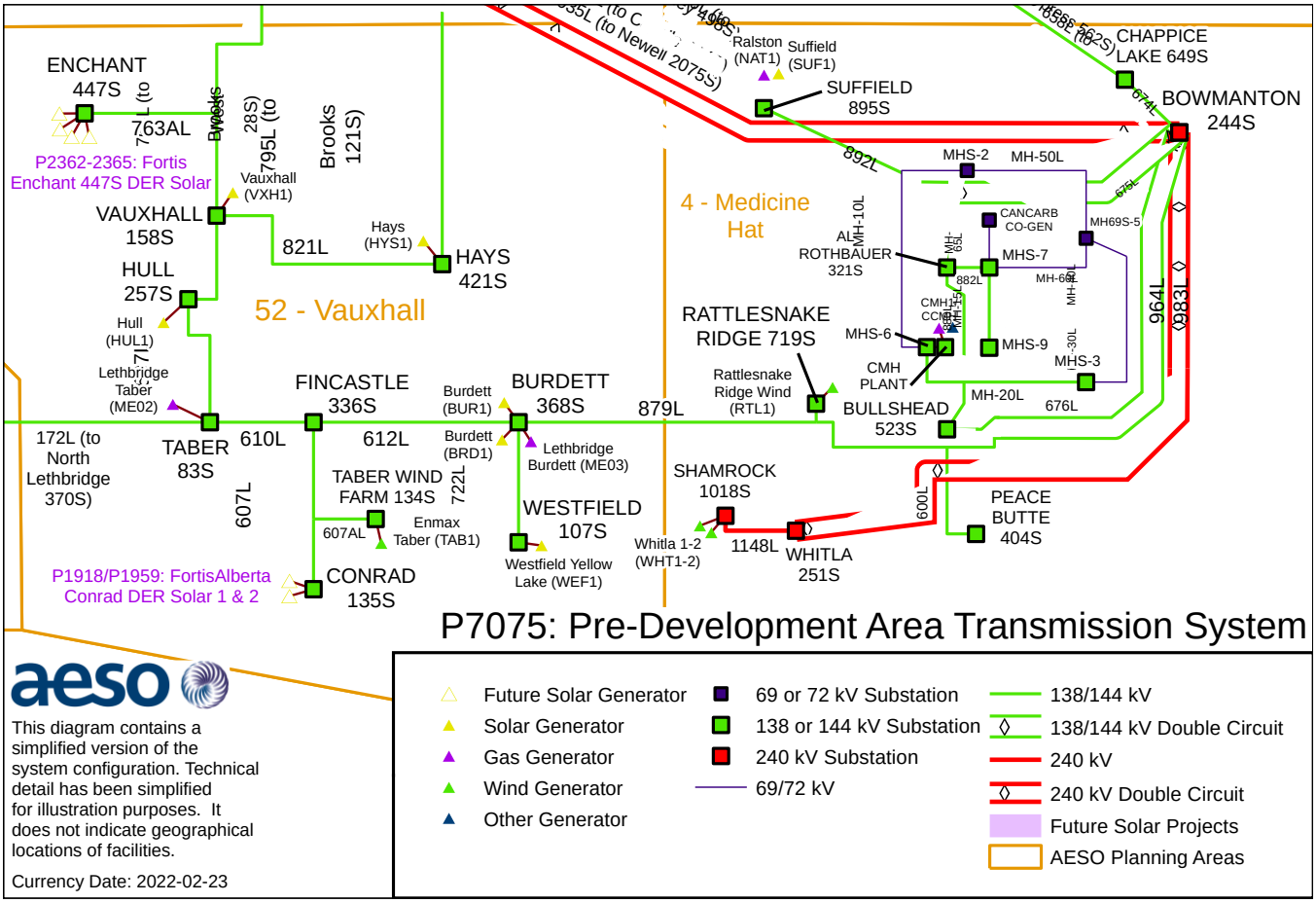
### *2.2.1 Existing Constraints in the Study Area*

Real-time congestion is observed in the AESO planning areas of Vauxhall (Area 52) and Medicine Hat (Area 4) and the curtailment of generation is required to mitigate Category A thermal criteria violations on the 138 kV transmission lines 610L (between Taber 83S and Fincastle 336S substations) and 879L (between Bowmanton 244S substation and 138 kV transmission line 879AL), which are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management.*[6] There are currently two existing remedial action schemes (RAS) and automatic protection schemes (APS) used to manage Category B Reliability Criteria violations in the Study Area.

[5] The AESO's *Vauxhall Area Transmission Development Planning Report* is provided in Appendix A of this Application.

[6] Also referred to as the TCM Rule.

**Figure 1: Study Area**



## 2.3 AESO Generation and Load Forecast Assumptions

Pursuant to its responsibilities under Section 33 of the Act and Section 11(3)(c) and (d) of the TReg, the AESO has forecasted generation and load growth in the Study Region.[7][8] The generation and load data is based on the latest available information and is in alignment with the *AESO 2021 Long-term Outlook* (2021 LTO).[9]

### *2.3.1 Generation Forecast*

Existing generation in the Study Region is approximately 1,039 MW and comprised of wind, solar, biomass, and gas-fired (i.e., combined cycle and simple cycle) generation as of December 2021.[10] There is high interest in the Study Region for renewable generation because of its solar and wind potential, with approximately 68% of the existing generation in the Study Region being solar and wind generation. This is further demonstrated by the fact that there are several solar and wind generation projects in the Study Region that meet the AESO's project inclusion criteria[11] as of December 2021, with an additional generation capacity of approximately 523 MW anticipated to be in service before 2023.

The AESO used AURORA[12] software to develop three renewable generation scenarios, which used assumptions of the 2021 LTO[13] Reference Case as a basis to inform the deterministic studies (see Section 3.2). AURORA software is also used to conduct the congestion assessment (see Section 3.3), with additional specific generation scenarios created within the Study Region.

### *2.3.2 Load Forecast*

The AESO South Planning Region consists of multiple industrial and commercial load types including pipelines, natural gas processing, manufacturing, farming and agriculture, meat and agri-food processing, and tourism and hospitality.

The load forecast for the 2023 to 2041 planning horizon[14] in the Study Region is aligned with the 2021 LTO Reference Case load forecast and represents the AESO's current expectation for long-term load growth.

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[7] Details of the AESO's generation and load forecast are set out in Appendix B of this Application.

[8] The Study Region for the AESO generation and load forecast is the AESO planning areas of Vauxhall (Area 52) and Medicine Hat (Area 4).

[9] The 2021 LTO is available on the AESO website. The 2021 LTO is the AESO's view of Alberta's load and generation requirements over the next 20 years.

[10] A list of the assets providing existing generation capacity in the Study Region, as of December 2021, is provided in Appendix B of this Application.

[11] The AESO's project inclusion criteria are available in *ID #2018-018T Provision of System Access Service and the AESO Connection Process*, on the AESO website. The solar and wind generation projects in the Study Region that meet the AESO's project inclusion criteria are as of December 2021.

[12] AURORA is an energy forecasting software developed by Energy Exemplar. Please refer to their website for more information: https://energyexemplar.com/solutions/aurora/

[13] The 2021 LTO assumptions used to develop the renewable generation scenarios are provided in Appendix B of this Application.

[14] A 20-year planning horizon was not used because the forecast and planning studies started with the year 2023 as the earliest in-service date of the Preferred Transmission Development.

The AESO used the 2021 LTO as a basis, which considered historical load patterns and trends, substation-level load forecasts provided by the applicable legal owners of electric distribution systems (DFOs), and recent project developments. The South Planning Region generally peaks in the summer season. The 2021 LTO expects a recovery in load in the near-term (2023) from pandemic levels, and moderate load growth thereafter, offset by growth in rooftop solar generation and some distribution-connected wind farms. The 2021 LTO also forecasts some load growth in the City of Medicine Hat, driven by cryptocurrency mining and general population and economic growth.

The forecast compound annual growth rate (CAGR) of the load for the 20-year planning horizon in the Study Region is 2.5% for Summer Light, 0.8% for Summer Peak, and 1.1% for Winter Peak. The 2023, 2031, and 2041 seasonal Winter Peak, Summer Peak, and Summer Light load forecasts for the Study Region are presented in Table 1.

**Table 1: Seasonal Load Forecasts in the Study Region**

| Year | Winter Peak (MW) | Summer Peak (MW) | Summer Light (MW) |
|---|---|---|---|
| 2023 | 364 | 523 | 245 |
| 2031 | 416 | 569 | 278 |
| 2041 | 420 | 566 | 295 |

# 3. Need for Vauxhall Area Transmission Development

## 3.1 Real-time Generation Curtailment History

The Category A thermal criteria violations observed in the deterministic studies are observed today in real-time operations. Real-time congestion was first experienced in the Study Area with all system elements in service in March 2022, with the real-time overload of the 138 kV transmission line 610L (between Fincastle 336S and Taber 83S substations). From March 2022 to the end of July 2022 there have been a total of 57 events of real-time congestion involving both 138 kV transmission lines 610L (between Fincastle 336S and Taber 83S substations) and 879L (between Burdett 368S and Bowmanton 244S substations). Congestion was observed on 138 kV transmission line 610L for 48 events, and on 138 kV transmission line 879L for 2 events. Congestion was observed on both 138kV transmission lines 610L and 879L at the same time for 7 events.

## 3.2 Deterministic Studies: Transmission System Capability

### *3.2.1 Methodology and Assumptions*

With the existing generation and several solar and wind generation projects in the Study Area that meet the AESO's project inclusion criteria, the AESO performed deterministic studies[15] for the year 2023 (near-term). The purpose for conducting the deterministic studies is to assess the performance of the pre-development[16] transmission system. The results of the deterministic studies were used to establish the need for transmission development, evaluate the considered Transmission Development Options,[17] and select the Preferred Transmission Development.[18]

Study cases were created and used to perform the deterministic studies. The study cases used the congestion assessment results[19] to represent reasonably stressed operating conditions, including various load conditions and generation dispatches for the year 2023. Three scenarios were used for the study cases.[20] Scenario 1 represents a transmission system state where thermal loading is maximized on 138 kV transmission line 610L, between the Fincastle 336S and Taber 83S substations. Scenario 2 represents a transmission system state where thermal loading is maximized on 138 kV transmission line 879L, between 879AL and Bowmanton 244S substation. Scenario 3 represents a transmission system state where the net generation is maximized between the terminals of Bowmanton 244S and Taber 83S substations with a maximum power flow exiting the Study Area.

Studies were first completed to determine the generation integration capability of the pre-development transmission system in the Study Area and identify potential transmission system constraints when optimizing the distribution of generation integration. Transmission Development Options were developed to address the transmission system constraints and evaluate the Category A generation integration

[15] Additional information about the deterministic studies and results are provided in Appendix A of this Application.

[16] The 2023 pre-development transmission system is the existing 138 kV transmission line path from Bowmanton 244S substation to Taber 83S substation with existing connection projects in service and connection projects that meet the AESO's project inclusion criteria that will be in service before 2023. Refer to Appendix A for further information.

[17] Presented in Section 4.0 of this Application.

[18] Presented in Section 5.0 of this Application.

[19] Presented in Section 3.3 of this Application.

[20] Additional information about the scenarios and assumptions used for the study cases are provided in Appendix A of this Application.

capability of each Transmission Development Option to arrive at the Preferred Transmission Development. The performance of the Preferred Transmission Development was verified through Category B power flow analysis, short-circuit and transient stability studies, and the congestion assessment results.

### *3.2.2 Study Results*

Using the three scenarios, the AESO conducted power flow analyses on the existing transmission system to identify Category A thermal criteria violations in the Study Area prior to the energization of the Preferred Transmission Development. With existing generation and the connection and dispatch of generation projects that meet the AESO's project inclusion criteria, Category A thermal criteria violations were observed on the 138 kV transmission lines 879L (879AL to Bowmanton 244S substation) and 610L (Fincastle 336S substation to Taber 83S substation). Without any transmission development, the existing 138 kV transmission lines 879L (879AL to Bowmanton 244S substation) and 610L (Fincastle 336S substation to Taber 83S substation) in the Study Area do not have the capability of supporting the connection of existing and new generation projects without additional Category A thermal criteria violations. Generation curtailment of approximately 98 MW is required to mitigate the Category A thermal criteria violations observed on the 138 kV transmission lines 879L (879AL to Bowmanton 244S substation) and 610L (Fincastle 336S substation to Taber 83S substation) for existing generation and generation projects that meet the AESO's project inclusion criteria. Therefore, there is a need for the existing transmission system in the Study Area to be enhanced to remove Category A thermal criteria violations allowing for the unconstrained dispatch of all anticipated in-merit electricity in the Study Area.

## 3.3 Congestion Assessment

Hourly probabilistic studies were run to test how much congestion could potentially develop in the Study Area.[21,22] A congestion assessment[23] was performed for various generation development levels where the AESO considered three renewable generation scenarios.[24] Scenario 1 assumed existing generation plus projects that met the AESO's project inclusion criteria in the Study Region (1,562 MW), Scenario 2 assumed Scenario 1 plus the energization of the Taber distributed energy resources (DER) projects before 2023 (1,627 MW), and Scenario 3 assumed Scenario 1 plus the addition of 20 MW of solar generation connected at Burdett 368S substation (1,582 MW). While renewable generation development was the focus of the congestion assessment, it is expected that, should other types of generation develop in the Study Area, the results would be similar.

The purpose of the congestion assessment was to:

- estimate the probability of congestion arising in the Study Area as new generation develops; and
- determine congestion probability before and after the energization of the Preferred Transmission Development.

[21] A modified forecast was used for the congestion assessment, as described in Appendix B of this Application.

[22] The Study Area for the AESO congestion assessment is the 138 kV path from Bowmanton 244S substation to Taber 83S substation.

[23] The congestion assessment results and report are provided in Appendix B of this Application.

[24] Additional information on the three scenarios and methodology is provided in Appendix B of this Application.

Key conclusions of the congestion assessment are:

- congestion is observed on the 138 kV transmission lines 610L and 879L, with a frequency of approximately 8-9% of hours in 2023, prior to the energization of the Preferred Transmission Development; and
- the frequency and magnitude of congestion is reduced to 0% after the energization of the Preferred Transmission Development.[25]

Additional information regarding the methodology, assumptions, and results for measuring the hours of congestion within the Study Area are detailed in Appendix B.

[25] In the most-stressed study scenario two hours with congestion were observed on the 138 kV transmission line 612L following the energization of the Preferred Transmission Development. The probability of congestion materializing in real-time is highly dependent upon the production profile of the generation facilities in the area. If the AESO determines that congestion will arise on 138 kV transmission line 612L under Category A conditions, the AESO will make an application to the AUC to obtain approval for an "exception" under Section 15(2) of the *Transmission Regulation*.

# 4. Evaluation of Transmission Development Options and Selection of the Preferred Transmission Development

This section explains the Transmission Development Options that were evaluated by the AESO and the factors that were taken into consideration in the process of selecting the Preferred Transmission Development.

## 4.1 Transmission Development Options

The AESO identified the following seven Transmission Development Options:

**Option 1** - **Upgrade 610L and 879L to 118 MVA and one Static Synchronous Series Capacitor (SSSC) per phase on 610L**

- Increase the minimum capacity of the 138 kV transmission line 610L, between Fincastle 336S and Taber 83S substations, to approximately 118 MVA;
- increase the minimum capacity of the 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA;
- add one Static Synchronous Series Capacitor (SSSC) per phase on the 138 kV transmission line 610L; and
- add or modify associated equipment as required for the transmission developments.

**Option 2 - Upgrade 610L and 879L to 118 MVA and two SSSCs per phase on 610L**

- Increase the minimum capacity of the 138 kV transmission line 610L, between Fincastle 336S and Taber 83S substations, to approximately 118 MVA;
- increase the minimum capacity of the 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA;
- add two SSSC per phase on the 138 kV transmission line 610L; and
- add or modify associated equipment as required for the transmission developments.

**Option 3 – Upgrade 610L to 173 MVA and Upgrade 879L to 118 MVA**

- Increase the minimum capacity of the 138 kV transmission line 610L, between Fincastle 336S and Taber 83S substations, to approximately 173 MVA;
- increase the minimum capacity of the 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA; and
- add or modify associated equipment as required for the transmission developments.

**Option 4 - Upgrade 610L to 173 MVA, Upgrade 879L to 118 MVA, and one SSSC per phase on 610L**

- Increase the minimum capacity of the 138 kV transmission line 610L, between Fincastle 336S and Taber 83S substations, to approximately 173 MVA;
- increase the minimum capacity of the 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA;
- add one SSSC per phase on the 138 kV transmission line 610L; and
- add or modify associated equipment as required for the transmission developments.

**Option 5 - New 138 kV Circuit 173 MVA, Discontinue 610L, and Upgrade 879L to 118 MVA**

- Add one 138 kV circuit, approximately 15 km in length, between the existing Fincastle 336S and Taber 83S substations, with a minimum capacity of approximately 173 MVA;
- discontinue from use for transmission purposes the existing 138 kV transmission line 610L, between Fincastle 336S and Taber 83S substations, only after the new 138 kV circuit is in service;

- increase the minimum capacity of the existing 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA; and
- add or modify associated equipment as required for the transmission developments.

**Option 5A - New 138 kV Circuit 120 MVA bundled with 610L, and Upgrade 879L to 118 MVA**

- Add one 138 kV circuit, approximately 15 km in length, between the existing Fincastle 336S and Taber 83S substations, with a minimum capacity of approximately 120 MVA, and operate in a bundled configuration with the existing 138 kV transmission line 610L;
- increase the minimum capacity of the existing 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA; and
- add or modify associated equipment as required for the transmission developments.

**Option 5B - New 138 kV Circuit 173 MVA bundled with 610L, and Upgrade 879L to 118 MVA**

- Add one 138 kV circuit, approximately 15 km in length, between the existing Fincastle 336S and Taber 83S substations, with a minimum capacity of approximately 173 MVA, and operate in a bundled configuration with the existing 138 kV transmission line 610L;
- increase the minimum capacity of the existing 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA; and
- add or modify associated equipment as required for the transmission developments.

## 4.2 Transmission System Performance and Generation Integration Capability Assessment

The AESO evaluated the transmission system performance of the seven Transmission Development Options by performing Category A generation integration capability studies.

The Category A generation integration capability studies were performed on the transmission system in the Study Area with each of the seven Transmission Development Options in place. The studies determined and compared the amount of generation integration that could occur in the Study Area before thermal criteria violations were observed. The results of the studies are as follows:

- Options 1 and 2 were not recommended for further consideration as they do not allow for the reliable generation integration of existing generation and generation projects in the Study Area that meet the AESO's project inclusion criteria (hereafter referred to as "all generation"),[26] without Category A thermal criteria violations occurring.

- Options 3, 4, 5, 5A, and 5B allow for the reliable generation integration of all generation in the Study Area and were recommended for further consideration.

    - Options 3 and 5 had similar technical performance and mitigated Category A thermal criteria violations with the increase of 138 kV transmission line 879L summer thermal line rating to 118 MVA and 138 kV transmission line 610L summer thermal line rating to 173 MVA.

[26] The phrase "all generation" will be used going forward in this Application when discussing existing generation plus generation projects that meet the AESO's project inclusion criteria in the Study Area.

- Option 4 mitigated Category A thermal criteria violations on 138 kV transmission lines 879L and 610L with the installation of SSSC on 138 kV transmission line 610L.
- Options 5A and 5B had similar technical performance and mitigated Category A thermal criteria violations with the new circuit operating in a bundled configuration with the existing 138 kV transmission line 610L.

Options 3, 4, 5, 5A, and 5B allow for the reliable generation integration of all generation projects in the Study Area and mitigate Category A thermal criteria violations. As a result, Options 3, 4, 5, 5A, and 5B were assessed for further consideration from a cost and environmental and land use effects perspective, with further details provided in Sections 4.3 and 4.4 of this Application. Additional information regarding the Transmission Development Options and the Category A generation integration capability studies is provided in Appendix A of this Application.

## 4.3 Transmission Development Option Costs

To further assist with its evaluation of Transmission Development Options 3, 4, 5, 5A, and 5B described in Section 4.1, the TFO prepared cost estimates (+30%/-30%) for these options that meet the requirements of AUC Rule 007, Section 7.1.1, NID4. The AESO reviewed the cost estimates provided by the TFO against cost benchmark data and found the cost estimates to be reasonable. The estimated transmission capital costs[27] are summarized in Table 2 and provided in Appendix D of this Application.

**Table 2: Transmission Development Options Cost Estimates**

| Transmission Development Option | Transmission Capital Cost (+30%/-30%) | Distribution Cost | 610L End of Life Replacement Costs | Total Cost |
|---|---|---|---|---|
| 3 | $12.4M | $3.5M | $18.7M | $34.6M |
| 4 | $25.3M | $3.5M | $18.7M | $47.5M |
| 5 | $18.7M | $3.5M | N/A | $22.2M |
| 5A | $15.7M | N/A | $22.2M | $37.9M |
| 5B | $15.8M | N/A | $4.5M | $20.3M |

Based on the cost estimates summarized above, Options 3, 4 and 5A were not recommended for further consideration due to the higher estimated total cost, that includes the 610L end of life replacement. Options 5 and 5B were selected for further consideration.

### *4.3.1 Net Present Value Analysis*

Transmission Development Options 5 and 5B vary in levels of modification to the 138 kV transmission line 610L. The TFO conducted a net present value (NPV) assessment to account for the future cost of construction to replace the end-of-life of the existing 138 kV transmission line 610L. The NPV costs are summarized in Table 3.

[27] The cost estimates are in nominal dollars using a base year of 2024 with escalation considered and an accuracy level of +30%/-30%.

**Table 3: Net Present Value (NPV) Analysis Summary**

| Transmission Development Option | NPV |
|---|---|
| 5 | $22.2M |
| 5B | $21.1M |

Deferring the discontinuation of 138 kV transmission line 610L creates a cost savings opportunity of approximately $1 million. However, further assessment of Transmission Development Option 5B revealed that construction of a new control building at Taber 38S substation may be required. Based on AESO transmission cost benchmarks, the cost of a new control building can be between $0.5 - $1 million. This results in Transmission Development Options 5 and 5B having approximately equal NPV, negating any potential cost savings of deferring the discontinuation of 138 kV transmission line 610L.

## 4.4 Environmental and Land Use Effects

The AESO directed the TFO to prepare a report (see Appendix C) comparing all Transmission Development Options according to the environmental and land use effects information contemplated in AUC Rule 007, *Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations, Hydro Developments and Gas Utility Pipelines*, Section 7.1.1, NID2. The TFO's conclusions are summarized as follows:

- From an environmental and land use effects perspective, the TFO concludes that all the Options are considered viable and there were no features identified that would preclude development of any of the Options;
- Option 5 has the second highest potential for environmental and land use effects as new transmission line development is required, however, is slightly preferred over Option 5B due to the removal of transmission line 610L; and
- Option 5B has the highest potential environmental and land use effects as new transmission line and substation development is required and there is no removal of transmission line 610L.

Based on the above conclusions, Option 5 has lower potential environmental and land use effects compared to Option 5B.

## 4.5 Selection of the Preferred Transmission Development

Options 5 and 5B both mitigate Category A thermal criteria violations and enable future generation connection. The NPV analysis results show Transmission Development Options 5 and 5B having approximately equal NPV, negating any potential cost savings of deferring the discontinued use for transmission purposes of 138 kV transmission line 610L. Transmission Development Option 5 has lower potential environmental and land use effects when compared to Transmission Development Option 5B. Due to similar costs between Option 5 and Option 5B, Option 5 was selected as the preferred alternative based on the lower potential environmental and land use effects compared to Option 5B.

## 4.6 Technical Performance of the Preferred Transmission Development

Additional deterministic studies were conducted to assess the impact that the Preferred Transmission Development would have on the transmission system. Category B, short circuit, and transient stability analyses were performed before and after the energization of the Preferred Transmission Development. Category B thermal criteria violations were observed on 138 kV transmission lines 879L, 610L, and 763L after the energization of the Preferred Transmission Development and can be mitigated by RAS. The observed short-circuit fault levels following the energization of the Preferred Transmission Development were not significantly higher than the levels of the pre-energized system. The transient stability analysis found the transmission system to be stable for Category A and Category B contingencies after the energization of the Preferred Transmission Development.[28] Based on the probabilistic studies,[29] the Preferred Transmission Development is effective at reducing congestion in the Study Area.

[28] Additional information is provided in Appendix A of this Application.

[29] Additional information is provided in Appendix B of this Application.

# 5. Preferred Transmission Development

This section describes the AESO's Preferred Transmission Development to address the need described in Section 3.

## 5.1 Preferred Transmission Development

Figure 2 illustrates the Preferred Transmission Development, and includes the following major transmission system elements:

- Add a 138 kV circuit, approximately 15 km in length, between the existing Fincastle 336S and Taber 83S substations with a minimum capacity of approximately 173 MVA;[30]
- Discontinue from use for transmission purposes the existing 138 kV transmission line 610L between Fincastle 336S and Taber 83S substations only after the new 138 kV circuit is in service;
- Increase the minimum capacity of the existing 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA; and
- Add or modify associated equipment as required for the above transmission developments.

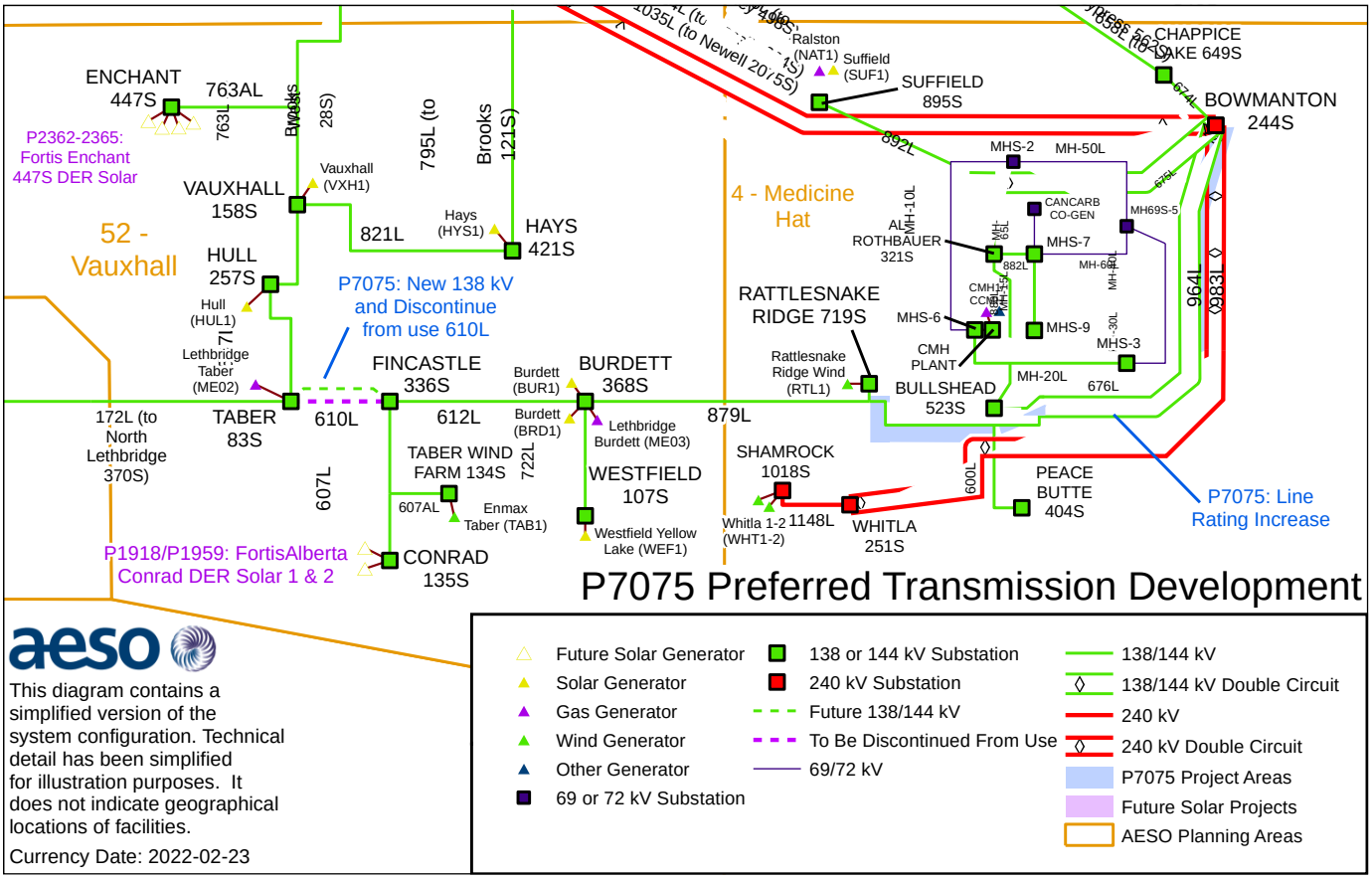
## 5.2 Preferred Transmission Development Costs

As mentioned in Section 4.3, the TFO prepared a cost estimate for Option 5, the Preferred Transmission Development, and has an approximate in-service cost of $22.2 million.[31]

[30] Studied transmission circuit ratings have been approximated to the accuracy level required by the AESO for transmission planning purposes. Actual ratings of constructed facilities may vary.

[31] The cost estimate is in nominal dollars using a base year of 2024 with escalation considered. Further details of this cost estimate, which has an accuracy level of +30%/-30%, can be found in Appendix D of this Application.

**Figure 2: Preferred Transmission Development**



# 6. Long-term Transmission Plans

The AESO's long-term transmission system plans are high-level assessments of transmission capability and required transmission system development in Alberta focusing on broad technical aspects. More detailed studies are performed in preparation of a needs identification document application to ensure that the AESO's Preferred Transmission Development will address the identified reliability violations in the most efficient manner.

The Preferred Transmission Development proposed by the AESO in this Application is aligned with the *AESO 2022 Long-term Transmission Plan* (2022 LTP) ,[32] which identifies the need for transmission system development in the Vauxhall area driven by generation in the Vauxhall and Medicine Hat planning areas including the following planned developments:

- Increase the capacity of 610L (Fincastle 336S to Taber 83S);
- Increase the capacity of 879L (244S Bowmanton to 879AL tap); and
- Add flow control device if needed.

[32] The AESO's 2022 LTP is available on the AESO website.

# 7. Participant Involvement Program

The AESO conducted a Participant Involvement Program (PIP), in accordance with the requirement of NID6 and Appendix A2 of AUC Rule 007. The AESO directed the TFO to assist the AESO in conducting the AESO's PIP. Between April and November 2022, the TFO and the AESO used various methods to notify stakeholders and Indigenous groups of the need for transmission development in the area where transmission facilities could be installed to address the identified need. The AESO has not received any concerns or objections from any notified stakeholders or Indigenous groups about the AESO's Preferred Transmission Development to respond to the need for transmission development. In November 2022, the AESO notified stakeholders of its intention to file this Application with the Commission. Following the filing of this Application, the AESO will notify stakeholders that this Application has been filed with the Commission. Further information regarding the AESO's PIP for this Application is included in Appendix E.

# 8. Preferred Transmission Development Schedule

The scheduled in-service date for the Preferred Transmission Development is Q1 2024 with two energization dates: 138 kV transmission line 879L will be energized in Q1 2024 and 138 kV transmission line 610L will be energized in Q3 2024. The AESO has issued an unconditional direction to the TFO for preparation and submission of the TFO's Facility Proposal[33] to the Commission for the Preferred Transmission Development.

[33] Also referred to as facility application, or FA, under AUC Rule 007.

# 9. Request for Approval of an Exception to TReg Section 15(1)(f)

As described in Sections 2.2.1, 3.1, and 3.3 of this Application, the AESO has observed congestion in real-time under system normal conditions on 138 kV transmission lines 610L (between Taber 83S and Fincastle 336S substations) and 879L (between Bowmanton 244S substation and 138 kV transmission line 879AL). As such, and pursuant to section 15(2) of the TReg, the AESO requests approval of an exception to the matters described in section 15(1)(f) of the TReg. The AESO proposes that the exception will apply until the Preferred Transmission Development is fully energized, which is expected to occur in Q3 2024.

## 9.1 Market Participant Engagement

In support of this request, between January and May 2022 the AESO engaged market participants that it determined may be affected by potential congestion. In February 2022, the AESO held an information session for these market participants during which the AESO presented further information on this matter and answered questions. The AESO advised the Commission in April 2022 of its intention to file this request for approval of an exception. Further information is provided in Appendix F.

# 10. Request to Combine this Application with the Facility Proposals for Consideration in a Single Process

Pursuant to Subsection 35(1) of the Act, the AESO has directed the TFO to prepare a Facility Proposal that corresponds with this Application. The AESO understands the TFO will file two Facility Proposals that will be filed shortly.[34] The AESO requests, and expects the TFO will request, that this Application be combined with the Facility Proposals for consideration by the Commission in a single process. This request is consistent with Section 15.4 of the *Hydro and Electric Energy Act* and Section 7 of AUC Rule 007.

While it is believed that this Application and the Facility Proposals will be materially consistent, the AESO respectfully requests that in its consideration of all, the Commission be mindful of the fact that the documents have been prepared separately and for different purposes. The purpose of this Application is to obtain approval of the need for transmission system development and to provide a preliminary description of the manner proposed to meet that need. In contrast, the Facility Proposals will contain more detailed engineering and designs for the Preferred Transmission Development and seek approval for the construction and operation of specific facilities.

[34] The AESO understands that the TFO intends to file two Facility Proposals relating to this Application to be titled *Vauxhall Area Transmission Development 610L Transmission Line Replacement Project* and *Vauxhall Area Transmission Development 879L Transmission Line Restoration Project*.

# 11. Relief Requested

## 11.1 Approval is in the Public Interest

Having regard to the following:

- the transmission planning duties of the AESO as described in Sections 33 and 34 of the Act, and
- the requirements in Section 7.1, subsection 7.1.1, of AUC Rule 007,

the AESO also submits that:

- the AESO's assessment of the need to address real-time congestion and generation curtailment, remove thermal criteria violations observed under Category A conditions, and enable additional generation integration capability in the Study Area is technically complete; and
- the Preferred Transmission Development meets the identified need; satisfies the Alberta reliability standards; and is consistent with the AESO long-term forecasts and area transmission system plans.

Therefore, approval of the Application is in the public interest, having regard to the factors set out in Section 38 of the TReg and, in particular, subsection 38(d) and (e).

## 11.2 Request

For the reasons set out herein, and pursuant to Section 34 of the Act, the AESO requests that the Commission:

1. Approve this Application, including the Preferred Transmission Development, which will be comprised of the following:
    - Add a 138 kV circuit, approximately 15 km in length, between the existing Fincastle 336S and Taber 83S substations with a minimum capacity of approximately 173 MVA;
    - Discontinue from use for transmission purposes the existing 138 kV transmission line 610L between Fincastle 336S and Taber 83S substations only after the new 138 kV circuit is in service;
    - Increase the minimum capacity of the existing 138 kV transmission line 879L, between 879AL and the Bowmanton 244S substation, to approximately 118 MVA; and
    - Add or modify associated equipment as required for the above transmission developments.
2. Approve, pursuant to subsection 15(2) of the TReg, a specific and limited exception to the matters described in subsection 15(1)(f) of the TReg until the Preferred Transmission Development is fully energized in Q3 2024.

All of which is respectfully submitted this 15th day of November 2022.

Alberta Electric System Operator

*"Electronically Submitted by"*

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Robert Davidson, P.Eng.
Vice President, Grid Reliability – Projects and Planning

# PART B – APPLICATION APPENDICES

The following appended documents support the Application (Part A).

**APPENDIX A – AESO Planning Report**

**APPENDIX B – AESO Congestion Assessment**

**APPENDIX C – TFO Environmental and Land Use Effects Assessment**

**APPENDIX D – TFO Cost Estimates**

**APPENDIX E – AESO Participant Involvement Program Summary**

**APPENDIX F – Stakeholder Engagement Summary to Support the AESO's request under Section 15(2) of the TReg**

# PART C – REFERENCES

i. **AESO Planning Duties and Responsibilities and Duty to Forecast Need –** Certain aspects of the AESO's duties and responsibilities with respect to planning the transmission system are described in the Act. For example, section 17, subsections (g), (h), (i), and (j) of the Act, state the general planning duties of the AESO. Section 33 of the Act states that the AESO "must forecast the needs of Alberta and develop plans for the transmission system to provide efficient, reliable and non-discriminatory system access service and the timely implementation of required transmission system expansions and enhancements." As stated in subsection 34(1) of the Act, when the AESO determines that an expansion or enhancement of the capability of the transmission system is or may be required to meet the needs of Alberta and is in the public interest, the AESO must prepare and submit to the Commission for approval of a needs identification document that describes the constraint or condition affecting the operation or performance of the system and indicates the means by which or the manner in which the constraint or condition could be alleviated. In determining the means by which, or the manner in which, the constraint or condition affecting the operation or performance of the transmission system could be alleviated, the AESO has applied engineering judgments and made assumptions as necessary. Such judgments and assumptions being required and permitted by its prescribed responsibilities and authorities under the Act. In accordance with section 11 of the *Transmission Regulation*, the AESO has considered technical, economic, environmental and other factors as necessary in determining its preferred option for system expansion.

ii. **AESO Transmission Planning Criteria** In accordance with the Act, the AESO is required to plan a transmission system that satisfies applicable reliability standards. Alberta reliability standards, TPL-001-AB-0, *System Performance Under Normal Conditions* (TPL-001-AB-0) and TPL-002-AB1-0, *System Performance Following Loss of a Single BES Element* (TPL-002-AB1-0) are available on the AESO website. In addition, the AESO's *Transmission Planning Criteria – Basis and Assumptions* is included in Appendix G.

iii. **Application for Approval of an Exemption Pursuant to Subsection 15(2) of the *Transmission Regulation* –** Pursuant to subsection 15(1)(f) of the *Transmission Regulation*, the AESO must, in exercising its duties under sections 17 and 33(1) of the Act, make arrangements for the expansion or enhancement of the transmission system so that, under normal operating conditions, all anticipated in-merit electricity can be dispatched without constraint. Subsection 15(2) of the *Transmission Regulation* permits the AESO to apply for approval for a specific and limited exception to 15(1)(f). Pursuant to section 15(2) of the *Transmission Regulation*, this Application seeks approval for such a specific and limited exception to section 15(1)(f) of the *Transmission Regulation.* This Application is directed, in part, at permitting specific amounts of congestion to occur on the stated transmission lines for a particular period of time.

iv. **Application for Approval of the Need for Expansion or Enhancement of the Capability of the Transmission System –** This Application is directed, in part, to the question of the need for expansion or enhancement of the capability of the transmission system as more fully described in the Act and the *Transmission Regulation*. This Application does not seek approval of those aspects of transmission development that are managed and executed separately from the needs identification document approval process. Other aspects of the AESO's responsibilities regarding transmission development are managed under the appropriate processes, including the ISO rules, Alberta reliability standards and the ISO tariff, which are also subject to specific regulatory approvals. While the Application or its supporting appendices may refer to such other processes or information from time to time, the inclusion of such information is for context and reference only**.**

Any reference within the Application to market participants or other parties and/or the facilities they may own and operate or may wish to own and operate, does not constitute an application for approval of such facilities. The responsibility for seeking such regulatory or other approval remains the responsibility of the market participants or other parties.

v. **Directions to AltaLink**– Pursuant to subsection 35(1) of the Act, the AESO has directed AltaLink, in its capacity as a legal owner of transmission facilities, in whose service territory the need is located, to prepare a Facility Proposal to meet the need identified. The Facility Proposal is also submitted to the Commission for approval. The AESO has also directed AltaLink, pursuant to section 39 of the Act and section 14 of the *Transmission Regulation*, to assist in the preparation of the AESO's Application. AltaLink has also been directed by the AESO under section 39 of the Act to prepare a service proposal to address the need for the Preferred Transmission Development.

vi. **Capital Cost Estimates** – Capital cost estimates provided in the Application are planning cost estimates used by the AESO for the sole purpose of comparing Transmission Development Options. The requirements applicable to cost estimates that are used for transmission system planning purposes are set out in section 25 of the *Transmission Regulation*, AUC Rule 007, and Section 504.5 of the ISO rules, *Service Proposals and Cost Estimating*.