aeso

Protection Coordination
Assessment Guideline

MAY 2026

aeso

Alberta Electric System Operator
3000, 240 4 Avenue SW
Calgary, AB • T2P 4H4
aeso.ca

Protection Coordination

Assessment Guideline

Date of issue: April 22, 2026

	Name	Signature	Date
Author – Lead Engineer	Lucy Lin, P.Eng		April 22, 2026
Checked & Approved – Senior Advisor, Operational Reliability	Changling Luo, P.Eng		April 22, 2026

PROFESSIONAL ENGINEER
LUCY LIN
ID 93491
ALBERTA
2026-04-22

PERMIT TO PRACTICE
INDEPENDENT SYSTEM OPERATOR
RM SIGNATURE:
RM APEGA ID #: 98372
DATE: April 22, 2026
PERMIT NUMBER: P008200
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Contents

Executive Summary

Purpose and Scope

The Alberta Electric System Operator (AESO) has developed the Protection Coordination Assessment guideline to support Transmission Facility Owners (TFOs) and Market Participants (MPs) in complying with the proper coordination requirements under Section 503.15 of the ISO rules, *Interconnected Electric System Protection Technical Requirements*. This guideline:

- Describes protection coordination challenges due to the high penetration of inverter-based resources (IBRs) and increasing complexity of system connection topologies
- Clarifies AESO position on variance request to protection miscoordination and total fault clearing times
- Provides transparency and guidance on how to conduct the applicability, pre-screening, screening and detailed study by the responsible entity and how to provide the detailed study report to the AESO, demonstrating compliance
- Defines a standardized approach for protection coordination assessments, including methodology, inputs, assumptions, performance criteria and reporting requirements
- Helps TFOs and MPs understand the protection coordination assessment fit into the AESO connection process

Rationale

Proper coordination is a fundamental performance requirement of the protection system. Protection miscoordination can create several grid reliability and stability challenges including:

- Unnecessary or excessive outages
- Equipment damage and publish safety hazards
- Abnormal voltage and frequency excursions
- Cascading tripping and potential widespread blackouts

Performance Criteria

Connecting a new generating facility to the grid must achieve the requirements set out in

- Subsection 2 of Section 503.15, as to maintain the proper coordination with any adjacent protection systems and remain stable for faults external to the zone of protection
- ID #2020-018, *Generating Unit Technical Requirements*, as to achieve standard fault clearing times for transmission connection projects

Application

TFOs and MPs are expected to apply this guideline for all applicable projects to assess compliance with proper coordination requirements before energizing the proposed facility.

1. Protection Coordination Introduction

1.1 Background

Protection coordination assessment is related to Section 503.15, *Interconnected Electric System Protection* of the ISO rules (Section 503.15).

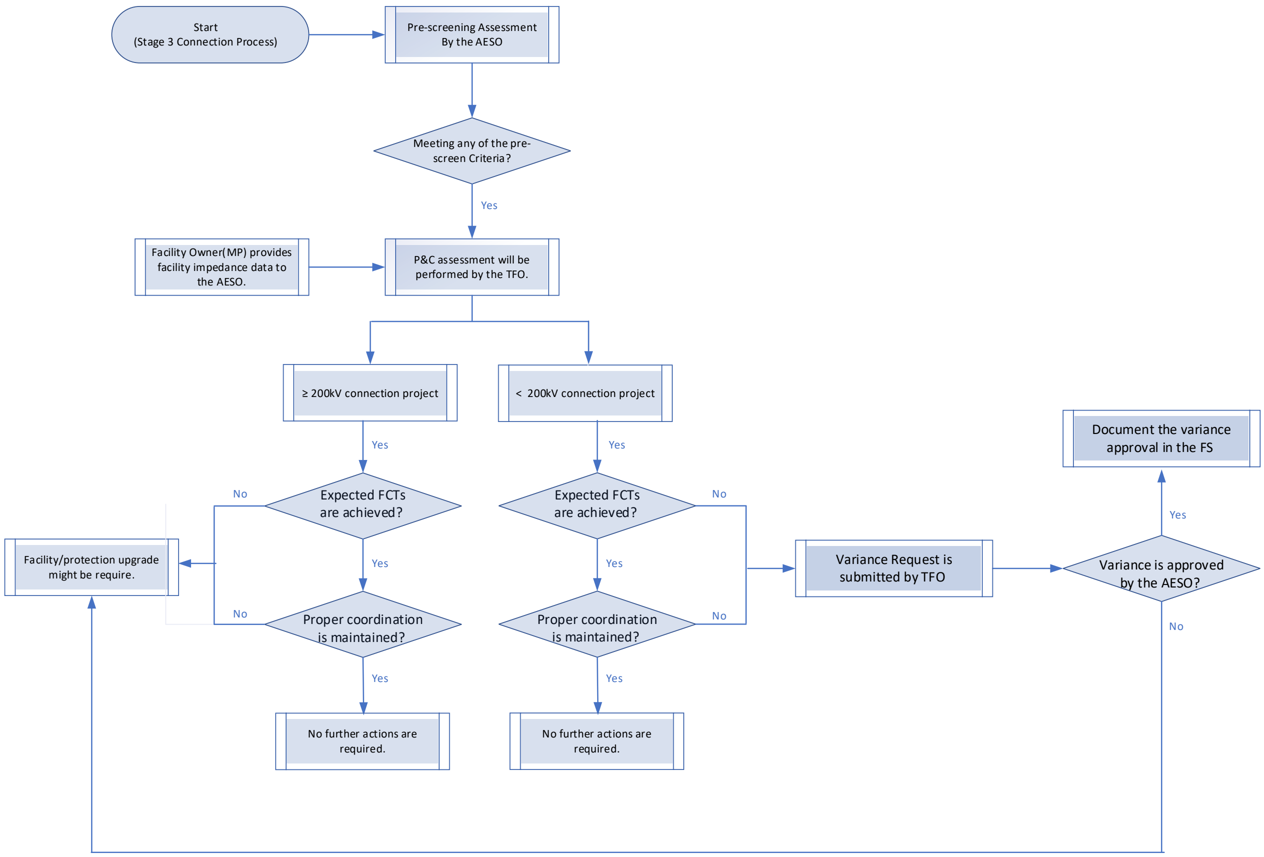
As transmission systems continue to develop, the growing penetration of IBRs creates some unique behaviours during system faults, such as low fault current contribution, voltage fluctuations and frequency deviations, which could lead to protection system malfunction. Also, when a new connection project is proposed to connect to the existing facilities (e.g. series compensated lines), thorough technical analyses are required to identify its potential risks on the existing facilities with the focus on the system protection issues. As a result, conducting preliminary protection coordination assessment early in the project stage becomes increasingly critical, particularly to support decisions on the connection alternative. Transmission facility owner (TFO) protection engineers should evaluate these underlying impacts and propose feasible solutions in detailed study in later stage to ensure the effectiveness and robustness of protection system and compliance.

MPs projects that have been as high-risk through the applicability, pre-screening criteria or screening steps will be required to conduct detailed study, providing evidence of compliance with the AESO Authoritative Document, which will be documented in a project’s functional specification.

This guideline was developed to educate stakeholders about why the protection coordination assessment is required and how a project will be assessed through a standardized approach. It provides transparency and guidance on how to conduct the applicability, pre-screening, screening and detailed study by the responsible entity and how to provide the detailed study report to the AESO, demonstrating compliance. It is not authoritative and for information purposes only.

A high level of the protection coordination assessment process flow is shown below in Figure 1.

Figure 1: Assessment Process Flow Visual



1.2 Roles and Responsibilities

This section outlines the high-level roles and responsibilities of various tasks in the study. All the parties can reach out AESO's project manager for details.

Table 1: RACI Chart for P&C Assessment

Note: R – Responsible; **A** – Accountable; **C** – Consult; **I** – Inform

Deliverable	AESO	Transmission Facility Owner (TFO)	Generation Facility Owner (GFO)	Distribution Facility Owner (DFO)	Market Participant (MP)
Applicability and Pre-Screening (Earliest Connection Process Stage: Stage 1)					

Identify the preferred connection alternative and perform the pre-screening	A/R	C	I	I	I
Screening Assessment (Earliest Connection Process Stage: Stage 2)					
Provide required protection information including modeling data at the proposed facility	I	C	R	R	R
Provide the connection alternatives for the connection project	R	C	I	C	I
Perform screening assessment and identify the need for detailed protection assessment study	A	R	I	I	I
Detailed Protection Assessment Study (Earliest Connection Process Stage: prior to Stage 3)					
Develop study scope for the detailed assessment study	C	R	C	C	C
Provide study data including modeling data and preliminary single-line diagram at the proposed facility	C	C	R	R	R
Perform detailed protection assessment study based on the study scope provided	C	R	C	C	C
Result Acceptance and Mitigation Recommendation (Earliest Connection Process Stage: Stage 3)					

Provide study results and/or mitigation plan	C	R	I	I	I
Review and accept study results	R	A/C	I	I	I
Review and accept the proposed mitigation plan	R	A/C	C	I	C
Update the functional specification	R	C	I	I	I

Note:

Responsible (R) = "the doer". Those who do work to achieve the task. There can be multiple resources responsible. The act of approving a deliverable can be categorized under the responsible party.

Accountable (A) = "the buck stops here". The resource ultimately answerable for the correct and thorough completion of the task There can only be one "A" specified for each task.

Consulted (C) = "in the loop". Those whose opinions are sought. Those who have special knowledge or expertise needed to make decisions or solve problem. Two-way communication.

Informed (I) = "in the picture". Those who are kept up-to-date on progress and decisions (once made). May be impacted by decision but are not active in final decision. One-way communication.

1.3 Applicability

Projects that may be applicable to this guideline include:

- Transmission-connected generation projects (e.g., generating unit, aggregated facility, or energy storage resource)
- Transmission-connected load projects (e.g., large-scale data center, industrial load)
- Behind-the-fence (BTF) projects that involve alteration (e.g., load or generation) situated within an industrial complex directly connected to the transmission system or distributed energy resources (DERs) with maximum authorized real power (MARP) equal and greater than 5 MW

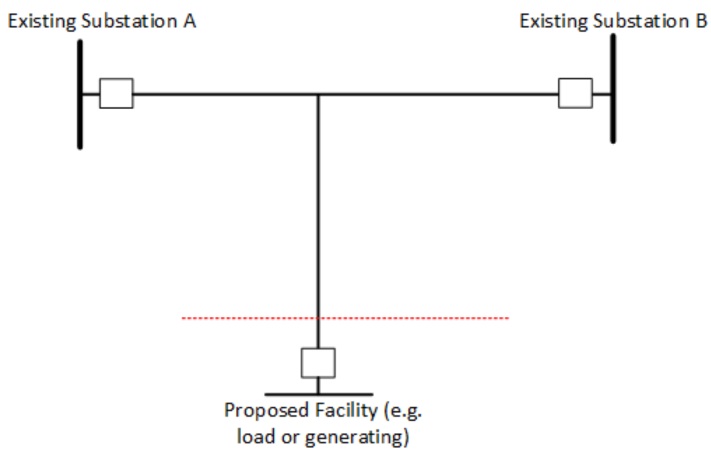
1.4 Pre-Screening

Pre-screening is required when project applicability cannot be directly applied, and engineering judgment must be applied to several factors to determine if a connecting facility can be excluded from further analysis.

The AESO will conduct a high-level pre-screening assessment based on the proposed connection topology as below, but is not limited to:

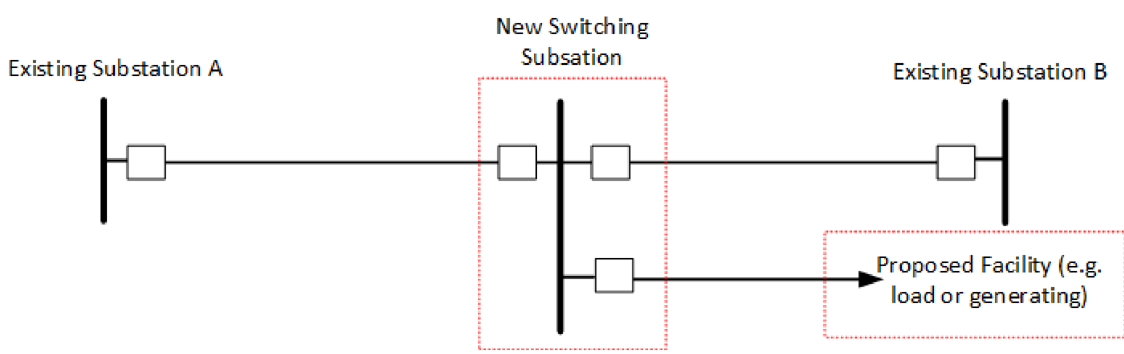
- BTF projects to connect DER
- T-tap connection alternative to the existing substations

Figure 2: T-tap Configuration for a Proposed Facility



- In-and-out configuration with a new switching substation

Figure 3: In-and-Out Configuration for a Proposed Facility



1.5 Screening Assessment

The purpose of the screening assessment is to identify potentially high-risk connection alternatives or existing protection deficiencies from the protection performance's perspective. If the screening study identifies a potential risk with protection performance, a subsequent phase involving either, or both, the hardware solution or a detailed assessment study will be pursued.

The TFO can skip the screening study and go directly to a detailed assessment study or hardware mitigation. The TFO should inform the AESO at the beginning of stage 2 and the AESO will skip the screening phase and proceed with the next phase (hardware mitigation and/or detailed assessment study requirements).

Refer to the Protection Assessment Study Requirements section for the screening assessment criteria.

If the screening assessment is passed but there are changes in the screening inputs during the connection process (e.g., connection alternative change), then the screening should be repeated. MPs should be aware of this risk especially if they decide to change their facility design.

1.6 Detailed Study

As outlined in AESO's Risk-Based Assessment Approach in Appendix A, the need for a detailed protection assessment study is identified if a project meeting the applicability or pre-screening criteria does not pass the Screening Assessment, which indicates that further assessment is required to ensure that there is no operational or reliability risk to the AIES, or that the risk can be adequately mitigated through difference protection scheme or facility upgrade. As such, the project functional specification will be updated to include the protections assessment detailed study requirement.

A structured and detailed approach to undertake a protection assessment study, covering all necessary steps from data collection to mitigation strategies to ensure power system reliability is outlined in Appendix B.

For identified high risk projects, the AESO will include the detailed study requirement in the functional specification. The AESO suggests MPs to present the detailed study results using the study report template in Appendix A.

1.7 Result Acceptance and Mitigation Implementation

The TFO must submit the study assessment study report for the connection alternatives provided by the AESO, if applicable, and the proposed mitigation solution, which must be accepted by the AESO before the in-service date of project. The AESO shall review the study report within reasonable time and may provide comments, requesting the MP to respond prior accepting the report. We may revise the functional specification of the project according to the study result or proposed mitigation solution. Any delay on the study report submission may result in delay in project energization.

1.8 Energization Requirements

The AESO authorizes the project to connect to the AIES and achieve energization when the project meets all our energization checklist requirements, outlined in the 100-day and 30-day energization packages. The required study report will be included in the energization checklist. We encourage the MP to check with AESO's project manager to fully understand how to meet the energization requirements.

2. Protection Assessment Study Requirements

With rapid growth of IBRs interconnection and the increasing complexity of system topology within the AIES, conducting protection assessments of a generating facility's potential impact on the existing grid becomes significantly important. This includes evaluating potential adverse impacts on the existing network equipment and other surrounding facilities as well. Accurate modelling of each network component is essential for fault current calculation and protection coordination analysis. Practical considerations such as general assumptions, input data, result interpretation, and data exchange are also essential. This section offers guidelines and discussions on key aspects to consider when performing protection assessment related to the connection of a new facility.

2.1 Study Software

Protection coordination analysis in power systems requires specialized software tools capable of short-circuit analysis, as well as accurate modelling and the relay coordination for electrical components. Typically, short-circuit analysis and relay coordination study are performed using a commercial system modelling tool (e.g., ASPEN OneLiner, PSS®CAPE, ETAP) with a data library. The AESO does not have any specific requirements regarding the type of software to use.

Regardless of who performs the study, any results that demonstrate an impact on the design or operation of the interconnection should be communicated to the concerned parties.

2.2 Required Modelling Data

A short-circuit study is an analysis of an electrical network that determines the magnitude of the currents flowing in the network during an electrical fault. Because the results of short-circuit studies are used as the basis for protective device coordination studies, the short-circuit model should accurately reflect the physical power system. Therefore, short-circuit analysis and relay coordination study necessitates the collection of a wide range of data to accurately assess existing protection system performance, determine potential risks, and propose appropriate mitigation measures.

The required modelling data often represents all associated system equipment in the proposed facility shown on a single-line diagram, including, but not limited to, power transformers, (aggregated) generating units, generator unit transformers, feeders/cables, instrument transformers (e.g., current and potential transformers), etc. From the short-circuit analysis point of view, basic data required for this study is to collect the positive, negative and zero-sequence impedance of each facility element and establish the correspondent sequence networks using symmetrical component method.

For synchronous generators, the sub-transient positive-sequence impedances Xd" should be applied to represent the fault behaviours during the first few cycles after a short-circuit occurs at the generator's terminal. For IBRs, MP is required to provide the type of IBRs with equivalent sub-transient impedance or maximum limiting current. If the data might not be available at a project's earlier stage, the typical data should be provided to the adjacent TFOs with the best assumption.

2.3 Acceptance Criteria

Once the data collection and modelling setup are complete, protection performance assessments will be carried out a review of whether the developed protection schemes and relay settings are adequately suitable for a new connection project, based on the two key criteria: total fault clearing times (FCTs) and proper coordination with adjacent protection systems.

If study results can not achieve the AESO protection requirements and cause some issues as miscoordination or prolonged FCTs, this may drive potential protection or facility upgrades when needed. Communication between the TFOs and the AESO throughout the connection studies is advised particularly where the studies identify these underlying deficiencies.

2.3.1 Standard Fault Clearing Times

The total FCT is the maximum allowable duration for a fault to be cleared while maintaining system stability. It serves as a benchmark for setting the operating times of protective relays, selecting the associated circuit breakers and optimizing telecommunication channels.

Requirement R1.3.10 in TPL-002-AB1-0 *System Performance Following Loss of a Single BES Element* does require simulation of normal clearing [1] when assessing the impact of a single line ground or 3-phase (3Ø) fault on the performance of the transmission system.

As part of the connection studies when connecting a new facility or modifying an existing facility within the AIES, the AESO is conducting transient stability analysis based on standard fault clearing times shown in Table 1. The actual total FCTs, including the protective relay operating time, circuit breaker interrupting time and telecommunication latency if applicable, are expected to be shorter than the standard FCTs and provide a safety margin to account for uncertainties and variations under fault conditions.

Table 2: Fault Clearing Times for Transmission Facilities by Nominal Voltage

Nominal Voltage	Near End	Far End
kV	**Cycles**	
500	4	5
240	5	6
144/138 (with telecommunications)	6	8
144/138 (without telecommunications)	6	30

[1] Normal clearing is when the protection system operates as designed and the fault is cleared in the time normally expected with proper functioning of the installed protection systems.

2.3.2 Proper Coordination

The primary purpose of the coordination assessment is to select the proper protection schemes and design relay settings for the protective devices to ensure the minimum isolation with the intended sequence during faults. Proper protection coordination study is very crucial to protect equipment protection, improve system reliability and stability and enhance safety. Transmission primary protection is required to clear all types of faults within the shortest possible time with reliability, selectivity and sensitivity, while backup protection shall cater for failure of any primary protection system to clear any fault that it is expected to clear.

The following basic requirements should be achieved when evaluating and proposing the protection schemes for a connection project:

- For 200 kV and above systems, proper coordination should always be maintained under Normal and N-1 contingencies (i.e., single protection component out-of-service or the strongest system element outage) conditions
  - Any instantaneous zone (e.g., distance relays Zone 1, permissive tripping zone) from each terminal must not operate for a fault external to its zone of protection
- Sequential fault clearance might be acceptable at below 200 kV system, pending to sransient system stability study to affirm no adverse implication with slower fault clearance

2.3.3 Recommendations on Tapped Line Protection Schemes with IBR Connection

Both IBRs and synchronous generators (SGs) can provide essential reliability sources to the AIES. Unlike traditional SGs, IBRs exhibit different short-circuit characteristics. The physical impedance behind a voltage source drives the fault response of SGs. In contrast, IBRs integrate with the power system through a power electronic interface. This power electronic interface is a fundamental physical difference between IBRs and traditional SGs, which results in their different fault behaviours and responses during faults. As such, legacy protection schemes and practices, which have been designed based on the fault current response of conventional rotating machines, are no longer adequately suitable to handle IBR characteristics, such as low magnitude of fault current, unstable polarizing angles, and limited negative-sequence current.

Moreover, considering economic and environmental constraints, t-tap connections have been frequently proposed to connect an IBR facility into the AIES. The protection of multi-terminal lines presents unique and complex challenges that are not encountered in applications with two-terminal lines. A line-tapped terminal supplied by an IBR often provides a strong zero-sequence path due to the transformer configuration but may behave as a weak positive-sequence and negative-sequence source, requiring additional attentions.

Based on the analysis on fault currents and apparent impedance with IBR connection, some recommendations for line protection schemes with IBR connection are outlined as below:

- Line differential protection scheme is a preferred solution in protecting 3-terminal lines wherever reliable tele-protection grade communication circuits are available

- Due to fault currents contribution largely depending upon pre-fault operating conditions, and lack of negative-sequence current I2 and inconsistency in phase relationships between I2 and negative-sequence voltage V2 during unbalanced faults, line protections (e.g., negative- and zero-sequence directional elements) at the IBR station are prone to being unreliable
- The instantaneous protection scheme at two substation terminals must be independent from the protection at IBR station
  - Line protection at IBR station should implemented with backup protection in case of breaker failure and channel failure

Operation of line protection at either substation terminal shall result in opening all breakers at the remote substation terminal and IBR station via direct transfer trip scheme between substation terminals and the IBR station.

3. Protection Consideration of Series Compensated Lines

Series compensation is an essential technology in modern power transmission systems, improving both steady-state and dynamic performance. By effectively reducing the line reactance, it offers a cost-efficient method to enhance system stability and increase the power-transfer capability of long-distance transmission corridors. When new connection projects are proposed alongside existing compensated lines; however, the combined effect can unintentionally lead to overcompensation. This condition requires careful consideration, as it can significantly affect the protection schemes of both the overcompensated line and nearby lines. Ensuring reliable protection performance under these altered electrical characteristics becomes a critical engineering challenge.

3.1 Challenges on Line Relays Based on Impedance Measurements

Series compensated lines are subject to subharmonics excited by system disturbances including but not limited to faults, switching in the capacitor, etc., causing transient current. Normally it takes a few cycles or longer for such transients to settle down with sufficient damping in the system.

Besides subharmonics, there are other sub-synchronous oscillations when there are rotating generator machines or inverter-based resources electrically nearby.

When being deployed to protect a series compensated line, typical distance (aka impedance) protection would suffer both voltage and current reversals. Different from overcurrent relays making decision on current magnitude, distance relays utilize both voltage and current measurements in detecting faults. Voltage connected to the distance relays depends on the source impedance and the impedance between the relay location and the fault location. Thus, the correct operation of distance relays including their directionality control depends on the relationship between the source impedance and the measured line impedance to fault location. With a large capacitor connected in series with the line, the classic algorithm in distance relays for the directionality control during faults may no longer work properly.

Voltage reversal happens when the impedance between the relay and the faulted location is capacitive. Note that on a conventional transmission line, the relay always measures the impedance to the faulted location to be inductive. Voltage reversal could also happen in negative and zero-sequence network when the source impedance is less than the magnitude of the reactance of a capacitive line impedance.

Current reversals happen at locations that the combined source impedance and the capacitive line impedance is capacitive. When that becomes the case, for a fault internal to the protected line, current appears as flowing out of one terminal and entering from the other terminal, which “fools” the distance relay to treat an internal fault as an external one.

The transients at frequency lower than 60 Hz impose challenges to distance relays too, causing it to overreach or fail to operate, if not mitigated in the relay’s algorithm.

The voltage protection on the series capacitors utilizing metal oxide varistor (MOV) cause abrupt voltage changes which may cause distance relays to fail too.

Despite of intelligence of tele-protection signalling being exchanged across different ends, distance protection needs a lot of studies to be set right.

3.2 Modern Protection Solution and Considerations

Through advanced protection hardware and algorithm available in modern digital relays, most of the above-mentioned challenges on distance relays may no longer be a big problem. Regardless, line differential protection has become a good and preferred solution in protecting series compensated lines wherever reliable tele-protection grade communication circuits can be installed.

Besides transients in current transformer (CT) saturation and capacitive voltage transformers (CVTs), protection on series compensate lines faces additional transients caused by series capacitor interacting with line inductance, and with other devices like MOV on the series capacitors and more and more inverters. Relay settings based on old operating experience or guideline would cause them to be less accurate. Instead of applying larger margin on settings, other means or tools may be resorted for settings to be made accurate, precise and effective. Even with line differential being the primary protection scheme, distance elements need to be correctly set anyway at least to serve purpose of system backup. Depending on facility owners' practice, some may feel necessary to implement distance-based permissive overreaching transfer trip (POTT) schemes in addition to the line differential protection being the primary scheme.

For jurisdictions allowing t-tapping transmission lines, it may be inevitable to allow a project with a concept to t-tap an existing transmission line with series compensation. Although 3-terminal line different protection may work, the operational mode becomes more complicated than before. Considering sub-synchronous transients and those challenges faced by classic distance relays under the more complicated operational modes, it becomes more challenging to set both the line differential elements and the distance backup elements accurately and effectively.

It is suggested real-time digital simulator (RTDS) or similar validation be specified to verify the protection settings, scheme effectiveness, and immunity to variety of non-faults but hard-to-predict behaviour of the power system under different contingencies. Those can be modelled and simulated in an electromagnetic transient (EMT) program like Power Systems Computer Aided Design (PSCAD) or Electromagnetic Transients Program (EMPT). In dealing with series compensated lines with t-tap IBRs, as a matter of fact, the system operator and the facility owner have not had operational experience. For a new type of application, it is imperative to conduct comprehensive RTDS or similar testing backed by EMT modelling and simulation in designing, validating and testing the protection hardware and software (relay algorithm and relay settings). Putting extra effort that is not required in normal or common applications should be justifiable because examining and validating protection effectiveness using RTDS type of tools before putting the protection into service would benefit system integrity by avoiding protection mis-operations during a future operation incident or a fault.[2]

[2] Note: a connection project closed to fixed series capacitor (FSC) may initiate protection system changes to the FSC itself. Since the FSC protection is proprietary to the FSC manufacturer, TFO should consult with FSC manufacturer to review the existing FSC protection and identify the potential impacts on FSC. The MOV study needs to be completed before checking whether FSC protection changes are required.

Appendix A: GRIP Overview

Introduction

The Alberta Interconnected Electric System (AIES) is undergoing a period of grid transformation driven by multiple factors, including the increasing integration of inverter-based resources (IBRs) such as wind and solar, changes in system topology, and evolving operating conditions. Collectively, these factors present the following challenges to the Alberta Electric System Operator (AESO):

- High penetration of IBR, which can reduce system capability to manage and maintain frequency stability, system strength and operational flexibility
- Restrictions on the availability of reliability support through interties due to weak connectivity with the Western Interconnection, where excessive reliance on external resources increases the risk of intertie tripping
- Increasing operational limitations associated with newly energized facilities
- An increase in reliability-related phenomena observed during real-time operations

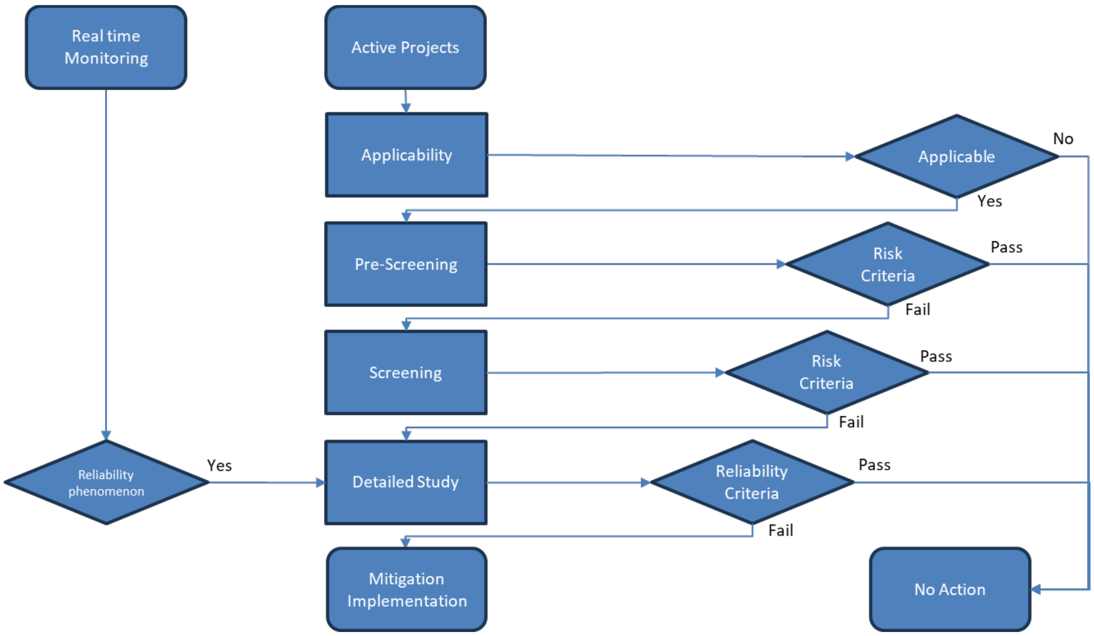
As a result of these emerging AIES reliability challenges, the AESO has identified several areas where performing Grid Readiness, Integration and Performance (GRIP) Requirements would be beneficial. System reliability is also heavily dependent on how market participants (MPs) conduct technical assessment and design the facility accordingly to meet connection requirements prior to energization. Therefore, we have created standard guidelines on how to conduct GRIP. We have adopted a risk-based approach, which considers the risk to the reliability of the AIES using project information, beginning with high-level screening assessments for all active connection projects and, where necessary, proceeding to more detailed studies. These studies may identify potential mitigation measures to be implemented during the connection process. This approach seeks to strike the right balance between moving efficiently through the connection process and exercising the due diligence required to ensure system reliability.

AESO's Risk-Based Assessment Approach

The AESO's process for GRIP uses a risk-based framework, as shown in Figure A1, which consists of:

- Applicability
- Pre-screening
- Screening
- Detailed study, report and submission
- Result acceptance
- Mitigation implementation

Figure A1: Risk-Based Assessment Approach



The phases of this process occur at different points throughout the AESO's Connection Process. For topics related to AESO Authoritative Documents, MPs are responsible for completing applicability, pre-screening and screening steps independently, and are encouraged to use the approach and methodology outlined in this guideline. In all other cases, the AESO will conduct these initial steps. These steps will determine whether a facility requesting system access can be excluded from further analysis or requires further study as a high-risk project. Projects identified as high risk will include a detailed study requirement in the project's functional specification. This guideline provides details on the recommended approach for conducting detailed studies. Upon receiving the detailed study, the AESO will work with MPs to review and comment on the report in accordance with this guideline. We may revise project's functional specification if the report results in changes to a project's scope of work.

Applicability

The objective of applicability phase identifies projects requiring further assessment using applicability criteria based on accessible project information available early in the customer connection process such as, facility size, type and technology. As this topic relates to the AESO Authoritative Documents, the guidelines applicability aligns with that of the relevant AESO Authoritative Documents.

Once a project meets the applicability criteria it will move to the next relevant step following the guideline. MPs have the option to skip the pre-screening or screening steps and move directly to the detailed study or mitigation steps.

Pre-screening

The objective of pre-screening is to conduct a further assessment once the preferred connection alternative is selected. At this stage, the project details such as point of connection, nearby facilities and project scope are known, which are used to help identify potential high-risk projects by the AESO. This information helps the MP and the AESO understand the risk of meeting protection coordination requirements.

Screening

The objective of screening is to conduct a further assessment when more detailed technical information on MPs proposed facility becomes known. This guideline introduces a technical evaluation to assess whether a project qualifies as high-risk. Projects identified as high-risk move to the detailed study stage.

Detailed Study, Report and Submission

The objective of the detailed study is to demonstrate compliance with the AESO's Authoritative Document. If a project does not meet these requirements, it may create reliability risks to the AIES. The study aims to identify potential reliability issues through advanced calculations or simulations outlined in this guideline prior to project energization. To conduct this work, the responsible entity will require detailed project information and models, which usually occurs in the later stages of the customer connection process. The AESO will identify and include the detailed study and report submission requirements in the functional specification for the high-risk projects.

Mitigation

The detailed study report may show that the MP cannot fully demonstrate compliance with the AESO's Authoritative Document. When this happens, the MP must propose a solution to address the potential non-compliance and consult the AESO on the proposed solution. The detailed study will then need to be revised to confirm the effectiveness of the proposed mitigation.

As indicated above, a responsible entity has the option to skip the screening steps and proceed directly to the Detailed Study. Further, if the responsible entity is aware the detailed study will indicate a reliability issue or potential non-compliance, the responsible entity may proceed with proposing a mitigation solution to the AESO.

Result Acceptance

Upon submission of the detailed study report, the AESO will follow this guideline to review and comment on the report within a timely manner. The responsible entity of the detailed study will be responsible to address all AESO comments and authenticate the study report. The detailed study must be completed 100 days and 30 days prior to the project energization.

It is important to note that this guideline is meant to assist the AESO in understanding and mitigating the risks to reliability of the AIES. This risk-based assessment is not conclusive and if the reliability phenomenon is observed in real-time, we will work with the MP on real-time mitigation measures. Furthermore, project changes, accepted through the AESO's Project Change Proposal process may trigger the need for additional applicability, pre-screening, screening and detailed study.

aeso

Appendix B: Detailed Study Report Template

It is encouraged that a study report will be written based on the template below to present your relevant study, analysis, or findings for a specific study topic. Following AESO's study guidelines on the specific study topic can help the AESO to review your study report in an efficient and effective manner. This template can also be used for the report to present screening results if required.

1.0 Title Page

This section shall include report title, project number, author/reviewer/approvers names, date of submission and Association of Professional Engineers and Geoscientists of Alberta (APEGA) authentication.

2.0 Executive Summary

This section will provide a summary of the study report, including main objectives, study methodology, key findings, recommendations, mitigation if required, etc.

3.0 Table of Contents

This table will list sections and subsections with page numbers in the report.

4.0 Introduction/Objective

This section will outline the background information on a specific topic, and study purpose, objective and its scope.

5.0 Methodology and Scenarios

This section will elaborate on the study approach and list the scenarios to study. Other key information such as simulation software and its version, data collection methods, analysis or evaluation techniques should be included. Please check with AESO's corresponding study guideline to use the recommended methodology and scenarios.

6.0 Criteria (if applicable)

This section will define the basis for judgement and decision-making in the report, including applicable standards, justification for selecting these criteria, application of criteria, etc.

7.0 Inputs Data and Assumptions

This section will define the information, variables and underlying assumptions in the report, including raw data and key variables, credible assumptions made in the study. Please check with AESO's corresponding study guideline to use the recommended inputs and assumptions.

8.0 Simulation Results Analysis

This section will demonstrate the key outcomes from the study, including overview of the simulation, data presentation using tables, graphs or charts, and interpretation of expected or unexpected results. Please check AESO's corresponding study guideline to use the recommended way to present simulation results if defined.

9.0 Mitigation/Correction Actions (if applicable)

This section will explore solutions or measures to address risks identified in the study report and proposes the mitigation/corrective actions which shall be implemented prior to the project energization. If the mitigation requires another study to confirm the effectiveness, the separate study report can be submitted to the AESO.

10.0 Conclusion

This section will summarize the main takeaways, interpret the implications of the findings and provide the final thoughts to support the decision-making.

11.0 References

The section will list all sources cited in the study report.

12.0 Appendices

This section will provide some additional information that supports the study report. It can include raw data, diagrams, detailed calculations, etc.

Alberta Electric System Operator

3000, 240 4 Avenue SW
Calgary, AB • T2P 4H4
aeso.ca

06/2026