Project Connection Assessment

P2758 Oyen 2 Solar Project

UK Solar West Ltd.

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The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

1 Introduction

This Project Connection Assessment evaluates the connection alternatives using the study results and other considerations, and identifies the AESO's preferred connection alternative for the approved Oyen 2 Solar Project (the Facility), which includes the Robin 1135S substation.[1] The conclusions in this report are based on the documents listed below which were prepared by the AESO in accordance with the AESO's Cluster Assessment Process:

- Detailed Assessment Report titled "Detailed Assessment Report Central Cluster" dated May 26, 2025, Version 3.
- Detailed Re-Assessment Study Scope titled "Detailed Re-Assessment Study Scope Central Cluster" dated May 14, 2025, Version 1.

1.1 Overview

UK Solar West Ltd. (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its approved Facility to the AIES. The Market Participant's request includes: a request for new system access service in the area, with a Rate STS, *Supply Transmission Service*, contract capacity of 162 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 1 MW; and a request for transmission development (collectively, the Project). The scheduled in-service date (ISD) for the Project is April 1, 2029.

The Project was studied as part of the Central Cluster, which includes the Vegreville (Area 56), Lloydminster (Area 13), Wainwright (Area 32), Provost (Area 37), Alliance/Battle River (Area 36), Hanna (Area 42), Red Deer (Area 35), Didsbury (Area 39), Caroline (Area 38), Drayton Valley (Area 30), Hinton/Edson (Area 29), Abraham Lake (Area 34), and Cold Lake (Area 28) AESO planning areas. A total of 18 new generation and energy storage projects were studied as part of the Central cluster.

Power flow and short circuit studies were performed in the assessment for both the pre-Cluster and post-Cluster scenarios. Transient stability studies were performed for only the post-Cluster high generation scenarios and voltage stability studies were performed for only the post-Cluster low generation scenarios.

2 Connection Alternatives

The AESO, in consultation with the Transmission Facility Owner (TFO) in the Study Area and the Market Participant (MP), examined 5 transmission alternatives to meet the MP's request for system access service for the Project.

[1] Decision 29307-D01-2026: UK Solar East Ltd. and UK Solar West Ltd. - Oyen 1 and Oyen 2 Solar Projects, Proceeding 29307, Applications 29307-A001 to 29307-A004, January 9, 2026.

2.1 Connection Alternatives Examined

Below is a description of the developments associated with the transmission alternatives that were examined for the Project.

Alternative 1a – T-Tap connection to the existing 240 kV transmission line 9L46

This alternative included the following developments:

- Add one 240 kV circuit, approximately 3 km[2] in length, to connect the Facility to the existing 240 kV transmission line 9L46; and
- Add or modify associated equipment as required for the above transmission developments.

Alternative 1b – In-and-Out connection to the existing 240 kV transmission line 9L46

This alternative included the following developments:

- Add one 240 kV switching substation, including three 240 kV circuit breakers, connected to the existing 240 kV transmission line 9L46 (between Pemukan 932S and Lanfine 959S substations) using an in-and-out configuration;
- Add one 240 kV circuit, approximately 3 km[3] in length, to connect the Facility to the switching substation; and
- Add or modify associated equipment as required for the above transmission developments.

Alternative 2a – T-tap connection to the existing 240 kV transmission line 9L24

This alternative included the following developments:

- Add one 240 kV circuit, approximately 11.5 km[4] in length, to connect the Facility to the existing 240 kV transmission line 9L24; and
- Add or modify associated equipment as required for the above transmission developments.

Alternative 2b – In-and-Out connection to the existing 240 kV transmission line 9L24

This alternative included the following developments:

- Add one 240 kV switching substation, including three 240 kV circuit breakers, connected to the existing 240 kV transmission line 9L24 (between Oakland 9465S and Lanfine 959S substations) using an in-and-out configuration;
- Add one 240 kV circuit, approximately 11.5 km[5] in length, to connect the Facility to the switching substation; and
- Add or modify associated equipment as required for the above transmission developments.

[2] Exact line length to be determined by the TFO.

[3] Exact line length to be determined by the TFO.

[4] Exact line length to be determined by the TFO.

[5] Exact line length to be determined by the TFO.

Alternative 3 – Radial connection to the existing 240 kV Lanfine 959S substation

This alternative included the following developments:

- Add one 240 kV circuit, approximately 12.2 km[6] in length, to connect the Facility to Lanfine 959S substation;
- Modify Lanfine 959S substation by adding one 240 kV circuit breaker; and
- Add or modify associated equipment as required for the above transmission developments

2.2 Connection Alternatives Not Selected

Alternative 1a and 2a were ruled out as T-tap connections to 9L46 and 9L24 have already been offered to other projects more advanced in the AESO Connection Process (P1567 EDPR Sharp Hills Wind Farm and P2464 Sunnynook Solar Battery, respectively). Adding an additional tap onto 9L46 or 9L24 to connect the Facility would create a 4-terminal configuration. Four terminals on a transmission line can pose potential protection coordination challenges and may result in adverse impacts on system stability and reliability. This configuration negatively impacts transmission and generation facility reliability and can result in an increased probability of forced and planned outages on these facilities. These risks are exacerbated with the unavailability of validated hardware and lack of field and operational experience by the TFOs to implement four-terminal protection schemes.

Given the risks and operational complexities associated with a four-terminal configuration explained above, and because a technically feasible in-and-out connection (Alternative 1b) was available with a comparable scope of transmission development, Alternative 1a was ruled out. Alternative 2a was also eliminated due to the risks and operational complexities associated with a four-terminal configuration, and because it involves increased transmission development and hence increased cost and environment and land impact compared to Alternative 1b.

Alternatives 2b and 3 involve increased transmission line developments, and hence increased cost and environmental and land use impacts, compared to Alternative 1b. Therefore, Alternatives 2b and 3 are ruled out.

2.3 Selection of Preferred Alternative

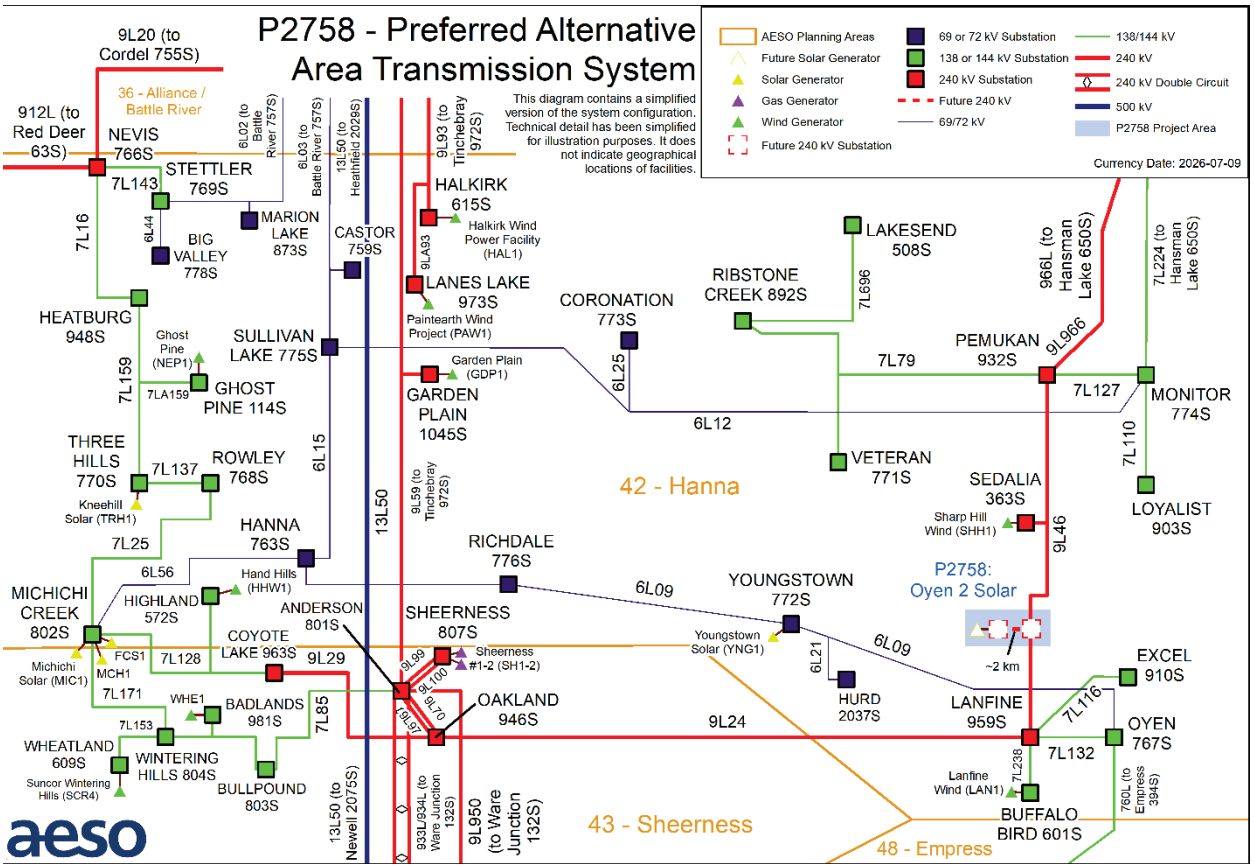
The AESO selected Alternative 1b as the preferred connection Alternative to respond to the Market Participant's request for system access service.

The conductor used for the 240 kV circuit should have a minimum thermal rating of 180 MVA to accommodate the MP's requested STS contract capacity.

The proposed connection configuration for this alternative is shown in Figure 3-1.

[6] Exact line length to be determined by the TFO.

Figure 3-1: Preferred Connection Alternative



2.4 Summary of Cluster Study Results for Alternative 1b

This section summarizes the results of the detailed cluster assessment, which is included under separate cover. The study results are based on the forecast, as well as the planned projects (load and generation) that are included in the studies.[7]

Category A Conditions

The pre-Cluster and post-Cluster power flow studies identified a number of thermal criteria violations under Category A conditions. All the thermal criteria violations observed were exacerbated in the post-Cluster scenarios compared to the pre-Cluster scenarios.

Post-cluster maximum short-circuit fault levels were not significantly higher than pre-cluster levels and found to be within the typical capabilities of the facilities.

[7] As other projects move through the AESO Connection Process, the AESO may conduct additional studies for the Project to determine if new mitigation measures or modifications to the initial mitigation measures specified in the Functional Specification are required. Such mitigation measures, if feasible and required, must be implemented by the in-service date of the Project. The AESO will discuss any proposed changes and/or additions with the market participant and the TFO prior to specifying new or modified mitigation measures.

Category B Conditions

The pre-Cluster and post-Cluster power flow studies identified a number of thermal violations under Category B condition. All of the thermal criteria violations observed were exacerbated in the post-Cluster scenarios compared to the pre-Cluster scenarios. The post-cluster transient stability study results showed transient stability violations under following the loss of 240 kV transmission lines 9L24, 9L29, and 953L.

Mitigation Measures

The most effective generators in the study area were dispatched down to alleviate the thermal criteria violations observed under Category A system conditions. Due to high contribution of this Facility to the thermal criteria violations in the area, generation curtailment under the Category A condition may be required for the Facility in real time.

The Category A violations will be mitigated through the use of real-time operational practices, which include applying the procedures set out in Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* (the TCM Rule) to curtail generation as required. The need for system developments to address Category A violations will be assessed according to the forthcoming Optimal Transmission Planning (OTP) framework.

Thermal criteria violations under Category B can be mitigated through the use of existing, planned and/or new RASs in the study area and real-time operational practices, alone or in combination, as appropriate. The Project will be added to modified RAS 201. The transient stability concerns were mitigated by new transient stability RASs for 9L29 and 9L24 and reducing fault clearing times for 953L; none of these transient mitigation measures involve the Project.

The total amount of generation assigned to RAS 201 is greater than the Most Severe Single Contingency (MSSC). Therefore, pre-contingency generation curtailment might be required under the Category A condition to maintain system reliability.

The Constraint Summary Table in the Detailed Assessment Report describes the mitigation measures in more detail. Modified RAS 201[8] is identified as a requirement in the AESO Functional Specification. With the implementation of this mitigation measure, connecting the project with the preferred connection alternative does not adversely affect the performance of the AIES.

[8]Proposed mitigation measures highlighted in this document are preliminary. New or revised mitigations measures may be proposed at a later stage of the project.