Development of Proposed New Section 502.11 of the ISO rules, *Substation Technical and Operating Requirements* (“Section 502.11”)

September 2019

Fire safety:
AESO building evacuation procedures

Calgary Place

Slow alarm:
- Stand by
- Listen to announcements

Fast alarm:
- Evacuate to muster point

Muster point:
- Courtyard at 5th Ave Place

BP Centre

Slow alarm:
- Stand by
- Listen to announcements

Fast alarm:
- Evacuate to muster point

Muster point *South*:
- Courtyard at 5th Ave Place

Muster point *West:*
- Courtyard by Chinese Cultural Center

SCC

When alarm sounds:
- Proceed to Guard House
- Wait for further instruction *(From your fire captain or fire department)*

Access to Wi-Fi

User Name: A-Guest

Password: @Great$YYC

Agenda
September 10, 2019

Time	Agenda Item
10:00-10:10	Consultation Session Overview and Introductions
10:10-10:15	ISO Rule Development Process Overview
10:15-12:30	Review Each Subsection of Proposed New Section 502.11 and Provide Opportunity for Stakeholder Discussion and Feedback
12:30-1:00	Lunch
1:00-2:45	Review Each Subsection of Proposed New Section 502.11 and Provide Opportunity for Stakeholder Discussion and Feedback (continued)
2:45-3:00	Wrap Up and Next Steps

Agenda
September 24, 2019

Time	Agenda Item
10:00-10:10	Consultation Session Overview and Introductions
10:10-12:30	Review Each Subsection of Proposed New Section 502.11 and Provide Opportunity for Stakeholder Discussion and Feedback (continue from where the September 10 Consultation Session ended)
12:30-1:00	Lunch Break
1:00-2:45	Review Each Subsection of Proposed New Section 502.11 and Provide Opportunity for Stakeholder Discussion and Feedback (continued)
2:45-3:00	Wrap Up and Next Steps

Consultation Session Overview and Introductions

Consultation Session Overview
Stakeholder Expectations

- All stakeholders:
  - This is your session to ask questions and provide feedback so please actively participate
  - One speaker at a time
  - Introduce yourself by stating your name and company
  - Your positions are not binding, but provide your input in good faith so we can work together to address the issues

- In-person attendees:
  - Raise your hand to speak and use the microphone

- Webinar attendees:
  - Please submit questions or comments using the question button

Consultation Session Overview
Meeting Minutes

- Session is recorded and will be used to assist in preparation of meeting minutes
  - Recording will be deleted after minutes are finalized

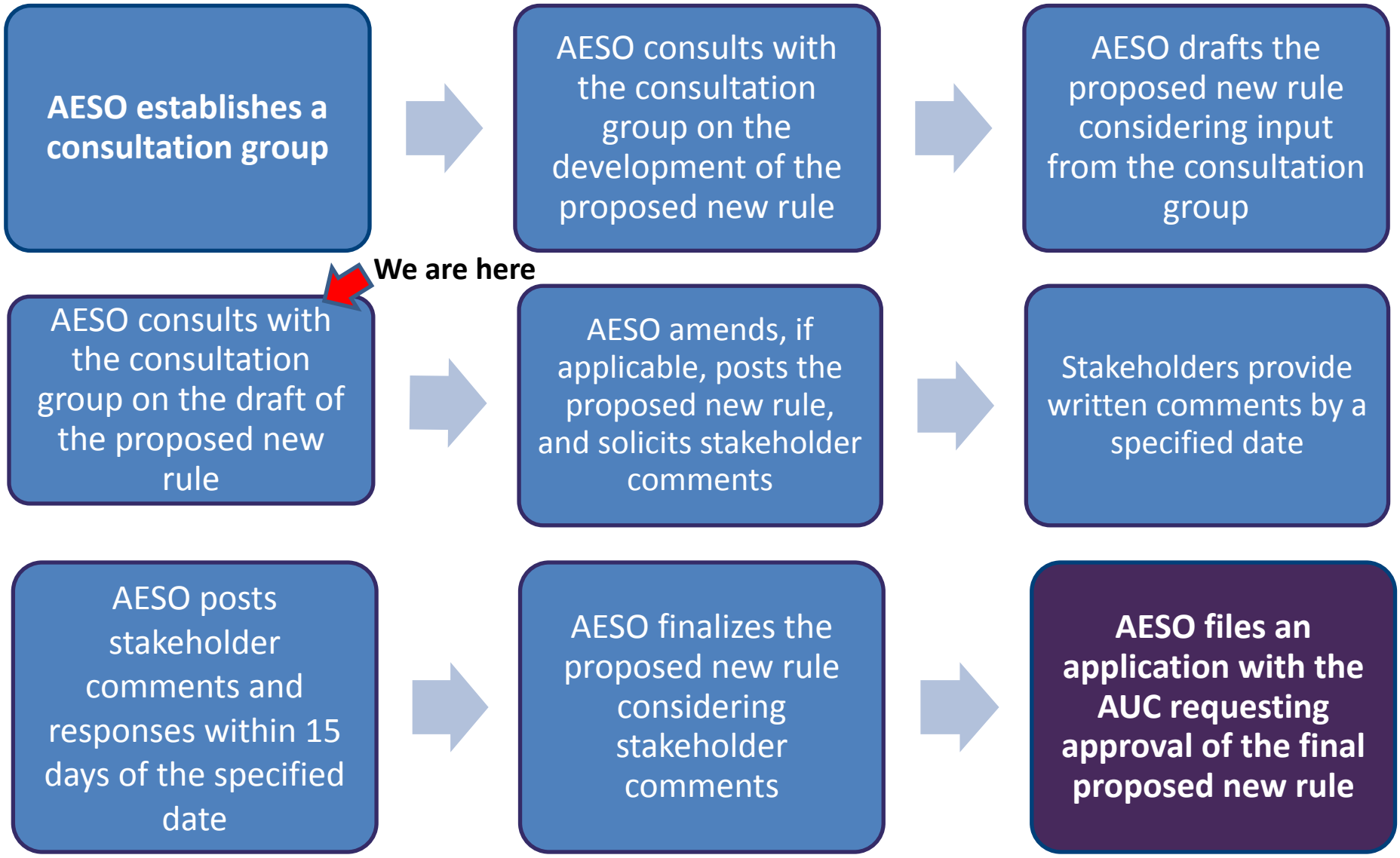
- Meeting minutes will be circulated for review and ultimately posted to AESO.CA
  - Company names will be incorporated where applicable

- Personal information is collected in accordance with section 33(c) of the *Freedom of Information and Protection of Privacy Act*
  - Questions or concerns can be directed to the Director, Information and Governance Services at 403-539-2528

Introductions

Proposed New Section 502.11
ISO Rule Development Process

Current ISO Rule Development Process Overview



Proposed New Section 502.11
Stakeholder Consultation – Pre-AUC Rule 017

- Determined that a new rule was needed;
- Formed a working group made up of technical experts from impacted organizations;
- Worked with the working group to draft the proposed rule;
  - Met from August 2015 to March 2016
- Commissioned two studies
  - *Cold Temperature Frequency Analysis for Alberta* prepared by Custom Climate Service Inc. in 2010
  - *US/Canada TFO/ISO/RTO Minimum Substation Connections Technical Requirements* prepared by CANA High Voltage Ltd. ("CHV") in 2016
- Prepared and solicited stakeholder feedback on proposed substation technical and operating requirements:
  - Outlined in the 2016 *AESO Discussion Paper Regarding the Proposed New Substation Rule – Section 502.11 of the ISO rules*

Proposed New Section 502.11 – Stakeholder Consultation Pursuant to AUC Rule 017

- Issued a Letter of Notice for Development of the Proposed New Section 502.11 (November 22, 2018), which included:
  - An invitation for stakeholders to participate in consultation
  - A request for stakeholder feedback
- Held a Stakeholder consultation session (March 18, 2019), which included:
  - A summary of ISO rule development to date
  - A discussion on stakeholder feedback received following the November 22, 2018 letter
- Posted Stakeholder session invitation with draft of the proposed new Section 502.11 and related material (August 20, 2019), which included:
  - Proposed Agendas for September 2019 Stakeholder sessions
  - Consultant reports
  - Past work group meeting material and minutes
  - Stakeholder Feedback on AESO Discussion Paper (received January 2017)

Overview of September 2019 Stakeholder Sessions

At the September 10 and September 24 stakeholder sessions, we will:

- Review the draft text for each requirement found in the proposed new Section 502.11
- For each requirement, the following will be discussed:
  - Alternatives considered, where applicable
  - Rationale for determining AESO's preferred alternative
- This is your session to ask questions and provide feedback so please actively participate

Where alternatives were considered, all have been presented, and the AESO's preferred alternative is ***bolded****.*

Questions or Comments

Proposed New Section 502.11

Establishing Substation Requirements Guiding Principles

The requirements of the proposed Section 502.11 will:

- Set the minimum substation equipment functional requirements that support and promote the safe and reliable operation of the Alberta interconnected electric system (“AIES”) and fair, economic and openly competitive market for electricity
- Be measureable, and performance data should be collectible
- Be appropriate for the majority of substations that meet the applicability criteria
- Follow good electric industry practice with consideration given to current design and engineering practice
- Provide sufficient maintenance and operating flexibility
- Consistent with, but not duplicative of, Alberta reliability standards, other ISO rules, applicable legislation and regulations, including the Alberta Electrical Utility Code (“AEUC”)
- Consider substation initial and future capital and operating costs to ensure costs are optimized and balanced

Rated Voltage

Alternatives

1. **Include all substations that are directly connected to the AIES and have at least one rated voltage equal to or greater than 100 kV**
2. Include all substations that are included in the North American Electric Reliability Corporation ("NERC") definition of "Bulk Electric System"
3. Include all substations that are directly connected to the AIES and have at least one rated voltage equal to or greater than 25 kV

Rationale for Selecting Alternative 1

- Ensures consistent reliability requirements for all ≥100 kV substations
- Minimizes stranded cost when substation expansion will be needed for the future
- Aligns with applicability of Section 502.2 of the ISO rules, *Bulk Transmission Line Technical Requirements*, ("Section 502.2") and Section 502.3 of the ISO rules, *Interconnected Electric System Protection Requirements* ("Section 502.3")
- Considers the fact that the AESO does not anticipate the building of many new 69/72 kV substations, which can continue to be addressed through project functional specification documents

Connection Configuration

Alternatives

1. **Include all radially-connected substations**
2. Exclude all radially-connected substations
3. Exclude all radially-connected point of delivery ("POD") substations

Rationale for Selecting Alternative 1

- Ensures consistent reliability requirements among all substations in Alberta
- Optimizes future capital and operating costs
- Compared to Alternatives 2 and 3, Alternative 1 has a minimal cost difference for the following:
  - subsection 11(8): Main bus ampacity (1200 A vs. a lower value), any cost savings would only be associated with material cost and is based on project
  - subsection 13(2): Battery capacity (8 hours vs. 4 hours), cost saving is estimated to be around $5,000 based on the AESO's research
  - subsection 15(3): 138 kV circuit breaker or switcher operating cycles (3 vs. >3): most manufacturers do not make >3 cycle 138 kV breakers; therefore cost savings likely small

2 New and Existing Substation Facilities Alternatives and Rationale

Alternatives

1. **Include new substations and all new equipment that is part of a substantial substation upgrade or modification***
2. Include all existing and new substations
3. Only include new substations

Rationale for Selecting Alternative 1

- Ensures the safe and reliable operation of the AIES without requiring existing facilities to upgrade unnecessarily
- Ensures equal treatment of all substation owners
- With respect to Alternative 2, in the AESO's view, the costs outweigh the benefits

*Generally, the AESO intends to apply the new rule to substantial substation upgrades and modifications in accordance with subsection 2(3). However, the determination will be made based on reliability assessments.

Description of Substantial Upgrades and Modifications

- Includes addition, modification, or expansion of the following equipment:
  - Circuit breaker or circuit switcher
  - Gas-insulated switchgear ("GIS")
  - Transformer
  - Bus
  - Reactive power resource / flexible AC transmission ("FACT") devices
  - Battery bank
  - Grounding system
- Does not include projects where the AESO does not issue a functional specification, such as: "like-for-like" replacements of existing equipment and minor projects, including additions, modifications, or replacements of the following:
  - Microwave receivers on existing tower
  - Circuit board in an existing panel
  - Grounding rod
  - Secondary cables
  - Circuit breaker or transformer bushings
  - Current Transformer ("CT") ratio or protection settings

3 Functional Specification Description and Rationale

Description

- The AESO will continue to prepare and approve a project functional specification that will include project-specific requirements

Rationale

- The AESO project functional specification will continue to be used to inform owners of substation transmission facilities of project-specific technical requirements on a project-by-project basis
- The AESO will continue to manage ≤72 kV transmission facilities with specific functional specification documents containing project-specific requirements

4 Ambient Temperature
Background and Consultant Study

Background

- In the past, the AESO had required that all outdoor equipment be designed to withstand -50°C
- Stakeholder feedback resulted in the AESO commissioning a study in 2010 to look at historical ambient temperature

Consultant Study

- *Cold Temperature Frequency Analysis for Alberta* was prepared by Climate Solutions Inc.
- Study considered the following:
  - Up to 54 years of weather data
  - The coldest temperature exceeded 0.1% of the time (8.7 hours)
- Study conclusions:
  - Cold Lake is roughly the demarcation line for temperatures exceeding -40°C
  - General trend is that many weather stations are getting warmer over time

4 Ambient Temperature Alternatives and Rationale

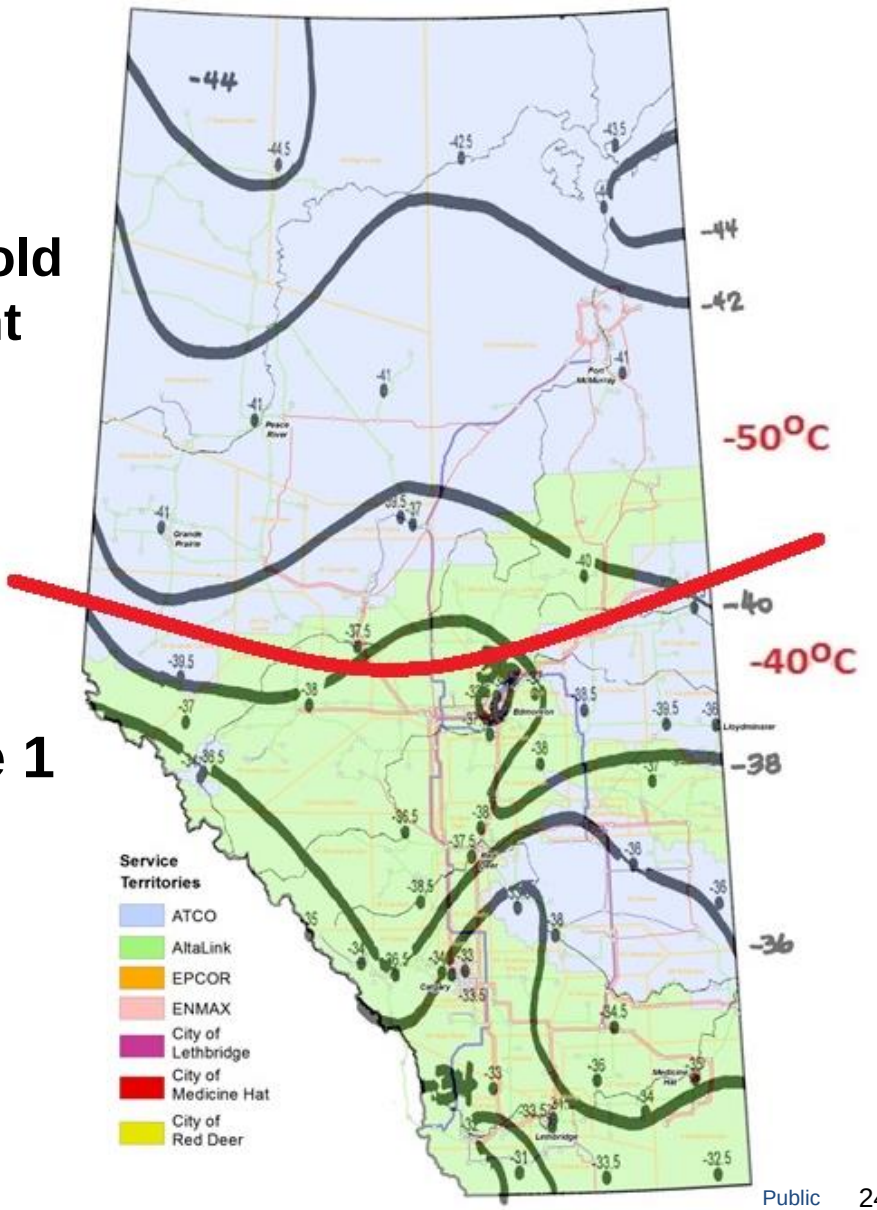
Alternatives

1. **Establish two temperature zones, with –50ºC and –40ºC, demarcated north of Edmonton and north of Cold Lake, based on the 2010 consultant study (smoothed out line)**
2. Continue to use –50ºC for the entire province
3. Use the consultant's line, which is less smooth

Rationale for Selecting Alternative 1

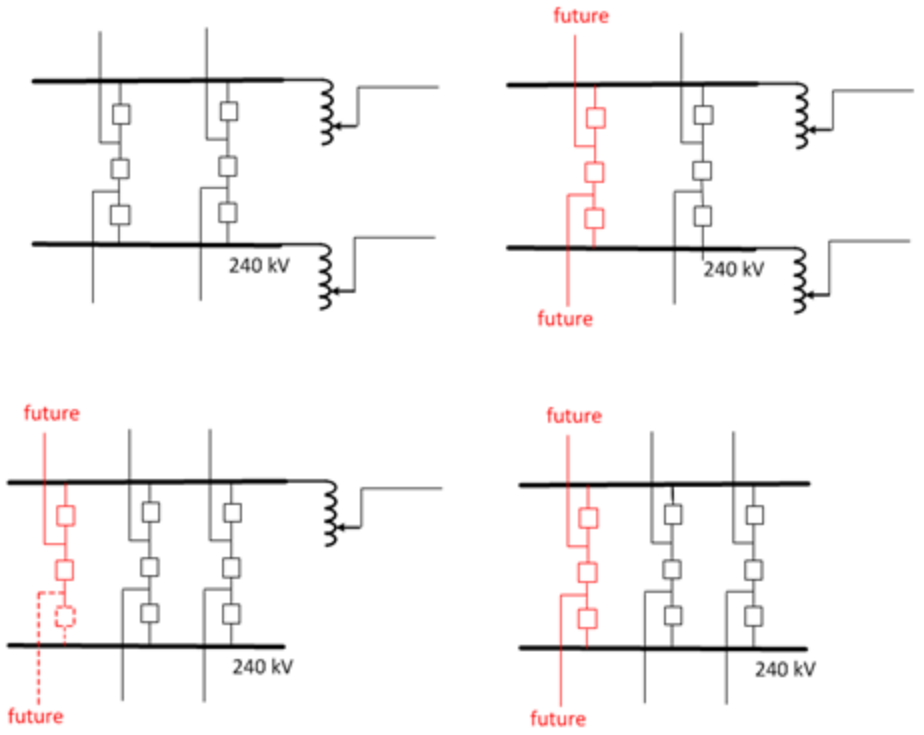
Generally aligns with:

- 2010 temperature study map
- 240/260 kV voltage levels
- TFO service territories



Major Substation Description

A **"major substation"** means a substation that has a voltage of 500 kV, or 240 kV that has or may have at any time in the future at least 6 terminations, with each termination being a bulk transmission line operating at 200 kV or higher or a transformer with a secondary nominal voltage of >100 kV; or a substation that the AESO designates as a major substation in its project functional specification.



Major Substations are required to have the following enhanced requirements:

- Subsection 5 Weather Loading Return Periods
- Subsection 9 Insulation Requirements
- Subsection 11 Bus Arrangement
- Subsection 12 Alternating Current Station Service Supply System
- Subsection 13 Direct Current Station Service Supply System
- Subsection 14 Transformer

Major Substation (cont'd)
Impact of Proposed Enhanced Requirements

Subsection 5 Weather-related parameters requirement

- 100 year return period versus 50 years (cost depends on project and voltage)

Subsection 9 Insulation requirement

- Perform insulation study (likely <$25,000)

Subsection 11(10) Bus arrangement

- Procure more land (cost is highly location dependent)
- Install extra disconnect switches (cost is voltage dependent, likely <$20,000)*

Subsection 12 Alternating current station service supply system

- Dual AC station service supply is required (likely <$20,000)

Subsection 13 Direct current station service supply system

- Install more battery banks
  - Extra battery banks (likely <$10,000)
  - larger control building for second battery bank (likely <$20,000)
  - Extra protection panels (likely <$5,000)

*If designated a major substation, this requirement may not have to be addressed at initial construction; however, appropriate provisions should be made so these requirements can be met in the future.

5(1) Minimum Return Periods for Weather Loading

Alternatives

1. **100 years for a major substation, and 50 years for all other substations**
2. 50 years for all substations
3. 100 years for all substations

Rationale for Selecting Alternative 1

- Reduces failure of a major substation, which has significant reliability impact
- Aligns with Section 502.2, which also stipulates 100 years for critical transmission lines and 50 years for other transmission lines
  - If Alternative 2 was selected, a major substation may fail before a critical transmission line
- Alternative 3 may lead to unnecessary extra cost for small substations and for some future substation upgrades

5(2) and 5(3) Gust wind and wet snow and wind loading

Description

- Return periods for outdoor substation transmission facilities must either be based on the *Gust Wind Loading* map and the *Wet Snow and Wind Loading* map available on the AESO website or on local historical weather data

Rationale

- Takes into account extreme environmental conditions in order to ensure the safe and reliable operation of the AIES
- Align with Section 502.2 weather loading return period requirements
- Provides market participants with the ability to use more precise weather data, if available

6 Grounding
Description and Rationale

Description

- The AESO must provide, in the project functional specification, the short circuit levels: at the commissioning date; and forecasted at least 7 years after the commissioning date
- Grounding design for each and every transmission project must be such that it meets the short circuit levels provided by the AESO at the commissioning date, and such that it is upgradable to accommodate the ultimate short circuit levels

Rationale

- In the event of faults or lightning strikes:
  - Ensures the safety of on-site personnel and the general public
  - Reduces damage to equipment
- Does not overlap with the AEUC, which provides numerous grounding and bonding requirements

7(1), 7(2), and 7(3) Design of lightning surge protection system

Description

- Lightning surge protection must be designed to: take into account average lightning ground flash density levels; the protective distances required for transformers and transmission line entries; and the minimum mean-time-between-failure requirements presented in Table 1

Rationale

- Ensures that substation equipment have adequate protection against lightning strikes
- Aligns with existing ISO rule requirements prescribed in Section 502.1 of the ISO rules, *Aggregated Generating Facilities Technical Requirements*, 502.5 of the ISO rules, *Generating Unit Technical Requirements,* and 502.13, *Battery Energy Storage Facility Technical Requirements*
- Aligns with current TFO design practices in Alberta
- Aligns with IEEE recommendations

7(4), 7(5), 7(6), and 7(7) Surge arrestor installation

Description

- Surge arresters must be installed at: all exposed terminals of transformers and GIS, each shunt capacitor and shunt reactor, and at each transmission line entrance

Rationale

- Ensures that substation equipment has adequate protection against lightning and switching surges
- Aligns with current TFO design practices in Alberta
- Aligns with IEEE and IEC recommendations

7(8) Insulation coordination study

Description

- An insulation coordination study must be conducted to determine the required protective levels where surge arresters are applied to shunt capacitor, shunt reactor, or reactive power resource

Rationale

- Ensures shunt capacitor, shunt reactors and reactive power resources are protected in the event of a lightning strike or switching surge
- Aligns with current AESO functional specification practice

8 Continuous Operating Voltage Range Description and Rationale

Description

- The substation must be designed such that the substation components are capable of operating continuously within the minimum and maximum voltage levels provided in Table 2
- Of note, it:
  - Designates a 260 kV nominal voltage equipment class
  - For 138 kV class equipment, it reduces the maximum continuous voltage rating requirement from 152 kV to 150 kV

Rationale

- Accounts for transmission system in Northern Alberta, which operates at a 260 kV nominal voltage and can experience voltages of 275 kV at peak
- For 138 kV class equipment, reducing to maximum continuous voltage rating from 152 kV to 150 kV, aligns with equipment manufacturers' typically test voltage for 138 kV class equipment

9(1), 9(2), and 9(3) Basic Insulation Level (“BIL”) and Basic Switching Impulse Insulation Level (“BSL”)

Description

- Equipment insulation levels must meet the BIL and BSL applicable requirements outlined in Tables 3, 4, and 5.

Rationale

- Requiring insulation levels for all equipment < 100 kV ensures coordinated protective levels between all substation equipment
- Aligns with North American utility practice
- Aligns with IEEE and IEC recommendations
- Aligns with current TFO design practices in Alberta

9(4) and 9(6) Insulation coordination study

Description

- The AESO must state, in the project functional specification, if an insulation coordination study is required
- If the altitude is >1000 m, the altitude factor must be taken into account in an insulation coordination study and in determining equipment ratings

Rationale

- Ensures insulation is designed in a manner that ensures safe and reliable operation of the substation, such that flash over is minimized
- Aligns with IEEE and IEC recommendations
- Aligns with existing TFO design practices in Alberta

9(5) Insulators and Bus Design

Description

- Contamination levels must be taken into account in designing insulators and bus

Rationale

- Ensures insulation is designed in a manner that ensures safe and reliable operation of the substation, such that flash over is minimized
- Aligns with current TFO design practices in Alberta
- Aligns with good electric industry practice

10(1) and 10(2) Terminal Components Cannot be Limiting Factor

Description

- The ampacity rating of all terminal components connecting either a bulk transmission line or a transformer cannot limit the ampacity rating of the facility, be it the bulk transmission line or the transformer

Rationale

- Ensures the terminal components do not limit the capability of the bulk transmission lines or the transformers
- Aligns with good electric industry practice
- Aligns with Section 502.3, which similarly requires that CTs not be the limiting factor
- Aligns with requirement in Alberta reliability standard FAC-008, *Facility Ratings*, which states that "…a facility rating must not exceed the most limiting applicable equipment rating of the individual equipment that comprises that facility"
- Aligns with current TFO design practices in Alberta

11(1) Substation element definition

Description

- "Substation element" refers to a critical substation equipment, including:
  - A phase-shifting transformers
  - A transformer with a rated capacity of 100 MVA or higher
  - A transformer with a secondary nominal voltage of 100 kV or higher
  - A transmission step-up transformer for a generating unit, an aggregated generating facility or an energy storage facility
  - A termination connecting a bulk transmission line
  - A reactive power resource with a primary nominal voltage of 100 kV or higher

11(2) Design for planned maintenance event

Description

- No additional substation elements will be taken out of service to accommodate planned maintenance event, except where substation elements are in series or approved by the AESO.
  - A circuit breaker or circuit switcher is required for each critical equipment

Rationale

- Ensures that the impact of a planned maintenance event on the continuity of power system is minimized
- Aligns with existing AESO functional specification practice
- Aligns with good electric industry practice

11(3), 11(4), 11(10) Design for circuit breaker and circuit switcher failure events

Description

A failure event of any circuit breaker or circuit switcher must not:

- Result in losing >4 of transformer(s) and/or bulk transmission line(s), except tie breakers
- Simultaneously trip all bulk transmission lines terminating at the same remote substation or generating station where there is > one connection operated at ≥ 200 kV
- At major substations, result in the loss of >2 of the following: a transformer with a secondary nominal voltage of >100 kV; step-up transformer for a generating unit or an aggregated generating facility, or an energy storage facility; or a bulk transmission line

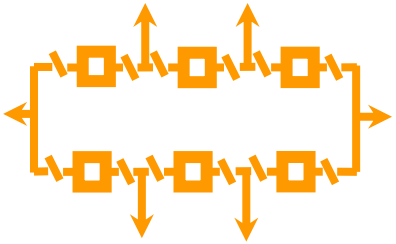
Rationale

- Reduces the extent and scope of a circuit breaker failure
- Aligns with the general practices of many utilities in North America
- Generally aligns with current TFO design practices in Alberta

11(5) and 11(6) Ring bus design

Description

- A ring configuration is acceptable with ≤6 nodes. Ring bus with >6 nodes must be approved on a case-by-case basis by the AESO.



Rationale

- Reduces operational difficulty caused by a large number of nodes
- Aligns with current AESO functional specification practice
- Aligns with the general practices of many utilities in North America
- Aligns with IEEE and IEC recommendations

11(7) and 11(9) Ultimate substation design

Description

- The AESO must provide the ultimate number of terminations and reactive power resources in the project functional specification
- The TFO must design the high voltage bus such that the ultimate design can be realized without relocating any existing substation elements except a termination connecting a bulk transmission line.

Rationale

- Ensures information is available to allow the TFO to appropriately consider:
  - Initial and long-term costs
  - How to design the substation in a manner that considers the ultimate design, for example, how to design the bus such that bus arrangement conversion could occur in a short amount of time
- Aligns with current AESO functional specification practice

11(8) High voltage bus minimum current capability

Description

- High voltage bus must be designed such that it is capable of carrying the minimum continuous current specified in Table 6, unless otherwise specified in the functional specification

Rationale

- Ensures the bus can carry the minimum continuous current expected under normal and contingency operating conditions, and that it can accommodate reasonable future growth
- Balances out initial needs and future expansion
- Aligns with current AESO functional specification practice

12 AC Station Service Supply System Description and Rationale

Description

- For major substations, there must be dual independent AC station service supply sources and, if the station service transformer (“SST”) meets the criteria outlined in 12(2), there must be a circuit breaker or circuit switch installed on the high voltage side of the SST

Rationale

- Ensures the battery remains charged and the AC load continues to be supplied with electricity
- Reduces chance of failure of a major substation, which has a significant impact on system reliability
- Aligns with the general practices of many utilities in North America
- Aligns with current TFO design practice in Alberta

13 DC Station Service Supply System Description and Rationale

Description

- Major substations must have 2 independent battery banks with independent chargers, each with 8 hours of discharge time, for connected load. Common mode failure must be avoided
- All substations must have a minimum of 8 hours of discharge time from loss of AC station supply, and a minimum of 24 hours or less charging time from “empty” to full capacity

Rationale

- Ensures that, in a blackout event, the substation equipment (breaker operating mechanisms, protection and controls and communication systems) can maintain operation for a sufficient duration before the local transmission system is restored
- Aligns with the general practices of many utilities in North America
- Considers the cost difference between 4-hour and 8-hour batteries to be minimal, when compared to the overall substation cost

14(1), 14(2), 14(3), and 14(4) Testing and emergency ratings

Description

- Transformer ratings must based on CSA C88 M90 standard or later versions
- The AESO must specify in the functional specification whether a transformer must have emergency rating above its normal rating
  - If this is required, the TFO must test and provide the AESO with evidence that the transformer emergency rating meets or exceeds this requirement
- The load cycle test to meet functional specification requirement and must be performed in accordance with IEEE standards C57.91 and C57.119

Rationale

- Ensures transformers operate as required
- Ensures consistent testing standards are used across all transformers
- Aligns with current TFO design practice in Alberta
- Aligns with good electric industry practice

14(5), 14(6), and 14(7) On-Load Tap-Changing ("OLTC") Transformers

Alternatives

1. **The AESO must specify whether an OLTC is required in the project functional specification for every transformer**
2. No OLTC requirement in the functional specification
3. Requires OLTC for all transformers

Rationale for Selecting Alternative 1

- Ensures that transformers will be equipped with voltage regulation capability where needed
- Provides the AESO with the flexibility to take into account system reliability and operational needs when determining whether or not to specify an OLTC transformer
- Aligns with current AESO functional specification practice

14(8) and 14(9) Loss evaluation

Alternatives

1. **The AESO must specify whether a facility owner must perform a loss evaluation on any transformer**
2. No loss evaluation is conducted on any transformer
3. Loss evaluation is always conducted on all transformers

Rationale for Selecting Alternative 1

- When performed, loss evaluations assist the facility owner to minimize the long term overall cost of the transformer
- Ensures loss evaluation is not required when benefit of performing the study is minimal
- Aligns with current AESO function specification practice

14(10), 14(11), and 14(12) Impedance and parallel operation

Description

- The facility owner must determine the impedance value of transformers, except for the following, which will be specified by the AESO in the project functional specification:
  - Transformers with a secondary nominal voltage of >100 kV
  - Step-up transformer for a generating unit or an aggregated generating facility, or an energy storage facility that has a rated capacity of 400 MVA or higher
- The major substation owner must ensure that any transformer with a secondary nominal voltage of >100 kV is designed such that parallel operation can be executed

Rationale

- Ensures that operational needs of the AIES are addressed
- Provides the facility owner the flexibility to determine impedance based on the local system conditions where appropriate
- Aligns with current AESO functional specification practice

15 Circuit Breaker or Circuit Switcher Description and Rationale

15(1), 15(2), and 15(4) Testing, performance after power loss, and single pole operation

Description

Circuit breakers or circuit switches must:

- Be tested in accordance with IEEE C37 or IEC 62271 standards
- If operating at ≥100 kV, be capable of performing an open-close-open sequence after power loss
- If connected to a bulk transmission line with a nominal voltage of ≥ 200 kV be capable of single pole operation, unless specified by the AESO

Rationale

- Testing ensures circuit breakers and circuit switchers operate as required
- Testing also ensures that consistent testing standards are used across all circuit breakers and circuit switchers
- Open-close-open sequence aligns with circuit breaker capability
- All requirements align with current TFO design practice in Alberta

15 Circuit Breaker or Circuit Switcher (cont'd) Alternatives and Rationale

15(3) Maximum operating cycles voltage

Alternatives

1. **3 cycles for 138 kV, 2.5 cycles for 240 kV, 2 cycles for 500 kV**
2. 3 cycles for all voltage levels 138/240/500 kV
3. 3 cycles for 138 kV, 2 cycles for 240/500 kV

Rationale

- Aligns with available product specifications from manufacturers and current AESO functional specification practice
- Fast clearing times preserves system stability and reliability
- Provides minimum required reliability
- Most manufacturers do not make >3 cycle 138 kV breakers; therefore, cost savings likely small

16 Disconnect or Isolation Switches
Description and Rationale

Description

- Disconnect and isolation switches must be tested in accordance with the IEEE C37 or IEC 62271 standards and must have ice breaking capability

Rationale

- Ensures disconnect and isolation switches operate as required
- Ensures consistent testing standards are used across all disconnect and isolation switches
- Ensures that disconnect and isolation switches are able to operate when covered in ice, which can occur in Alberta during the winter months
- Aligns with current TFO design practice in Alberta

17/18(1) & 17/18(2) Circuit Breaker, Circuit Switchers and Switching Transients Review and Mitigation

Description

- A circuit breaker or circuit switcher is required for a shunt capacitor bank (≥100 kV), a tertiary winding of a system transformer, or a shunt reactor
- Switching transients must be reviewed by the TFO for a shunt capacitor bank (≥100 kV) or a shunt reactor, to determine if controlled energization or other methods are required

Rationale

- Ensures reliable operation of AIES
- Aligns with current AESO functional specification practice
- Mitigation of switching transient issues by way of controlled energization or other methods ensures reliable operation of AIES

18(3) and 18(4) Impedance and Grounding

Description

- The impedance of a shunt reactor should not vary by more than 15% from the rated impedance up to 1.5 per unit ("p.u.") of the nominal voltage
- Shunt reactor bank must be solidly grounded or grounded through a neutral reactor

Rationale

- Ensures the shunt reactors operate as intended under various operational conditions
- Ensures reliable and safe operation of the AIES
- Aligns with IEEE recommendations

Not Included
Site Remediation Requirements

- The AESO does not intend to include requirements relating to oil containment, clean up/reclamation or noise in the proposed new Section 502.11
- Section 7.1.1 of AUC Rule 007, *Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments,* requires each application to construct or alter a substation to "include environmental and land use information at a level of detail commensurate with the size and type of potential effects of the project."
- Commission guidance with respect to environmental information requirements of applications (including oil containment) is provided in the document *Substation Developments – Environmental Guidelines Checklist for Applicants*
- A clean up and reclamation plan is required as part of the application.
- Approval from Alberta Environment and Parks may also be required.
- Requirements regarding noise are addressed in AUC Rule 012, *Noise Control.*

Final Questions, Thoughts, Comments

Next Steps

Thank you