



Alberta Utilities Commission

In the Matter of the Need for the Provost to Edgerton and Nilrem to Vermilion Transmission System Reinforcement

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 *Transmission Regulation*, AR 86/2007 and Alberta Utilities Commission Rule 007, all as amended

Application of the Alberta Electric System Operator for Approval of the Needs Identification Document for the Provost to Edgerton and Nilrem to Vermilion Transmission System Reinforcement

PART A - APPLICATION

1 Introduction

1.1 Application – Pursuant to Section 34 of the *Electric Utilities Act* (“Act”), the Independent System Operator, operating as the Alberta Electric System Operator (“AESO”), applies to the Alberta Utilities Commission (“Commission”) for approval of this Provost to Edgerton and Nilrem to Vermilion (“PENV”) Transmission System Reinforcement Needs Identification Document (“Application”).

1.2 Application Overview – This Application seeks approval of the need to alleviate identified constraints in the PENV area¹ and of the AESO’s preferred transmission development to meet the need and provide options for future generation system access in the area.

The Application also seeks approval to amend the Central East Transmission Development (“CETD”) Approval No. U2013-130 (“CETD NID Approval”) to cancel certain approved developments, as more particularly described in Section 9.

This Application is organized as follows.

Part A – Application	
Section 1 – Introduction	Describes the Application, its organization, and AESO directions that were issued to legal owners of transmission facilities in the PENV area.
Section 2 – PENV Area Transmission Network	Describes the PENV area transmission network and the AESO’s load and generation forecast in the PENV area.

¹ The PENV area is described in Section 2.

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Section 3 – Need for PENV Area Transmission System Reinforcement	Describes the existing system adequacy and reliability requirements in the PENV area and timing of the need for transmission system reinforcement.
Section 4 – Preferred Development Option	Describes the Preferred Development Option and its estimated cost, and provides an explanation of the new Drury 2007S substation.
Section 5 – Evaluation of Options and Selection of the Preferred Development Option	Describes the evaluated transmission development options, schedule and estimated costs; provides a summary of the system performance and capability studies; summarizes the conclusions of the TFO reports provided in accordance with Commission Rule 007, Section 6.1, NID7(9); and provides a comparison of the options considered by the AESO to select the Preferred Development Option.
Section 6 – Participant Involvement Program (“PIP”)	Describes the AESO’s PIP.
Section 7 – Proposed Development Schedule	Describes the proposed development schedule and estimated in-service date including information consistent with Commission Rule 007, Section 6.1, NID10.
Section 8 – Long-term Transmission Plans	Describes the alignment between the Preferred Development Option and the AESO’s long-term plans, and interdependencies between any planned developments and this Application.
Section 9 – CETD NID Approval Amendment	Describes the background and proposed amendments to the CETD NID Approval.

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Section 10 – Relief Requested	Describes the relief requested by the AESO.
Part B – Application Appendices	
Appendices A to G	A list of all appendices to the Application and a brief description of each are provided in pPart B. These appendices provide all of the supporting materials for the Application.
Part C - References	
For information purposes, certain legislative provisions applicable to the AESO’s transmission system planning duties are briefly described, together with a description of the scope of this Application.	

1.3 AESO Directions – Pursuant to Section 39 of the Act and Section 14 of the *Transmission Regulation*, the AESO directed ATCO Electric Ltd. (“ATCO”) and AltaLink Management Ltd. (“AltaLink”), in their separate capacities as the legal owners of transmission facilities (“TFOs”) in the PENV area, to assist the AESO in preparing this Application.

2 PENV Area Transmission Network

2.1 Existing PENV Area Transmission Network – The PENV area is one of three load zones in the Central East Sub-region, each of which is served by local transmission networks.² The PENV area includes the following five AESO planning areas.

- Vegreville (Area 56)
- Lloydminster (Area 13)
- Wainwright (Area 32)
- Provost (Area 37)
- Alliance/Battle River (Area 36)

The existing PENV area load is chiefly served by three local 138 kV/144 kV transmission lines - 7L701/701L, 7L50/7L129 and 749L/7L749 - that supply power from the Battle River 240 kV system in the south and the Cold Lake area in the north. Loading on transmission lines 749L/7L749 is approaching thermal limits under Category A conditions (all transmission elements in service) and is surpassing thermal limits under Category B contingency conditions (one transmission element out of service), resulting in thermal overloads and local voltage violations. The AESO currently manages constraints in the PENV area transmission system in real time by operational procedures such as line reconfigurations, forming radials, and remedial action schemes.

2.2 AESO Load Forecast and Generation Assumptions – Pursuant to its responsibilities under Section 33 of the Act and Section 8 of the *Transmission Regulation*, the AESO has forecast load growth in the Central Region, which includes load growth in the PENV area, as part of its current forecast, being the *AESO 2016 Long-term Outlook* (“2016 LTO”).³

² The remaining two load zones are the Cold Lake and Hanna planning areas.

³ Central Region is located at page 25 of the 2016 LTO available at: <https://www.aeso.ca/grid/forecasting/>

The PENV area load peaks in the winter season and primarily comprises manufacturing, pipeline pump stations and oil storage facilities. Compound annual load growth over 2010-2015 was approximately 3.3% summer and 1.9% winter and is forecast to be 2.7% summer and 3.5% winter over 2015-2021.

Existing PENV area generation includes the 689 MW Battle River coal-fired units and a 29 MW distribution connected wind generator at Bull Creek. In the PENV area planning studies, attached as Appendix A, the AESO considered existing generation, in conjunction with anticipated Battle River coal unit retirements, to isolate load serving constraints from the effects of any potential future generation developments.

The 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. Wind resources are more attractive in the eastern parts of the Central Region, including the PENV and Hanna areas, than elsewhere within the region. The 2016 LTO for the Central Region includes a forecast of 836 MW of wind development in the near term (2022) increasing up to 1,561 MW by 2030. However, the amount, timing and location of wind power developed in the Region will depend on renewables support, available transmission, and other factors.

To address generation forecast uncertainty, the AESO conducted a generation connection assessment to determine the amount of new generation that could connect to the transmission development options described below, taking into account various Battle River retirement scenarios.⁴

The AESO's Load and Generation Forecasts used in the PENV area planning studies are attached at Appendix B.

⁴ Included in the PENV area planning studies, attached at Appendix A.

3 Need for PENV Area Transmission System Reinforcement

This section describes the transmission system adequacy and reliability requirements, and the need for, and timing of, transmission reinforcement in the PENV area.

3.1 PENV Area Transmission System Adequacy and AESO Reliability Requirements – The AESO assessed the adequacy of the PENV area transmission network to supply load using the 2016 LTO load forecast for the 2021 study year under various scenarios and transmission contingencies (the “Need Assessment”).⁵

The Need Assessment scenarios included various combinations of forecast load, including summer and winter peak periods, and generation dispatch to stress the transmission system in the local PENV area. Thermal constraints under Category B contingencies were observed for both summer and winter peak load under several scenarios and contingencies. These thermal constraints were observed primarily when a local PENV area transmission element was taken out of service, forming long radial lines from the otherwise networked 138 kV/144 kV transmission system. Under these conditions, the lines remaining in service have limited capacity to serve local load. When coupled with the most critical generator for the scenario off-line, power is drawn from fewer sources in the Central East Sub-region, which exacerbates loading on lines that remain in service, leading to overloads.

The Need Assessment demonstrates that thermal overloads and low voltage violations occur in the near-term (2021) under the studied Category B contingencies in both winter and summer seasons. Several of the observed thermal overloads, up to 118.5% of rated line capacity, occur along two of the three main 138/144 kV transmission paths described in Section 2.1 - 7L50/7L129 and 749L/7L749. In addition, four other local 138 kV/144 kV transmission lines become overloaded under single contingency conditions.

⁵ As defined in the AESO’s *Consolidated Authoritative Document Glossary*, a contingency means the unexpected failure or outage of a system component, such as a generating unit, transmission line, circuit breaker, switch or electrical element. Appendix 1 to each of the Transmission Planning (TPL) standards, within the Alberta Reliability Standards, explains the contingency conditions through categories of events and their expected performance requirements. Additionally, the AESO’s Transmission Reliability Criteria are referenced in Part C of this Application.

The observed low voltage violations occur near the Lloydminster and Edgerton substations following the loss of transmission line 749L.

The AESO has determined that transmission reinforcement is needed in the PENV area to reliably serve the forecast load growth, in accordance with Alberta Reliability Standards TPL-001-AB-0, *System Performance Under Normal Conditions* and TPL-002-AB-0, *System Performance Following Loss of a Single BES Element*.

3.2 Timing of Transmission System Reinforcement – The AESO’s current use of operational procedures to manage PENV area constraints in real time, combined with the magnitude of the observed violations in the 2021 study year, indicate that there is a need to reinforce the PENV area transmission network before 2021. Therefore, the AESO evaluated the PENV area historical peak load and system performance and determined that the local transmission system has little or no remnant capacity to serve summer load above 400 MW under single contingencies. Since the recorded PENV area summer peak load was greater than 400 MW in 2013, 2015 and 2016 and is forecast to increase further, the AESO concluded that there is an immediate need for transmission reinforcement in the PENV area.

Since the earliest estimated in-service date (“ISD”) for the Preferred Development Option is Q1 2021, the AESO will continue to use operational measures to manage the PENV area transmission network prior to transmission reinforcement being placed into service.

4 Preferred Development Option

This section describes the Preferred Development Option included in this Application to alleviate the thermal and low voltage violations described in Section 3.

4.1 Preferred Development Option – Figure 1 illustrates the transmission system in the PENV area following the Preferred Development Option which includes the following major elements, all to be in service in 2021.

1. One new 144 kV Drury 2007S substation, expandable to 240/144 kV, in the vicinity of the Vermilion 710S substation.
2. One new 240 kV single circuit from the existing 240/138 kV Nilrem 574S substation to the Drury 2007S substation with a minimum capacity in the order of 485 MVA.⁶ The new 240 kV circuit to be operated at a nominal voltage of 138 kV.
3. One new 240 kV single circuit from the existing 240/138/25 kV Hansman Lake 650S substation to the existing 138/25 kV Edgerton 899S substation with a minimum capacity in the order of 485 MVA. The new 240 kV circuit to be operated at a nominal voltage of 138 kV.
4. Connect 7L65 line in/out to Drury 2007S substation; rename section of line between Drury 2007S and Vermilion 710S substation as 7L205.
5. Provide option for an additional T-tap on the new 240 kV circuit between the Hansman Lake 650S and Edgerton 899S substations for the 749AL tap.
6. Modify, alter, add or remove equipment, including switchgear, and any operational, protections, control and telecommunication devices required to

⁶ Studied transmission circuit ratings have been approximated to the accuracy level required by the AESO for transmission planning purposes. Minimum circuit ratings specified by the AESO are consistent with ratings of the existing circuits. Actual ratings of constructed facilities may vary.

4.2 Proposed Drury 2007S Substation – The AESO initially considered terminating the proposed single circuit from Nilrem 574S substation at the Vermillion 710S substation. By way of letter dated May 24, 2016, attached at Appendix F, ATCO advised the AESO that adding a new line at Vermillion 710S would not be feasible due to right of way constraints. Directly as a result of this information, the AESO is now proposing the Drury 2007S substation to terminate the new 240 kV single circuit from Nilrem 574S substation.

4.3 Preferred Development Option Costs – The total capital cost of the Preferred Development Option is estimated to be in the order of \$240 million (+/-30%).⁸ In accordance with the ISO tariff, the Preferred Development Option does not include any costs classified as participant-related.

⁸ The cost is in nominal dollars using a base year of 2016 with escalation considered. Refer to the TFOs' capital cost estimates included as Appendix C of this Application for further details. Also, note iv of Part C of this Application describes the AESO's responsibilities with respect to transmission cost estimates and reporting.

5 Evaluation of Options and Selection of the Preferred Development Option

This section explains the transmission development options that were evaluated by the AESO and all factors that were taken into consideration in the process of selecting the Preferred Development Option.

5.1 Transmission Development Option – In addition to the AESO’s Preferred Development Option, the AESO identified the following similar 138 kV/144 kV transmission development option built to 138 kV/144 kV standards (“138 kV/144 kV Option”).

1. One new 144 kV Drury 2007S substation near the Vermilion 710S substation.
2. One new 138 kV/144 kV single circuit from the existing 240/138 kV Nilrem 574S substation to the Drury 2007S substation with a minimum capacity in the order of 165 MVA.
3. One new 138 kV single circuit from the existing 240/138/25 kV Hansman Lake 650S substation to the existing 138/25 kV Edgerton 899S substation with a minimum capacity in the order of 165 MVA.
4. Connect 7L65 line in/out to Drury 2007S substation; rename section of line between Drury 2007S and Vermilion 710S substation as 7L205.
5. Provide option for an additional T-tap on the new 138 kV circuit between the Hansman Lake 650S and Edgerton 899S substations for the 749AL tap.
6. Modify, alter, add or remove equipment, including switchgear, and any operational, protections, control and telecommunication devices required to undertake the work as planned and ensure reliable integration with the transmission system

5.2 Development Schedule and Estimated Cost of the 138 kV/144 kV Option –

The earliest ISD for the 138 kV/144 kV Option is Q1 2021, which is the same as that of the Preferred Development Option. The total capital cost of the 138 kV/144 kV Option is

estimated to be in the order of \$210 million (+/-30%).⁸ In accordance with the ISO tariff, the 138 kV/144 kV Option does not include any costs classified as participant-related.

5.3 Transmission System Performance Study Results – The AESO PENV area planning studies, attached at Appendix A, evaluated the transmission system performance under certain assumptions following the Preferred Development Option. The same evaluations were also conducted for the 138 kV/144 kV Option and for a variation of the Preferred Development Option operated at 240 kV to evaluate conversion to 240 kV in the future, if needed (“240 kV Variation”). Each of the options studied would alleviate the thermal and voltage violations described in Section 3 for the 20-year planning horizon apart from thermal violations on the 138 kV transmission line 174L which worsen over the long-term in conjunction with load growth.

The AESO is cognizant of the potential for thermal overloads on 174L which are dependent not only on load growth but also off-setting generation growth in the PENV area, Battle River coal retirement timing, and the addition of coal replacement generation. In addition, the AESO is considering future transmission development to increase transfer in/out of the PENV area which could reduce thermal loading on 174L and avoid the observed overloads. The AESO will continue to evaluate the need to address potential constraints on 174L and establish mitigative operational procedures, if required.

The Preferred Development Option and the 138 kV/144 kV Option would each reduce system losses in the near term by approximately 1%.

5.4 Generation Integration Capability Assessment – As part of the PENV area planning studies, the AESO assessed the capability of the 138 kV/144 kV Option, the Preferred Development Option, and the 240 kV Variation to integrate additional generation. Assuming the three inter-area transmission lines 174L, 7L92 and 7L53 were operated normally open to avoid cross flows, and 749L was not restored, the maximum generation integration capability available along the proposed Drury-Nilrem and Hansman Lake-Edgerton paths would be:

1. 138 kV/144 kV Option – 410 MW

2. Preferred Development Option – 410 MW
3. 240 kV Variation – 860 MW

5.5 Information In Regards to Rule 007, Section 6.1, NID7(9) – The AESO directed the TFOs to prepare a report comparing transmission development options according to the major aspects contemplated in Commission Rule 007, Section 6.1, NID7(9). In response to this direction, the TFOs collaborated on study area boundaries and each submitted separate NID7(9) reports for their respective service territories. The TFOs' conclusions can be summarized as follows: (i) no features or factors were identified that preclude development of either of the transmission development options; (ii) features on the landscape where transmission developments would be expected to create higher impacts can likely be avoided or mitigated during route development; (iii) the transmission development options are geographically similar and as such, anticipated impacts would be similar in terms of the elements listed in NID 7(9); and (iv) the Preferred Development Option has a greater potential for land impacts than the 138 kV /144 kV Option given the increased footprint of the 240 kV structures, which would also limit routing options compared to the 138 kV /144 kV Option.⁹ The area for the Preferred Development Option is within the North Saskatchewan Planning Region, for which the North Saskatchewan Regional Plan is being developed.¹⁰ However, the stated strategic directions for the regional plan development are applicable to each option in a broad sense, as they relate to criteria used by the TFOs for routing and siting. The TFOs will investigate routing and siting alternatives in detail when preparing the related transmission facility proposals.

The above-referenced NID7(9) reports are included at Appendix E of this Application.

5.6 Selection of the Preferred Development Option – The AESO has compared the Preferred Development Option and the 138 kV/144 kV Option in respect of

⁹ ATCO further compared three options to reconfigure 144 kV transmission lines in the vicinities of Vermilion 710S and the proposed Drury 2007S substations. The AESO has subsequently determined that these line configurations are not needed and as such are not a factor in comparing options.

¹⁰ <https://landuse.alberta.ca/REGIONALPLANS/NORTHSASKATCHEWANREGION/Pages/default.aspx>

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transmission system performance, losses, generation integration capability, capital cost estimates, and Commission Rule 007, Section 6.1, NID7(9) requirements, and expandability, all as presented below.

Merits	Preferred Development Option	138 kV/144 kV Option
Transmission System Performance	Reliably serve load growth over twenty year planning horizon. Meets Alberta Reliability Standards with operational mitigation of 174L overloads, if necessary.	Reliably serve load growth over twenty year planning horizon. Meets Alberta Reliability Standards with operational mitigation of 174L overloads, if necessary.
Average System Losses	2021 – 443.1 MW, 1% reduction over existing system losses of 449 MW 2037 – 492.1 MW	2021 – 443.1 MW, 1% reduction over existing system losses of 449 MW 2037 – 492.9 MW
Generation Integration Capability ¹¹	410 MW	410 MW
Estimated Capital Cost +/- 30% (2021 ISD)	\$240 million	\$210 million
Commission Rule 007, Section 6.1, NID7(9) requirements	Feasible; avoidable or manageable impacts during routing and siting. Higher relative land impact due to structure footprint; reduced routing options.	Feasible; avoidable or manageable impacts during routing and siting.
Expandability to connect generation	The Preferred Development Option is expandable to 240 kV operation subject to a future needs identification	Additional transmission line development required with concomitant land impact to connect more than 410 MW

¹¹ Transmission capability to accommodate generation could be increased to 520 MW for both options if transmission line 749L were to be restored.

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	document approval and an additional cost at terminating substations (Nilrem, Drury, Edgerton, Hansman Lake). 240 kV operation would provide 860 MW of new generation connection capability.	of new generation to the 138 kV/144 kV Option.
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As both options are planned to be operated at 138 kV/144 kV, there is no material difference in respect of system performance, losses and generation integration capability. Further, there is a higher potential for land impact with the Preferred Development Option but there are no factors that would preclude the development of either option.

As the Preferred Development Option will be built to 240 kV standards, its estimated +/- 30% cost is approximately 14% higher, or \$30 million, than the 138 kV/144 kV Option. The value of the Preferred Development Option rests with its expandability to 240 kV operation in the future to provide increased connection options and transmission capacity for new generation along the new paths. The Preferred Development Option, when converted to 240 kV operation, could accommodate up to 860 MW of new generation along its two paths while the 138 kV/144 kV Option is limited to 410 MW of new generation.¹² The AESO sees the potential to exceed the 410 MW limit for the following reasons:

1. the Government of Alberta recently announced its Climate Leadership Plan, under which a target has been established that at least 30% of the electric energy produced in Alberta, measured on an annual basis, will be produced from renewable energy resources by 2030. 5,000 MW of this renewable generation

¹² If transmission line 749L were restored, generation capability of the Preferred Development Option would increase from 410 MW to 520 MW and from 860 MW to 950 MW for the 240 kV Variation.

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will be supported through the Renewable Electricity Program that will be administered by the AESO;¹³

2. wind generation is expected to be one of the most attractive and economic renewable resources to develop in Alberta;
3. the Central East Sub-region, including the PENV area, has extensive wind resource suitable for economic development;
4. the 2016 LTO forecasts wind development in the Central Region of approximately 1,600 MW by 2030;
5. there are two Vermilion area generation developments in the AESO connection queue that total 210 MW of additional generation;¹⁴ and
6. additional connection access opportunities will be attractive to wind developers.

For these reasons, the AESO selected the Preferred Development Option as its preferred transmission system reinforcement option.

¹³ <https://www.aeso.ca/market/renewable-electricity-program/>

¹⁴ Grizzly Bear Creek Wind Power at 120 MW and Irma Wind at 90 MW, both with 2018 in-service dates.

6 Participant Involvement Program

The AESO conducted a participant involvement program (“PIP”), in accordance with the requirement of NID11 and Appendix A2 of Commission Rule 007. Between October and December 2016, the AESO utilized various methods to notify occupants, residents and landowners as well as stakeholder groups and appropriate government bodies, agencies and representatives (collectively, “Stakeholders”) of the need for transmission reinforcement in the area where transmission facilities could be installed to address the identified need. Stakeholders were also notified in areas where the AESO is proposing to cancel certain components of the CETD NID Approval, as well as the area where Stakeholders were previously notified regarding the Vermilion to Red Deer, Edgerton to Provost Transmission Development Needs Identification Document, which the AESO has decided not to file. Between November 28 and December 2, 2016, the AESO advertised its intention to file this Application in a number of newspapers in the same Stakeholder notification areas.

The AESO believes that all comments and questions received from Stakeholders have been appropriately addressed. No concerns or objections to the need for the reinforcements and/or the Preferred Development Option, or the proposed CETD NID Approval amendments have been raised. Further information regarding the AESO’s PIP for this Application is included in Appendix D.

7 Proposed Development Schedule

7.1 Information Regarding Rule 007, Section 6.1 – NID9(2) – The TFOs have provided an approximate implementation schedule for the Preferred Development Option that results in an estimated earliest ISD of March 31, 2021, taking into account the requirements of Rule 007, Section 6.1, NID9(2). The AESO considers this ISD to be acceptable in the circumstances; however, the TFOs have advised the AESO that because their schedules necessarily contain numerous assumptions, the estimated ISD is subject to change as more detailed engineering and project planning is undertaken and regulatory and permitting activities are conducted.

7.2 Information Regarding Rule 007, Section 6.1 – NID10 – The AESO plans to issue an unconditional direction to the TFOs for preparation and submission of the TFOs' facilities applications to the Commission for the Preferred Development Option in 2017. However, if the AESO has not issued such directions to the TFOs before Q1, 2019, the AESO will confirm to the Commission in writing whether the need to expand or enhance the transmission system described in this Application continues, and whether the Preferred Development Option continues to be the AESO's preferred option for transmission reinforcement.

8 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 development option will address the identified reliability violations in the most efficient manner.

The AESO's 2015 Long-term Transmission Plan ("2015 LTP") recommended transmission development in the Central East Sub-region that aligns with the Preferred Development Option proposed by the AESO in this Application.¹⁵

8.1 Transmission Development Interdependencies – The Preferred Development Option will alleviate the identified need in the 20-year planning horizon and is independent of any other transmission developments that are currently planned within the Alberta interconnected electric system ("AIES") in this timeframe. Future load connections in the PENV Area will depend on the implementation of the Preferred Development Option for reliable unconstrained access to the AIES. Additionally, future generation connections along the two PENV paths will depend on the implementation of the Preferred Development Option for reliable access to the AIES.

¹⁵ 2015 LTP can be found on the AESO website: <https://www.aeso.ca/grid/long-term-transmission-plan/>

9 CETD NID Approval Amendment

9.1 CETD NID Approval - On May 20, 2010, by Application No. 1606218, the AESO applied to the Commission for approval of the *Central East Region Transmission Development Needs Identification Document* (the “CETD NID”). The Commission approved the CETD NID by way of *Decision 2011-048* and Approval No. U2011-57.

On December 19, 2011, by Application No. 1607984, the AESO applied to the Commission for approval to amend Approval No. U2011-57 to replace the Willingdon substation with the new Watt Lake substation. The Commission approved the amendment by way of *Decision 2013-123* and the CETD NID Approval.

9.1 Amendment to the CETD NID Approval - For the reasons provided in Section 9.2, the AESO proposes to amend Stage I and Stage II of the CETD NID Approval to delete certain approved components as described below (collectively, the “Cancelled Developments”).

A. Delete the following Stage I and Stage II components in their entirety:

Stage I

“3. Provost area:

- a) Rebuild 144-kV transmission line 7L749 from Edgerton 899S substation (4-12-44-4-W4) to Lloydminster 716S substation (SW 26-49-1-W4) using one 477 kcmil ACSR conductor per phase.
- b) Build a new single-circuit 138-kV transmission line from Provost 545S substation (13-7-39-2-W4) to Hayter 277S substation (1-17-41-1-W4) using one 795 kcmil ACSR conductor per phase.
- c) Rebuild 138-kV transmission line 748L from Hayter 277S substation to Killarney Lake 267S substation (4-1-42-3-W4) using one 795 kcmil ACSR conductor per phase.
- d) Rebuild 138-kV transmission line 715L from Hansman Lake 650S substation (SE-1-40-5-W4) to Provost 545S substation using one 795kcmil ACSR conductor per phase.

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- e) Rebuild 138-kV transmission line 749L from Metiskow 648S substation (4-6-40-4-W4) to Edgerton 899S substation and build a 138-kV double-circuit transmission line from the existing Killarney Lake tap on transmission line 749L to Killarney Lake 267S substation as an in-and-out configuration using on 795 kcmil ACSR conductor per phase.

4. Wainwright area:

- a) Build a new single-circuit 138-kV transmission line on the existing 69-kV right-of-way from Wainwright 51S substation (1-10-45-7-W4) to Edgerton 899S substation using one 477 kcmil ACSR conductor per phase.
- b) Rebuild 138-kV transmission lines 704L and 704AL between Wainwright 51S substation, Tucuman 478S substation (2-32-42-9-W4) and Jarrow 252S substation (8-18-46-10-W4) using one 477 kcmil ACSR conductor per phase.”

Stage II

- “1. Rebuild the existing 138/144-kV transmission line 7L50 from Battle River 757S substation (SW 29-40-15-W4) to Buffalo Creek 526S substation (4-12-48-9-W4) using one 477 kcmil ACSR conductor per phase.”

B. Delete the following Stage I components in their entirety:

5. Lloydminster and Battle River Planning areas:

- “b) Restore 144-kV transmission line 7L14 from Vermilion 710S substation to Hill 751S substation (SE 11-50-1-W4) and 144-kV transmission line 7L701 from Battle River 757S substation (SW 29-40-15-W4) to Strome 223S substation (4-2-46-15-W4) to their respective full thermal conductor rating by migrating line clearance issues.”

And replace with:

5. Lloydminster and Battle River Planning areas:

- “b) Restore 144-kV transmission line 7L701 from Battle River 757S substation (SW 29-40-15-W4) to Strome 223S substation (4-2-46-15-W4) to its respective full thermal conductor rating by migrating line clearance issues.”

9.2 Amendment Rationale – In the CETD NID, the AESO recommended the Cancelled Developments to accommodate load and generation growth and mitigate thermal constraints. The PENV area planning studies, which include up-to-date system topology, AESO corporate forecast, and planning horizons (2021-2037), demonstrate that the Preferred Development Option will alleviate the identified thermal and voltage violations in the PENV area and enable generation connections without the Cancelled Developments being in service. Therefore, the Cancelled Developments are no longer needed to reliably serve forecast load and generation in the area.

9.3 Estimated Costs – In the CETD NID, the TFOs estimated the cost of the Cancelled Developments to be in the order of \$205 Million (+30/-30%, 2009\$).¹⁶

¹⁶ CETD NID, Appendix G, PDF page 23

10 Relief Requested

10.1 Approval is in the Public Interest: Having regard to the factors set out in Section 38 of the *Transmission Regulation*, and in particular, Subsection 38(d) and (e), the AESO submits that:

- its assessment of the need for transmission system reinforcement in the PENV area is technically complete;
- its assessment that certain CETD NID components are no longer needed is technically complete, and cancelling them is in the public interest; and
- the Preferred Development Option meets the identified need, satisfies Alberta Reliability Standards, is consistent with the AESO long-term forecasts and area transmission system plans, and is in the public interest.

As such, the AESO also submits that approval of the Application is in the public interest.

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

(a) approve this Application, including the Preferred Development Option, which will be comprised of the following, with a target ISD of Q1 2021:

1. One new 144 kV Drury 2007S substation, expandable to 240/144 kV, near the Vermilion 710S substation.
2. One new 240 kV single circuit from the existing 240/138 kV Nilrem 574S substation to the Drury 2007S substation. The new 240 kV circuit to be operated at a nominal voltage of 138 kV.
3. One new 240 kV single circuit from the existing 240/138/25 kV Hansman Lake 650S substation to the existing 138/25 kV Edgerton 899S substation. The new 240 kV circuit to be operated at a nominal voltage of 138 kV.
4. Connect 7L65 line in/out to Drury 2007S substation; rename section of line between Drury 2007S and Vermilion 710S substation as 7L205.

PENV Transmission System Reinforcement

5. Provide option for an additional T-tap on the new 240 kV circuit between the Hansman Lake 650S and Edgerton 899S substations for the 749AL tap.
6. Modify, alter, add or remove equipment, including switchgear, and any operational, protections, control and telecommunication devices required to undertake the work as planned and ensure reliable integration of the Preferred Development Option with the transmission system; and

(b) amend CETD NID Approval No. U2013-130 as described in Section 9.1

All of which is respectfully submitted this 16th day of December, 2016.

Alberta Electric System Operator

< SIGNED ELECTRONICALLY >

Sami Abdulsalam, Ph.D., P. Eng.
Director, Transmission System Projects

PART B – APPLICATION APPENDICES

The following appended documents support the Application (Part A). The appendices include work undertaken by the AESO in the execution of its duties to plan the transmission system and in the preparation of this Application.

APPENDIX A **AESO PENV Area Transmission Reinforcement Planning Studies** – Appendix A contains the *Provost to Edgerton and Nilrem to Vermilion (PENV) Transmission Reinforcement Planning Studies Report*, which describes the need for transmission system reinforcement in the PENV area.

APPENDIX B **AESO Load and Generation Forecast** – Appendix B contains the *Provost to Edgerton and Nilrem to Vermilion Transmission Reinforcement 2016 Long-term Outlook Load and Generation Forecasts* used in the planning studies report contained in Appendix A.

APPENDIX C **TFO Capital Cost Estimates** – Appendix C contains the TFOs' capital cost estimates referred to in this Application. The estimates have been prepared by the TFOs according to the AESO's directions. The estimates are prepared to an approximate accuracy level of (+/-30), which meets the accuracy requirement of Commission Rule 007, NID8.

APPENDIX D **AESO Participant Involvement Program (PIP)** – Appendix D provides a summary of the PIP activities conducted regarding the need for the transmission reinforcement in the PENV area and the Preferred Development Option, and cancellation of certain approved CETD NID developments, all as described in this Application.

APPENDIX E **Commission Rule 007, Section 6.1, NID7(9)** – Appendix E contains the NID7(9) reports provided by the TFOs in consideration of the aspects of Commission Rule 007, Section 6.1, NID7(9).

APPENDIX F **ATCO Letter regarding Vermilion 710S Substation** – Appendix F contains ATCO's letter stating that right of way constraints prevent expanding the

Vermilion 10S substation to accept termination of the new circuit from Nilrem 574S substation.

APPENDIX G AESO Transmission Planning Criteria – Basis and

Assumptions – The AESO has revised the Transmission Reliability Criteria, Part II System Planning, Version 0, dated March 11, 2005 mainly to remove all criteria that are now included in the TPL Standards.¹⁷ Appendix G contains the Transmission Planning Criteria – Basis and Assumptions, Version 1, which includes the applicable thermal and voltage limits in support of the TPL standards. Planning studies that are included in this Application is in accordance with all the performance requirements of the specified TPL Standards (TPL-001-AB-0 and TPL-002-AB-0).

¹⁷ TPL Standards are included in the current Alberta Reliability Standards.

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), state the general planning duties of the AESO.¹⁸ 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 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. Where, as in this case, the AESO has identified a need to reinforce the transmission system to relieve anticipated reliability violations, it has set about to determine a reasonable solution to meet the identified need. 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 Planning Criteria** – The AESO is required to plan a transmission system that satisfies applicable reliability standards. TPL standards are included in the Alberta Reliability Standards and are described at: <http://www.aeso.ca/rulesprocedures/17006.html>¹⁹

In addition, the AESO’s *Transmission Planning Criteria – Basis and Assumptions* is included in Appendix G.
- iii. **Application for Approval of the Need for Expansion or Enhancement of the Capability of the Transmission System** – This Application is directed solely to the question of the need for expansion or enhancement of the capability of the transmission system as more fully described in

¹⁸ 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.

¹⁹ This link is provided for ease of reference and does not form part of this Application.

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 is not intended to constitute an application for approval of such facilities, and the responsibility for seeking such regulatory or other approval remains the responsibility of such market participants or other parties.

- iv. **Capital Cost Estimates** – Capital costs estimates provided in the Application are planning cost estimates used by the AESO for the sole purpose of comparing transmission development options. Where only a single transmission development option has been studied, capital cost estimates are provided for context. Project costs will be determined by the TFOs as part of their transmission facility proposals. The AESO's responsibilities with respect to project cost reporting are described in the *Transmission Regulation*, including Section 25, and Section 9.1 of the ISO rules.