# Alberta Utilities Commission

**In the Matter of the Need for the Muir 2018S Substation**

**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**

**Application of the Alberta Electric System Operator for Approval of the Muir 2018S Substation Needs Identification Document**

# PART A - APPLICATION

## 1 Introduction

**1.1 Application –** Pursuant to Section 34(1)(c) of the *Electric Utilities Act* (Act), and in accordance with further provisions set out in legislation,[1] the Alberta Electric System Operator (AESO) applies to the Alberta Utilities Commission (Commission) for approval of the *Muir 2018S Substation Needs Identification Document* (Application).

**1.2 Application Overview –** ATCO Electric Ltd. (ATCO)[2], as the legal owner of an electric distribution system (DFO), has requested system access service in the Town of Fox Creek area (AESO Planning Area 24, Fox Creek). ATCO's request includes a Rate DTS, *Demand Transmission Service*, contract capacity of 19 MW in the Town of Fox Creek area to serve new demand for electricity. ATCO's request can be met by adding a new 144/25 kV point of delivery (POD) substation, to be designated the Muir 2018S substation, and one 144 kV circuit to connect the proposed Muir 2018S substation and the existing 144 kV transmission line 7L90 using a T-tap configuration (the "Proposed Transmission Development", as further described in Section 2.2). The scheduled in-service date for the Proposed Transmission Development is March 1, 2018.

This Application describes the need to respond to the DFO's request for system access service. Having followed the AESO Connection Process,[3] the AESO has determined that the Proposed Transmission Development provides a reasonable opportunity for the DFO to exchange electric energy and ancillary services. The Proposed Transmission Development is consistent with the AESO's long-term plans for the Northwest Planning Region, which includes the Town of Fox Creek and the surrounding area. The AESO, in

[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 (AUC Rule 007).

[2] In this Application, ATCO acts as both the legal owner of the electric distribution system (DFO) and the legal owner of transmission facilities (TFO) as applicable to its specific business functions.

[3] For information purposes, refer to note iv of Part C of this Application for more information on the AESO's Connection Process.

accordance with its responsibility to respond to requests for system access service, submits this Application to the Commission for approval.[4,5]

**1.3 AESO Directions to the TFO –** During the AESO Connection Process, the AESO issued various directions to the legal owner of transmission facilities (TFO), in this case ATCO, including direction to assist the AESO in preparing this Application.[6]

[4] For information purposes, some of the legislative provisions relating to the AESO's planning duties and duty to provide system access service are referenced in notes i and ii of Part C of this Application.

[5] Note v of Part C of this Application describes the Application scope in more detail.

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

# 2 Need Overview and Proposed Transmission Development

**2.1 Duty to Provide Transmission System Access Service –** The AESO, pursuant to its responsibilities under Section 29 of the Act, must provide system access service on the transmission system in a manner that gives all market participants (in this case the DFO), a reasonable opportunity to exchange electric energy and ancillary services.

The AESO, in collaboration with the DFO and the TFO, has determined that the Proposed Transmission Development is the preferred option to meet the DFO's request for system access service. The DFO, in executing its duties as defined under Section 105(1)(b) of the Act, has determined that the Proposed Transmission Development will meet its distribution planning criteria and will serve the new demand for electricity in the Town of Fox Creek area. The DFO has made the appropriate applications to the AESO to obtain transmission system access service.[7]

Through the AESO Connection Process, the AESO, the DFO, and the TFO have collaborated to determine the characteristics of the Proposed Transmission Development and to assess the impacts that the Proposed Transmission Development and the associated load would have on the transmission system. The AESO has issued directions to the TFO to prepare a transmission facility proposal[8] (Facility Proposal) to meet the DFO's request.

**2.2 Proposed Transmission Development –** The Proposed Transmission Development includes the following elements:

[7] For information purposes, some of the duties of the DFO are described in note vii of Part C of this Application.

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

1. Add a 144/25 kV POD substation, to be designated as Muir 2018S, including:
    a. one 144/25 kV transformer rated at approximately 50 MVA,[9]
    b. one 144 kV circuit breaker; and
    c. six 25 kV circuit breakers;[10]
2. Add one 144 kV circuit to connect the proposed Muir 2018S substation and the existing 144 kV transmission line 7L90 using a T-tap configuration;
3. Modify the existing Fox Creek 741S substation, including:
    a. adding one 144 kV, 40 MVAr capacitor bank; and
    b. one 144 kV circuit breaker; and
4. Modify, alter, add or remove equipment, including switchgear, and any operational, protection, control and telecommunication devices required to undertake the work as planned and ensure proper integration with the transmission system.[11]

**2.3 Proposed Transmission Development Cost Estimate –** The AESO directed the TFO to prepare a cost estimate for the Proposed Transmission Development. The TFO estimated the in-service cost of the Proposed Transmission Development,

[9] A minimum transformation capacity of 22 MVA is required; however, a transformer size of 50 MVA would be recommended based on good electric industry practice and under advisement from the TFO regarding its asset management and inventory practices.

[10] As requested by the DFO, the proposed Muir 2018S substation includes provision to connect a second transformer and 25 kV bus.

[11] Details and configuration of equipment required for the Proposed Transmission Development, including substation single-line diagrams, are more specifically described in the AESO's Functional Specification included in the TFO's Facility Proposal. Also, further details will be determined as detailed engineering progresses and DFO operating requirements are finalized. Routing and/or siting of transmission facilities do not form part of this Application and are addressed in the TFO's Facility Proposal. The 144 kV circuit is currently estimated to have a length of approximately 7 km. This is subject to change as routing and/or siting is finalized by the TFO. Line numbering and substation names provided here are for ease of reference and are subject to change as engineering and design progresses. Distribution facilities that may subsequently be connected to the Proposed Transmission Development are the responsibility of the DFO and are not included in the Application.

described in Section 2.2, to be approximately $23 million.[12] In accordance with the ISO tariff, the AESO has determined that there are no system-related costs associated with the Proposed Transmission Development.

**2.4 Transmission Development Alternatives –** The AESO, in consultation with the DFO and TFO, examined three transmission alternatives to respond to the DFO's request for system access service (Transmission Alternatives). [13]

Transmission Alternatives

1. **Upgrade the Fox Creek 741S substation** – This entails upgrading the existing Fox Creek 741S substation, including adding one 144/25 kV transformer, the appropriate number of 25 kV circuit breakers, and associated equipment. This alternative was ruled out as the DFO determined that it was not technically viable from a distribution system perspective.
2. **Modify the existing Benbow 397S substation**- This entails modifying the existing Benbow 397S substation, including adding the appropriate number of 25 kV circuit breakers and associated equipment. This alternative was ruled out as the DFO determined that it was not technically viable from a distribution system perspective.
3. **Add the Muir 2018S substation**- This entails adding a new POD substation, to be designated as the Muir 2018S substation. The Muir 2018S substation would include one 144/25 kV transformer, six 25 kV circuit breakers, and associated equipment.

The proposed Muir 2018S substation was selected as the preferred transmission alternative. The AESO, in consultation with the DFO and TFO, examined four connection alternatives (Connection Alternatives) to implement the preferred

[12] The cost is in nominal dollars using a base year of 2016 with escalation considered, and with an accuracy level of +20%/-10%. Further details of this cost estimate can be found in Appendix B.

[13] The DFO also examined and ruled out load shifting and distribution system upgrades, as detailed in Section 4 DFO's Distribution Deficiency Report, which is included as Appendix E.

transmission alternative; that is, to connect the proposed Muir 2018S substation to the AIES.

Connection Alternatives

1. **T-tap connection configuration on the 144 kV transmission line 7L199 -** This alternative involves connecting the proposed Muir 2018S substation to the 144 kV transmission line 7L199 using a T-tap configuration. This would require the addition of one 144 kV circuit, approximately 9 km in length. This alternative was ruled out due to the increased transmission developments and hence, increased costs, compared to the Proposed Transmission Development.
2. **In-and-out connection configuration on the 144 kV transmission line 7L199 -** This alternative involves connecting the proposed Muir 2018S substation to the 144 kV transmission line 7L199 using an in-and-out configuration. This alternative would require the addition of two 144 kV circuits, each approximately 9 km in length, and the addition of three 144 kV circuit breakers at the proposed Muir 2018S substation or the addition of one 144 kV circuit, approximately 9 km in length, and the addition of a switching substation, including three 144 kV circuit breakers. This alternative was ruled out due to the increased transmission developments and hence, increased costs, compared to the Proposed Transmission Development.
3. **T-tap connection configuration on the 144 kV transmission line 7L90 -** This alternative involves connecting the proposed Muir 2018S substation to the 144 kV transmission line 7L90 using a T-tap configuration. This would require the addition of a 144 kV circuit, approximately 7 km in length.
4. **In-and-out connection configuration on the 144 kV transmission line 7L90 -** This alternative involves connecting the proposed Muir 2018S substation to the 144 kV transmission line 7L90 using an in-and-out configuration. This connection alternative would require the addition of two 144 kV circuits, each approximately 7 km in length, and the addition of three 144 kV circuit breakers at the proposed Muir 2018S substation or the addition of one 144 kV circuit, approximately 7 km

in length, and the addition of a switching substation, including three 144 kV circuit breakers. This alternative was ruled out due to the increased transmission developments and hence, increased costs, compared to the Proposed Transmission Development.

The T-tap connection configuration on the 144 kV transmission line 7L90 was selected as the preferred connection alternative to implement the preferred transmission alternative. That is, the addition of the Muir 2018S substation connected to the AIES using a T-tap configuration on the 144 kV transmission line 7L90 was selected as the Proposed Transmission Development and forms the basis of the cost estimates and connection assessment described herein.[14]

**2.5 Connection Assessment –** Power flow and voltage stability analyses were conducted to assess the impact that the Proposed Transmission Development, without the 144 kV, 40 MVAr capacitor bank at Fox Creek 741S substation, and the associated load would have on the transmission system.[15] Power flow analysis was conducted prior to and following connection of the Proposed Transmission Development. Voltage stability analysis was performed following connection of the Proposed Transmission Development.

The pre-connection assessment identified system performance issues. Under certain Category B conditions, point-of-delivery (POD) 25 kV bus voltage levels lower than DFO requirements (hereafter referred to as DFO voltage requirement violations) were observed at the Fox Creek 741S and Benbow 397S substations.

The post-connection assessment identified the same system performance issues that were identified in the pre-connection assessment, as well as additional system performance issues. A number of the observed DFO voltage criteria violations were

[14] The original Proposed Transmission Development did not include a capacitor bank addition at Fox Creek 741S substation. The rationale for the modification of the existing Fox Creek 741S substation, including the addition of a 144 kV, 40 MVAr capacitor bank and a 144 kV circuit breaker is described in Section 2.4 below.

[15] The connection assessment is included as Appendix A.

exacerbated. In addition, new DFO voltage requirement violations were observed under certain Category B conditions. DFO voltage requirement violations were observed at the Fox Creek 741S, Benbow 397S, and Deer Hill 1012S substations under certain Category B conditions.

The DFOs in the Study Area determined that the observed low POD 25 kV bus voltage levels were unacceptable and requested that the AESO develop mitigation measures to address these system performance issues. The AESO has determined that the DFOs' request for mitigation measures can be met by modifying the existing Fox Creek 741S substation, including adding one 144 kV, 40 MVAr capacitor bank. The addition of the capacitor bank would address the low voltage levels observed at the POD 25 kV busses at the Fox Creek 741S, Benbow 397S, and Deer Hill 1012S substations. As a result, the Proposed Transmission Development was revised to include a 144 kV, 40 MVAr capacitor bank and a 144 kV circuit breaker at the Fox Creek 741S substation.

Additional post-connection power flow and voltage stability studies were completed following connection of the Proposed Transmission Development. No system performance issues were identified. The Proposed Transmission Development would not adversely affect the performance of the AIES.

**2.6 AESO Forecast and Transmission System Plans –** The AESO's corporate forecast for the Northwest Planning Region is consistent with the load associated with the Proposed Transmission Development.[16] The AESO's corporate forecasts are used by the AESO to assess the adequacy of the regional transmission system and as a basis for identifying the need for transmission system expansion or enhancement. Therefore, the need associated with the Proposed Transmission Development is consistent with the AESO's long-term plans for this region.

[16] Section 5.0 of the *AESO 2016 Long-term Outlook* discusses the Northwest Planning Region, which includes the Proposed Transmission Development area.

**2.7 Transmission Dependencies –** The Proposed Transmission Development does not require the completion of any other AESO plans to expand or enhance the transmission system prior to connection.

**2.8 AESO Participant Involvement Program –** The AESO directed the TFO to assist the AESO in conducting a participant involvement program (PIP). Between December 2016 and March 2017, the TFO and the AESO used various methods to notify stakeholders about the need for development and the AESO's preferred option to respond to the system access service request. In March 2017, the AESO notified stakeholders of its intention to file this Application with the Commission. Subsequent to this filing notification, the NID filing date was revised. In April 2017, the AESO re-notified stakeholders of its intention to file this Application with the Commission.

The AESO is not aware of any concerns or objections that have been raised regarding the need for the Proposed Transmission Development or the AESO's preferred option to respond to the system access service request.[17]

**2.9 Information Regarding AUC Rule 007, Section 6.2.1, NID15(2) –** The AESO has been advised that the TFO's Facility Proposal addresses the requirements of AUC Rule 007, Section 6.2.1, NID15(2).[18] In consideration of that fact, and as the filing of the Application is combined with the TFO's Facility Proposal, the AESO has not undertaken a separate assessment of the sort contemplated in AUC Rule 007, Section 6.2.1, NID15(2).

**2.10 Confirmation Date** – In the event that the proposed facilities are not in service by September 1, 2018, which is six months following the scheduled in-service date of March 1, 2018, the AESO will inform the Commission in writing if the need to expand or enhance the transmission system described in this Application continues, and if the

[17] Further information regarding the AESO's PIP for this Application is included in Appendix C.

[18] Please refer to the letter included as Appendix D of this Application.

technical solution described in this Application approval continues to be the AESO's preferred technical solution.[19]

**2.11 Approval is in the Public Interest –** Having regard to the following:

- the transmission planning duties of the AESO as described in Sections 29, 33 and 34 of the Act;
- the request for system access service;
- the DFO's Distribution Deficiency Report;
- the connection assessment;
- the cost estimate for the Proposed Transmission Development;
- information obtained from AESO PIP activities; and
- the AESO's long-term transmission system plans;

it is the conclusion of the AESO that the Proposed Transmission Development provides a reasonable opportunity for the market participant to exchange electric energy and ancillary services. In consideration of these factors, the AESO submits that approval of this Application is in the public interest.

[19] A detailed project schedule, which includes potential limitations or constraints as contemplated in AUC Rule 007, NID17(2), can be found in the TFO's Facility Proposal.

# 3 Request to Combine this Application with the Facility Proposal for Consideration in a Single Process

3.1 Pursuant to Subsection 35(1) of the Act, the AESO has directed the TFO to prepare a Facility Proposal to meet the need identified. The AESO understands that the TFO's Facility Proposal will be filed shortly.[20] The AESO requests, and expects the TFO will request, that this Application be combined with the Facility Proposal 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 6 of AUC Rule 007.

3.2 While it is believed that this Application and the Facility Proposal will be materially consistent, the AESO respectfully requests that in its consideration of both, 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 to respond to the DFO's request for system access service and provide a preliminary description of the manner proposed to meet that need. In contrast, the Facility Proposal will contain more detailed engineering and designs for the Proposed Transmission Development and seek approval for the construction and operation of specific facilities.

[20] The AESO understands that the TFO intends to file a Facility Proposal relating to this Application to be titled *Muir Point-of-Delivery (POD) Project.*

# 4 Relief Requested

4.1 The AESO submits that its assessment of the need to meet the market participant's request for transmission system access service is technically complete and that approval is in the public interest.

4.2 In the event that the proposed facilities are not in service by September 1, 2018, which is six months following the scheduled in-service date of March 1, 2018, the AESO will inform the Commission in writing if the need to expand or enhance the transmission system described in this Application continues, and if the technical solution described in this Application approval continues to be the AESO's preferred technical solution.

4.3 For the reasons set out herein, and pursuant to Section 34 of the Act, the AESO requests that the Commission approve this Application, including issuing an approval of the need to respond to the market participant's request for system access service, and for transmission developments, as follows:

A. Add a 144/25 kV POD substation, to be designated as Muir 2018S, including one 144/25 kV transformer, one 144 kV circuit breaker and six 25 kV circuit breakers;

B. Add one 144 kV circuit to connect the proposed Muir 2018S substation and the existing 144 kV transmission line 7L90 using a T-tap configuration;

C. Modify the existing Fox Creek 741S substation, including adding one 144 kV, 40 MVAr capacitor bank and one 144 kV circuit breaker; and

D. Modify, alter, add or remove equipment, including switchgear, and any operational, protection, control and telecommunication devices required to undertake the work as planned and ensure proper integration with the transmission system.

All of which is respectfully submitted this 18th day of May 2017.

Alberta Electric System Operator

Warren Clendining
Manager, Transmission Regulation Projects

# PART B – APPLICATION APPENDICES

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

**APPENDIX A** **Connection Assessment –** Appendix A contains the *Connection Engineering Study Report for AUC Application ATCO Muir New POD* that assesses the transmission system performance prior to and following the connection of the Proposed Transmission Development.

**APPENDIX B** **TFO Capital Cost Estimates –** Appendix B contains detailed cost estimates corresponding to the Proposed Transmission Development. These estimates have been prepared by the TFO at the direction of the AESO, to an accuracy level of +20%/-10%, which exceeds the accuracy required by AUC Rule 007, NID16.

**APPENDIX C** **AESO PIP –** Appendix C contains a summary of the PIP activities conducted, in accordance with requirement NID19 and Appendix A2 of AUC Rule 007, regarding the need to respond to the market participant's request for system access service. Copies of the relevant materials distributed during the PIP are attached for reference.

**APPENDIX D** **TFO Information Regarding AUC Rule 007, Section 6.2.1, NID15(2) –** Appendix D contains a letter provided by the TFO confirming that the requirements of AUC Rule 007, NID15(2) will be addressed within the TFO's Facility Proposal.

**APPENDIX E** **DFO Distribution Deficiency Report –** Appendix E contains the DFO's *Distribution Deficiency Report Muir 2018S POD* that provides information in support of the DFO's request for system access service, including describing the need for development.

**APPENDIX F** **AESO Transmission Planning Criteria – Basis and Assumptions –** Appendix F contains the *Transmission Planning Criteria – Basis and Assumptions,* Version 1, which includes the applicable thermal and voltage limits in

support of the Transmission Planning (TPL) standards.[21] Planning studies that are included in this Application meet the relevant performance requirements of the specified TPL standards (TPL-001-AB-0 and TPL-002-AB-0).

[21] TPL Standards are included in the current Alberta Reliability Standards.

# PART C – REFERENCES

i. **AESO Planning Duties and Responsibilities –** Certain aspects of AESO 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), describe the general planning duties of the AESO.[22] 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." Where, as in this case, the market participant (refer to note ii below) is requesting system access service to meet its distribution planning needs, and the request requires or may require the expansion or enhancement of the capability of the transmission system, the AESO must prepare and submit for Commission approval, as per Section 34(1)(c), a needs identification document that describes the need to respond to requests for system access service, including the assessments undertaken by the AESO regarding the manner proposed to address that need. Other aspects of the AESO's transmission planning duties and responsibilities are set out in Sections 8, 10, 11, and 15 of the *Transmission Regulation*.

ii. **Duty to Provide Transmission System Access –** Section 29 of the Act states that the AESO "must provide system access service on the transmission system in a manner that gives all market participants [the DFO in this case] wishing to exchange electric energy and ancillary services a reasonable opportunity to do so."

iii. **AESO Planning Criteria –** The AESO is required to plan a transmission system that satisfies applicable reliability standards. Transmission Planning (TPL) standards are included in the Alberta Reliability Standards, and are generally described at: https://www.aeso.ca/rules-standards-and-tariff/alberta-reliability-standards/.[23]

In addition, the AESO's *Transmission Planning Criteria – Basis and Assumptions* is included in Appendix F.

[22] The legislation and regulations refer to the Independent System Operator or ISO. "AESO" and "Alberta Electric System Operator" are the registered trade names of the Independent System Operator.

[23] This link is provided for ease of reference and does not form part of this Application.

iv. **AESO Connection Process** – For information purposes, the AESO Connection Process, which changes from time to time, is generally described at: https://www.aeso.ca/grid/connecting-to-the-grid/connection-process/[24]

v. **Application for Approval of the Need to Respond to a Request for System Access Service –** This Application is directed solely to the question of the need to respond to a request for system access service, 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 other processes or information from time to time, the inclusion of this 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.

vi. **Directions to the TFO –** Pursuant to Subsection 35(1) of the Act, the AESO has directed the TFO, in whose service territories 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 TFO has also been directed by the AESO under Section 39 of the Act to prepare a proposal to provide services to address the need for the Proposed Transmission Development. The AESO has also directed the TFO, pursuant to Section 39 of the Act and Section 14 of the *Transmission Regulation*, to assist in the preparation of the AESO's Application.

vii. **Duties of DFOs –** The duties of DFOs to make decisions about building, upgrading and improving their electric distribution systems are described in Section 105(1)(b) of the Act. The DFO, being responsible for electric distribution system planning, determines its need for transmission system access service based on its own distribution planning guidelines and criteria. While the DFO's plans are considered during the AESO Connection Process, the AESO, in executing its duties to plan the transmission system, does not oversee electric distribution planning or the development of specific DFO planning criteria. The AESO does, however, review

[24] This link is provided for ease of reference and does not form part of this Application.

the DFO forecasts that are submitted to the AESO, which may be considered in the preparation of the AESO's corporate forecasts.

viii. **Capital Cost Estimates –** The provision of capital costs estimates in the Application is for the purposes of relative comparison and context only. The AESO's responsibilities in respect of project cost reporting are described in the *Transmission Regulation*, including Section 25, and in Section 504.5 of the ISO rules.