

**Location:** AESO BP Location, Meeting Room 6006, 6th floor of the BP Centre located at 240 – 4th Ave SW Calgary, AB T2P 2H8

**Date:** September 10, 2019

**Time:** 10:00 a.m. to 3:00 p.m.

**Attendees:**

Company
Alberta Electric System Operator (“AESO”)
Alberta Newsprint Company (“Alberta Newsprint”)
AltaLink Management Ltd. (“AltaLink”)
ATCO Electric Ltd. (“ATCO Electric”)
ATCO Power (“ATCO Power”)
Capital Power Corporation (“Capital Power”)
Cenovus Energy Inc. (“Cenovus”)
CNOOC International Ltd. (“CNOOC”)
Consumers Coalition of Alberta represented by BEMA Enterprises Ltd. (“CCA”)
Depal Consulting Limited (“Depal”) representing Inter Pipeline Ltd.
EPCOR Distribution & Transmission Inc. (“EDTI”)
ENMAX Energy Corporation (“EEC”)
ENMAX Power Corporation (“EPC”)
Suncor Energy Inc. (“Suncor”)
TransAlta Corporation (“TransAlta”)
Teshmont Consultants LP (“Teshmont”)
Warrior Rig Technologies (“Warrior”)

**Consultation Session Overview and Introductions**

- The AESO welcomed Stakeholders to the session, reviewed safety procedures, reviewed the agenda, and provided an overview of the current consultation session, as well as the upcoming September 24, 2019 session.
- The AESO explained what is expected of Stakeholders in each consultation, mainly encouraging them to ask questions, provide feedback, and ensure that one person speaks at a time into the webinar microphone. Further, the AESO provided instructions for asking questions in person and through the webinar.
- The AESO advised everyone that: the session is being recorded to aid in minute taking, and before being finalized the minutes will be circulated for comments. Further, the AESO noted that personal information is collected in accordance with the *Freedom of Information and Protection of Privacy Act*.
- All attendees introduced themselves.

**Current ISO Rule Development Process**

- The AESO reviewed its ISO rule development process. It noted that it is currently in the consultation stage of the process. The AESO notified market participants of the proposed development of the proposed new Section 502.11 and invited them to participate in the fall of 2018. It then drafted a proposed rule while taking into consideration the feedback from the consultation group and posted it on its website in August 2019. The AESO then mentioned that, depending on the progress and outcome of stakeholder consultation sessions, the AESO may stay in the consultation stage of the rule in order to conduct more studies and get more expert opinions.

- The AESO explained that pre-AUC Rule 017, it determined a new substation rule was needed. It then formed a working group of technical experts from impacted organizations which met from August 2015 to March 2016, and material from those meetings can be found on the AESO website. The AESO also commissioned two studies: *Cold Temperature Frequency Analysis for Alberta* prepared by Custom Climate Service Inc. in 2010 and *US/Canada TFO/ISO/RTO Minimum Substation Connections Technical Requirements* prepared by CANA High Voltage Ltd. (“CHV”) in 2016. Afterwards, the AESO prepared and solicited stakeholder feedback on AESO’s *2016 Discussion Paper Regarding the Proposed New Substation Rule – Section 502.11 of the ISO rules*.
- Further, the AESO provided an overview of the September 2019 Stakeholder Sessions. It noted that the purpose of these sessions is to review the draft text for each requirement found in the proposed new Section 502.11.
- Throughout the session, the AESO let attendees know that it is willing to listen and see if there are requirements that need to be amended or removed. The AESO also explained to market participants that they can look at the AESO’s discussion paper and see what research has been considered when drafting the proposed new Section 502.11. However, it is still willing to listen to comments and is open to discussion as the consultation sessions take place.

### Establishing Substation Requirements Guiding Principles

- The AESO emphasized that the rule is still in early stages and encouraged engagement from all market participants, including the ones present at the stakeholder sessions.
- The AESO gave an overview of its guiding principles noting that the requirements of the proposed new 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”); be measurable and collectible; be appropriate for the majority of substations that currently exist; provide sufficient maintenance and operating flexibility; be consistent with Alberta reliability standards (“ARS”), other ISO rules, applicable legislation and regulations including the Alberta Electrical Utility Code (“AEUC”); and consider substation initial and future capital and operating costs to ensure costs are optimized and balanced.
- There were discussions throughout the session about the purpose of the rule:
  - Depal asked what the problem was that started the conversation about standards and asked if the value that market participants would get out of it was worth the effort if there were cost impacts.
  - The AESO explained its intention is to establish minimum requirement, and the proposed new Section 502.11 is generally in alignment with what is on the grid and with current practice. The AESO noted that the intention is not to unnecessarily drive up cost, however, if all market participants think the costs are being driven up beyond what the AESO’s calculations show, then the AESO needs to know that.
  - The CCA referred to “standards” and explained that, as a previous employee of TC Energy (“TCE”), but not on behalf of them, their preference is to build one pumping station and one electric supply station that are standardized throughout every jurisdiction. CCA noted that when TCE runs into a jurisdiction with many sets of rules, costs blow up and that TCE has to have engineers find out exactly what is needed for their kind of load, and those folks are not currently represented in this consultation. The CCA noted that it begs the question if the AESO’s standardized rule allows for those types of loads to come through Alberta without being loaded up with unnecessary obligations. The CCA urged the AESO to get input from TCE as they are only interested when they build pipeline and might be outraged 5 years down the road when they build. The CCA further explained that, philosophically, rather than telling market participants how to do things, since the AESO looks after stability, let market participants know the maximum impact they can have on stability, and let people in industry make decisions and be creative about how to meet that stability rather than being too prescriptive. The CCA urged the AESO to take an outcome-based approach.
- There was a discussion about what the AESO means by measurability:
  - The CCA asked how a principle can be applied, if it cannot be measured. It further stated that, in Alberta, the kind of point-of-delivery (“POD”) substations that serve load that are built in rural areas

are different from the ones in urban areas with respect to the number of impacted residential customers. The CCA asked if there was the possibility of building lower cost substations in rural areas that don't need a high level of reliability because customers that require higher reliability have their own backup generation.

- The AESO noted the CCA's question around measurability and asked that attendees keep an eye out for potential measurability issues throughout the session so that the issue may be addressed on a case-by-case basis. The AESO also responded to CCA's question noting that the rule does not address rural versus urban POD substations, but it addresses absolute minimum requirements in order to build a facility in the province.
- There was a discussion about minimum substation requirements for different types of substations:
  - The CCA commented that the absolute minimum would be a lower standard than what is currently in the rule. It noted that a rural area POD substation serving a few thousand residential customers would be a very different POD substation than what would be designed for EPC. The CCA asked if the rural POD substation is used as the minimum requirement.
  - The AESO explained that the rule is flexible enough to design simple POD substations, while at the same time design large urban POD substations, and the AESO does have provision for identifying major substations that would set the bar higher.
  - Capital Power noted many of the requirements in the proposed new Section 502.11 are not minimum requirement. Minimum requirement for simple substations like aggregated generating facility collector substation ("generator substation") is lower compared to POD substations in urban areas. Capital Power explained that generator substations tend to have a lot less redundancy because they are shutdown once a year for maintenance; this differs from urban POD substations, which are not able to fully shutdown and; therefore, require redundancy. Capital Power encouraged the attendees to keep in mind that the intent of the proposed new Section 502.11 is to set minimum requirements.
  - The AESO noted this request. The AESO also noted that some generator substations have a high-side voltage of 34.5 kV and are not subjected to proposed new Section 502.11.
- There was a discussion about what is meant by "good electric industry practice":
  - The CCA further asked for clarification on what "good electric industry practice" means. Specifically, it questioned what forms good industry practice when utilities throughout the provinces as well as between the states are so different. In addition, the CCA stated that the term "good electric industry practice" is broad and it gives a range of possibilities, not a direct answer.
  - The AESO responded that part of assembling this definition includes at least recognizing what other jurisdictions are doing, and the workgroup has given us an idea of what other jurisdictions are doing while applying good judgment. The AESO considered the workgroup's recommendations and attempted to quantify this definition in specific rules. The AESO generally agreed that there is a range as opposed to a specific answer.
- There was a discussion about cost:
  - The CCA enquired if there were any talks about cost; specifically, if one of the AESO's guiding principles was to minimize cost while meeting reliability and safety requirements.
  - The AESO noted this is implied, and it is noted in the presentation; however, the AESO is willing to review this topic if further information comes out during the discussion.
  - Capital Power commented that the AESO should let the TFOs and GFOs decide their own reliability and cost consequence because it is not affecting the grid and the costs do not go to the ratepayer. Expansion follows the same process. If TFOs expand, they pay for it. Capital Power noted that it not referring to a system substation, but a generator substation, which are two different designs.

### Applicability

- The AESO presented the 3 applicability alternatives and noted its preferred alternative is to "Include all substations that are directly connected to the AIES and have at least one rated voltage equal to or

greater than 100 kV". The AESO explained its rationale behind this choice was that it: ensures consistent reliability requirements for all substations that have operating voltages above 100 kV; minimizes stranded cost; aligns with other technical rules; and considers that the AESO does not anticipate adding substations that have an operating voltage of 69 or 72 kV in the future. The AESO noted that if it does decide to add new substations to the transmission system with an operating voltage of 69 kV or 72 kV ("72 kV substations"), the requirements will be addressed in the project functional specification on a case-by-case basis.

- Discussion followed regarding the AESO's proposal to exclude 72 kV substations from the proposed new Section 502.11:
  - Capital Power asked the AESO about its decision.
  - AltaLink stated that 100 kV voltage minimum is in line with North American Electric Reliability Corporation ("NERC") standards.
  - The AESO confirmed that at this point in time it does not plan to include 72 kV substations. The AESO also noted that if the AESO is aware that there is a plan to convert a 72 kV substation to 138 kV in the future, it might very well ask that the proposed substation be designed and built to accommodate 138 kV in the first place. This would all be on a project-by-project basis.
- There was a discussion about whether the substation voltage applicability was based on the rated or operating voltage of the equipment:
  - Capital Power gave the example of a 72 kV substation that contained 100 kV rated equipment.
  - The AESO explained that the proposed new Section 502.11 is based on the operating voltage of the substation, so in Capital Power's example, the proposed new Section 502.11 would not apply.
- There was discussion about what it means to be "directly connected" to the AIES:
  - Capital Power wanted clarification on what it means to be "directly connected" to the AIES and stated its opinion that its generator substations are indirectly connected, not directly connected, to the AIES, and as a result, in its opinion, the proposed new Section 502.11 should not apply to its generator substations.
  - The AESO explained that if you are synchronized to the grid, you are directly connected and reviewed the definition of AIES in AESO's *Consolidated Authoritative Document Glossary* ("CADG"), which includes all transmission and distribution systems. The AESO further explained that this means that if a market participant is a part of or is connected to the transmission or distribution system than it is directly connected to the AIES.
- There was a discussion regarding the AESO's decision to not align with NERC's Bulk Electric System ("BES") definition:
  - Specifically, AltaLink wanted clarification on why the proposed new Section 502.11 applicability does not align with the NERC's BES definition. AltaLink stated its opinion that the proposed new Section 502.11 should apply only to substations that would be classified as BES by NERC or would be classified as BES substations in the future because all the radially-connected substations and all individual POD substations are excluded by NERC.
  - The AESO explained that when it adopts NERC standards, consideration is given to what is needed in Alberta in terms of the applicability and technical requirements.
  - AltaLink stated its opinion that the purpose of the proposed new Section 502.11 is to ensure system reliability, not individual load customer reliability; therefore, the proposed new Section 502.11 should only be applicable to system or networked substations because they are the only substations that impact the overall reliability of the system.
  - TransAlta commented on the applicability of using the NERC's BES definition, which is a consistent threshold across North America and puts a threshold on generation. TransAlta also expressed its opinion that there is probably not enough benefit to include facilities that are not BES.
- There was a discussion about the rationale put forward by the AESO, that applying the proposed new Section 502.11 will minimize stranded costs when substation expansion is needed in the future:

- AltaLink asked why the AESO would impose all the proposed new Section 502.11 requirements on all substations at time of initial construction when the requirements can be planned for and implemented in the future. AltaLink gave an example of a new substation that does not meet the applicability criteria when first constructed, but that the AESO plans to upgrade it to a substation that would meet the applicability criteria in 20 years. AltaLink asked, in this example, why the AESO would apply the proposed new Section 502.11 that far in advance.
- The AESO explained that there is the potential that a substation may become a system substation in the future and that establishing minimum requirements ensures that substations are expandable and able to meet the proposed new Section 502.11 system substation requirements. The AESO also noted that one possible consequence of not planning in advance of need could be that a substation is not expandable, which would result in a new substation being built beside the existing one in the 10-15 year time frame.
- Capital Power asked if a generator substation could become a system substation in the future. If so, a lot of designing needs to be taken into account.
- The AESO explained that if the difference between system and generator substations can be differentiated in advance, then that would be ideal. The facilities are there for a very long time, and the AESO believes it is driving incremental costs up front in order to have flexibility in the future.
- The AESO requested that attendees flag instances where they feel the proposed new Section 502.11 requirements will increase costs as the presentation moves along.
- The CCA noted that it needs a better understanding of the same issue. When there is a choice between Alternative 1 (i.e., include all substations with voltages greater than 100 kV) and Alternative 2 (i.e., include only substations that meet the definition of BES), the AESO should try to figure out what are the implications in and out of this rule being applied. The CCA noted that it looks like there is a cost implication and asked, in those instances, how the AESO picks between Alternative 1 and 2, assuming 2 is broader and affects system reliability as opposed to individual customer reliability. Also, the CCA asked if, in making its decision, the AESO analyzed the cost difference between Alternative 1 and Alternative 2.
- The AESO presented rationale on choosing its connection configuration alternative, Alternative 1, of including all radially-connected substations. This includes: ensures consistent reliability requirements among all substations in Alberta; optimizes future capital and operating costs, and compared to the other alternatives it was expected to have a minimal cost.
- There was a discussion regarding the inclusion of radially-connected substations:
  - AltaLink asked why, if the plan is to make the substation connection configuration a radial connection, the proposed new Section 502.11 would apply to it.
  - TransAlta asked what the minimum requirement from a reliability perspective was if radially connected and POD substations were excluded.
  - AltaLink commented that the NERC BES definition refers to radial connections not POD substations, and that there is a difference between the two. AltaLink further commented that excluding radially-connected substations frees up, from a cost perspective, the radially-connected substation owner to do whatever they want to do, because there is no rule for them to apply to, unless the AESO determines that its plans include turning the substation into a system substation. AltaLink further explained that, in that situation, the AESO could provide requirements that the substation would need to meet in the future.
  - The AESO explained that there is a potential that at some point in time its connection configuration will change from a radial connection be an in/out connection, so the minimum requirements are being established such that the reliability would be there to accommodate that.
- There was a discussion regarding the impact of the AESO's decision on applicability:
  - AltaLink stated its opinion that the applicability needs to be agreed upon before further consultation takes place because the AESO appears to be trying to set requirements to two different categories, which will result in lots of resistance and the actual requirements will get lost.

AltaLink also stated that if the proposed new Section 502.11 truly applies to system substation, then minimum requirements are good because they are required for system coordination and planning.

- The AESO also presented the expected difference in cost between a substation being included and excluding from the specific rule requirements based on its understanding of what is common industry design practice. This included subsection 11(8) main bus ampacity, subsection 13(2) battery capacity, and subsection 15(3) breaker operating cycles of the proposed new Section 502.11.
- There was a discussion specifically around subsection 11(8) main bus ampacity:
  - Capital Power questioned the AESO’s requirement for a 1200 ampere (“A”) main bus, when there are some substations that only need 600 A with future expansion considered, noting that the life of a substation is 30 years and that 1200 A may not be needed in the substation’s life span. Capital Power also questioned the value of the AESO getting into these detailed designs. Capital Power also mentioned that if a substation does expand and a 1200 A main bus is required in the future then the substation owner could upgrade the main bus at that time rather than spending all the money up front.
  - Capital Power further provided an example that if it builds one generator substation with phase 1 and phase 2, that substation would require a main bus of under 600 A on a 138 kV system, now if Capital Power is forced to build a 1200 A main bus, that it will impact the support system, foundation, and structures required, which will result in extra costs.
  - The AESO gave some background information. It noted that it has been struggling with the level of detail to put in the proposed new Section 502.11. The AESO further explained that the 1200 A requirement does not apply to substations that have a slack “bus” rather than a “main bus”.
  - Capital Power commented that things such as 1200 A for main bus in a substation are more applicable to TFOs than generators. So, as the rest of the section is explored, attention should be paid to that, and potentially exclude radially-connected substations.
- There was a discussion specifically about subsection 13(2) battery capacity:
  - The AESO noted that with respect to the batteries, it would need confirmation from its operations team, but to their knowledge all substations right now are designed for 8 hours. If the AESO starts allowing 4 hours on the transmission system, then there may be operational issue from its side if a blackout occurs. The AESO further noted that there is an appropriate minimum level such that the grid can be operated, and customers can be restored.
  - Capital Power noted that it already uses double batteries.
- There was a discussion specifically around subsection 15(3) breaker operating cycles:
  - The AESO noted it holds accountability for running system stability studies, so the AESO requires some certainty regarding clearing times, particularly on the major system lines, but the AESO does not specify total clearing times.
  - The AESO confirmed with market participants that the 3 cycle 138/144 kV circuit breakers are a non-issue; however, 3 cycles for 240 kV can be an issue.
  - Capital Power noted that it is hard to get a 138 kV breaker that operates slower than 3 cycles and asked the AESO why it would bother to make it a rule requirement.
- There was a discussion around the need for a breaker, required in subsection 15(3):
  - The AESO explained that the need for a breaker is driven from other places such as Section 502.3 of the ISO rules, *Interconnected Electric System Protection Requirements* (“Section 502.3”), and that the need for the breaker is to isolate faults and whether it is at the substation or at the remote end of the line can be addressed in a project functional specification.
  - AltaLink noted that Section 502.3 has many exceptions, and stated that its understanding was that the proposed new Section 502.11 would not have exceptions.
- There was a question regarding whether the proposed new Section 502.11 applied to generator substations.

- Specifically, TransAlta noted that the rule requirements often refer to the “legal owner of transmission facility” and asked if the rule applied to generator owners. If TransAlta is a TFO, then it has to be paid, and it will recover from the consumer. If TransAlta is made a TFO, then it should be getting a rate-based recovery on that.
- Capital Power further commented that if generator substations are used as inter-system substation, then generators should get reimbursed. However, Capital Power has not yet seen a situation like this because their substations are built very compactly.
- The AESO stated that all substations are transmission facilities and; therefore, the rule would apply to all legal owners of substations that have an operating voltage of 138 kV or higher.

(NOTE: The AESO would like to point out that, as indicated in the *Electric Utilities Act* and the AESO CADG, substations that form part of a generating unit or an aggregated generating facility are not considered transmission facilities. The intention of the proposed new Section 502.11 is to set minimum requirements for all substations that are part of, or directly connected to, the AIES regardless of whether or not the substation is part of a generation facility or a transmission facility. The AESO is currently reviewing the current draft the proposed new Section 502.11 to determine any changes that are required to capture this intent.)

- There was a discussion around the level of detail in the proposed new Section 502.11:
  - EPC noted that it understands concerns around the proposed new Section 502.11 being detailed, but from a planning perspective, EPC is in favour of the proposed new rule because the rule gives it certainty about the AESO’s requirements. EPC explained that this allows it to determine project costs early in the project life. EPC stated that it currently has projects in stage 1 and 2 of the AESO’s Connection Process and the AESO is asking it for detailed project cost estimates prior to the project functional specification being issued. It noted that it is helpful to have an agreed upon base substation requirement level and that it could eliminate years of back and forth on discussions on preliminary design decisions and related costs.
- There was general discussion regarding the AESO’s list of requirements:
  - The CCA asked, if the rule is required for just 3 subsection changes for radial substations that have cost implications, whether it would be more appropriate to have the requirements outlined in the project functional specification or direction letter.
  - AltaLink commented that there are other proposed new Section 502.11 requirements that would add cost, including the direct strike protection, insulation coordination, lightning protection, and breaker operation requirements. AltaLink agreed that if the AESO is looking to expand a substation or make it a system substation in the future, then AltaLink agrees with these costs because it is significantly easier to build to the requirements at initial construction than to do it at a later date.
  - The CCA stated that it is getting persuaded that there are other proposed new Section 502.11 rule requirements that will drive up cost other than the 3 subsections presented. The CCA explained that the other possibility is that the proposed new Section 502.11 will drive costs down because some of the things that are being added are going to lower the required substation standard, which will allow the CCA to challenge the utility for overspending. The CCA stated that it is assuming that the vast majority of the proposed new Section 502.11 will drive costs up.
  - The CCA noted that there has to be an option here that if, in 20 plus years, more life is needed, for example 8-hour batteries instead of 4, that the batteries can be changed instead of building a new substation. The CCA commented that the same applies to circuit switchers and breakers: it is not customary to change these things in advance and that when the arithmetic is run on extra cost of pre-building facilities; it is driving an extra cost into the system. The CCA further commented that, in order to be persuaded, the CCA requested a real example or something in the rule that causes market participants to construct a whole new substation. The CCA is of the opinion that deferring things as much as possible with a reasonable future snapshot is the way to go.
  - The AESO explained that if the requirements for 8-hours batteries, breaker operating times, and the potential for a bus ampacity rating, are excluded, the AESO can choose to address same in the functional specification.

- The AESO noted that the purpose of consultation is to determine if there are more than 3 subsections that have cost implications. The AESO further explained that cost savings come in to play in situations where a new substation is required because the existing substation, that does not meet the proposed new Section 502.11 rule requirements, cannot be expanded to accommodate load growth.
- There was a discussion on the impact of the proposed new Section 502.11 on industrial system designations (“ISD”):
  - Suncor commented that ISDs have different voltage classes: while ISDs have a 144 kV system that feeds loads only, substations can typically have 7-8 power transformers and one system transformer.
  - Suncor asked if it was relevant to include all of the ISD transformers in the applicability, even though they supply a load that is much less than 1200 A, such as a 34.5 kV substation.
  - The AESO confirmed that if a new facility is being built at 144 kV, then this would apply. However, the AESO stated that it would take Suncor’s question away.

### **New and Existing Substation Facilities**

- The AESO presented its alternatives and rationale regarding how to apply the proposed new Section 502.11 rule requirements to new and existing facilities. It explained that it chose to include new substations and all new equipment that is part of a substantial substation upgrade or modification because this ensures the safe and reliable operation of the AIES without requiring existing facilities to upgrade unnecessarily; and ensures equal treatment of all substation owners. The AESO further explained the substantial upgrades and modifications that would be part of this alternative, as well as the ones that would be beyond the scope. The AESO explained that this rule does not apply for like-for-like replacements; for those projects, the market participant would be expected to restore the facility to the standards to which it was originally designed. The AESO gave an example of a like-for-like replacement as a piece of equipment that failed.
- Further, the AESO explained that including all existing and new substations would be too expensive and the costs would outweigh the benefits, so it does not intend to apply the proposed new Section 502.11 retroactively. The AESO further explained that this choice generally aligns with the AESO’s practice over the past 15 years in which only new facilities are covered in a functional specification document.
- The AESO also noted that new facilities are straightforward when developing a rule and that the challenge is determining how the proposed new Section 502.11 rule requirements should apply to existing facilities, which is managed through project functional specifications.
- There was a discussion, with specific examples, regarding how the proposed new Section 502.11 would apply:
  - The CCA provided the example of a project where a new circuit and circuit breaker were being added to an existing bus with an empty bay. The CCA noted that the breaker would be set to the new standard, and asked if the existing bus would be required to meet the proposed new Section 502.11 rule requirement.
  - The AESO explained it would not automatically require the existing bus to meet the proposed new Section 502.11; however, if the TFO identifies something substandard, the AESO would engage in discussions and sort it out.
  - Depal requested clarification regarding how the proposed new Section 502.11 would impact circuit breaker addition projects. Specifically, Depal asked if the AESO will make facility owners redesign the whole substation. Depal also requested clarification regarding whether or not the standard mentioned is clear in the proposed new Section 502.11.
  - The AESO confirmed that for a new substation this rule will be applied, whereas for existing substations some judgment needs to be used between the AESO and the TFOs. The AESO clarified that the purpose of the alternatives presented is to show market participants how it generally anticipates applying subsection 2(3) and confirmed that it is not set in stone. The AESO

further confirmed that on every project concerning existing facilities, it will work with the TFO and issue a project functional specification.

- TransAlta gave the example of a project that involved adding an additional battery and a feeder to connect the battery to a bus in the substation. TransAlta asked how the proposed new Section 502.11 would apply to the project, and whether the project would trigger the need for a reliability assessment that could potentially result in a review of the whole substation.
- The AESO explained that if the project TransAlta was referring to was a capital project, the AESO would issue a project functional specification to identify what needs to be updated and, if the AESO identified that the substation as presently built has reliability concerns, it does have the right to direct that the whole substation be upgraded.
- There was a discussion regarding the term “system element”:
  - AltaLink suggested that the AESO consider using the term “transmission element” in the proposed new Section 502.11 because it is a defined term and, with substation upgrades and modifications, “transmission elements” are what is being replaced.
  - The AESO noted this suggestion.

[Note: the AESO assumes that AltaLink was referring to the term “system element” which is defined in the AESO’s CADG.]

- There was a discussion regarding the potential for overlapping system element requirements:
  - AltaLink noted that substations are different than other transmission facilities. As a result, the issues AltaLink sees going forward are related to standards being applied to different parts of the substation. The substation owner may not know, regulatory-wise, which rule applies first and supersedes the rest.
  - The AESO noted AltaLink’s concern. The AESO explained that it does require TFOs to sign off that they have met the requirements in the project functional specification. That is generally how the AESO manages the compliance aspect of substations; however, beyond that at some point in the future, there will be multiple system elements within the substation with different versions of a rule applied to it.
- There was a discussion regarding situations where, due to a substation upgrade, a substation either gets pulled into the applicability for the proposed new Section 502.11 or becomes a system substation.
  - Specifically, AltaLink suggested that these are possible situations that could occur.
  - The AESO noted that it may choose not to require that the entire substation is brought up to the current standard even if it became a system substation.

### Functional Specification

- The AESO reviewed their process and explained that it will continue to prepare and approve project functional specifications that will include project-specific requirements because it will continue to be used to inform owners of substations of project-specific technical requirements. Further, the AESO will continue to manage substations that have an operating voltage less than or equal to 72 kV with project-specific functional specification documents containing project-specific requirements.
- The AESO also noted that its proposed new Section 103.14, *Waiver and Variance* (“Waivers and Variances rule”) is due to be filed with the Commission the week of September 9, 2019.
- There was a discussion regarding the impact of the proposed new Section 502.11 on project functional specifications:
  - AltaLink asked if the project functional specification would become more of a requirement rather than a guideline now than the proposed new Section 502.11 will cover substation requirements. It explained that the requirements of the equipment are fine; however, it takes issue with the project functional specification outlining the number and layout of the substation equipment. AltaLink prefers to have the AESO provide guidelines and be given the flexibility to decide on a design as opposed to being locked into a design that cannot be changed. AltaLink mentions that TFOs are

stuck with the layout in the functional specification and that once the functional specification is submitted to the Commission with a facility application, changing the substation equipment layout does not happen. AltaLink explained that most of its design decisions are made during its facility application phase.

- The AESO responded that the rule will not trigger a change on certain functional specification aspects, such as substation layout. The AESO explained one reason the AESO includes substation layout in the functional specifications is to ensure it knows the relative physical locations of the system elements, so it can identify the bay that each transmission line is going into, such that it can identify failure and analyze reliability concerns.
- The CCA asked if the AESO can just state what substation requirements are and acknowledge the layout instead of dictating it and taking away flexibility, especially if there is an opportunity to reconfigure and save money. The CCA stated that it suspects the AUC wants to see utilities driving for cost savings and stated that the AESO should give TFOs the opportunity to reconfigure its substation.
- The CCA provided its opinion that once the substation layout has been put on paper, it is more rigid and that there is a disincentive to make changes that could interrupt the regulatory process. The CCA noted its issue is from a project functional specification being finalized and then having an application almost in front of the Commission. The CCA asked attendees how easy it is to make changes at that moment and stated that there may be missed opportunities if not everyone understands that a project functional specification is flexible.
- The CCA provided the example of a TFO that decides it would be less expensive and more reliable to reconfigure a substation in a different manner than is outlined in the project functional specification, but it has Commission approval for the substation that meets the project functional specification. The CCA asked if, in its example the TFO would be liable if they chose to construct the substation following their revised design rather than the project functional specification design.
- EPC stated that it does not see the project functional specification as a barrier. EPC explained that it has always understood the project functional specifications to represent the minimum requirement and its standard is to exceed the project functional specification. EPC also noted that, typically, the AESO requirements are lower than what EPC ends up designing. EPC noted that it has changed it many times and defended it to the Commission and that if EPC can't defend the design to the Commission, then they would have to change it anyway. EPC gave the example of its SS-35 substation. EPC relocated the existing SS-30 substation to the SS-35 substation. EPC determined that less meters were needed than were required per the project functional specification. EPC removed the extra meters and let the AESO know about the change so that the project functional specification could be updated accordingly.
- The AESO explained that it doesn't see project functional specifications as barriers and also noted that the project functional specification is an iterative process with back and forth between all parties. The AESO noted that if market participants have suggestions on substation layout, it wants to see them and the AESO would not stand in the way of the proposed substation being put into the project functional specification if there are no reliability concerns with what is being proposed.
- The AESO also noted that there have been changes made post-approval though there is some degree of trepidation. The AESO commented that it needs some documentation that exists with respect to what build has been agreed upon.

### Ambient Temperature

- The AESO presented the background of its assessment regarding the ambient temperature rating by explaining that in the past, it required that all outdoor equipment be designed to withstand -50°C. However, as a result of a request by some TFOs to use equipment rated for -40°C, feedback resulted in the AESO commissioning a study in 2010 entitled the *Cold Temperature Frequency Analysis for Alberta* to look at historical ambient temperature. The AESO also presented the 3 alternatives it considered for setting the minimum ambient temperature rating requirements, and the rationale that went into its decision to propose establishing two minimum ambient temperature rating zones, -50°C

and -40°C, demarcated north of Edmonton and north of Cold Lake, which aligns with the 260 kV/240 kV demarcation point and is slightly more conservative, and smoother than the line provided in the 2010 consultant report.

- A discussion followed regarding how the demarcation line and the attendees' preferred alternative:
  - AltaLink asked physically how the line is going to be determined if it is not a latitude/longitude line and whether or not there is a map provided that the TFOs can consult. AltaLink supports using a latitude line, but would also be ok with either of the 2 alternatives presented that involved a demarcation line.
  - ATCO Electric agreed that going straight across the map would be easier to identify. ATCO Electric also asked why the AESO is not picking the 240 kV/260 kV demarcation line as that line is used for reliability standards.
  - The AESO explained that the ambient temperature demarcation line is the 240 kV/260 kV demarcation line.
  - The CCA stated that it did not understand why the AESO didn't just use the line that was produced by the consultant and noted that there aren't many substations in that area, so the substations could be easily determined. It also mentioned that if money can be saved by designing equipment to -40°C rather than -50°C, then the line should be drawn where the facts lead. The CCA recalled cost differences being significant between substations that are designed for different wind zones, and advised the AESO that it is creating a cliff in cost, so it needs to be aware.
  - The AESO explained that there are shortcomings in the data used by the consultant. If you look closer at the consultant study map, you will see that each dot represents an individual weather station. The AESO further explained that many of the weather stations don't have 24 hour data and that the line provided by the AESO nicely aligns with the 240 kV/260 kV territories. The AESO commented that if everyone agrees that latitude and longitude lines are the way to go, this can be entertained and that whatever line is decided on has to be easy and clear to all market participants so that none of them need to double check if their outdoor equipment is subject to a minimum ambient temperature rating -40°C or -50°C.
  - EPC noted that it is better to go with two temperature zones.
- There was a discussion around the cost difference between the equipment rated to -40°C and equipment rated to -50°C:
  - The AESO asked if anyone is in position to comment on the incremental cost between equipment that is rated to withstand -50°C and equipment that is rated to withstand -40°C.
  - EPC explained one difference in cost was the addition of another heat jacket on equipment and that heat jackets typically cost about \$1000-\$2000 each.

### Major Substation Description

- The AESO explained that, as part of the proposed new Section 502.11 rule development process, it is also consulting on its proposed definition of a "major substation", then it presented its proposed definition of a "major substation" as 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 greater than 100 kV; or a substation that the AESO designates as a major substation in its project functional specification. It also noted that once approved, this definition will end up in the AESO's CADG.
- There was a discussion that followed regarding the term "that has or may have at any time in the future" in the major substation definition:
  - The CCA asked how the definition is to be interpreted and stated that "may have" is too ambiguous. It also stated its concern with the definition including "any time in the future", which can mean more than 50 years and that allowing a predicted line to be included in the definition is something the CCA objects to. The CCA explained its objection by remarking that having 6 terminations, including potential ones, is problematic because planners will sit and think over what

can happen in 30 years and will throw lines everywhere that it has no support for. The CCA also expressed its concern over the use of the word “ultimate” and asked the AESO what defines an ultimate line. It further stated that the province is overbuilt, and no more money should be spent if it doesn’t need to.

- AltaLink agreed with the CCA’s concern over the definition including “may” and suggested that it be changed to “planned”. AltaLink further commented that substations that the AESO has planned to be a “major substation” should be required to meet the major substation requirements when the substation becomes major, not at the beginning.
- The AESO explained it needs some ability to design substations such that they can be expanded in the future. The AESO does not want a facility design that puts the substation in a corner where the substation cannot expand in the future and would indicate when, at a reasonable point in the future, that the expansion to the substation is expected.
- The AESO stated that the definition is still in draft form and it would consider the feedback provided. It also mentioned that the definition presented in the 2016 Discussion Paper used the term “planned to have” and that the AESO would consider the feedback provided.
- There was a discussion about the AESO’s decision to limit major substations to those that have more than 6 terminations:
  - TransAlta asked how the AESO determined that 6 terminations was appropriate and if the AESO considered aligning with NERC, where it is 5 terminations.
  - ATCO Electric noted that it supports maintaining 6 terminations in the definition and that if the definition moves to 5 terminations there would be CIP cost implications. ATCO Electric further noted that CIP costs a lot of money for compliance, and there is no benefit to reduce to number of terminations to 5 with respect to capital or ongoing costs.
  - AltaLink explained that this aligns with NERC with a slight change because NERC requirements are more specific to CIP infrastructure. AltaLink further explained that NERC is worried more about the lines; therefore 5 lines and 1 transformer allow TFOs to still meet the requirements. AltaLink also noted that lots of substations, 240 kV down to 138 kV, are now built with a single transformer.
  - The AESO explained that in terms of indication, there is a requirement for the AESO to provide the number of terminations at commissioning date as well as the ultimate number of terminations down the road and that this is a way to check if a substation is a major substation or not.
- The AESO presented the enhanced requirements for a substation that has been designated as a major substation and its estimate of the cost implications. The AESO noted that the major costs are related to requirements outlined in subsection 5 weather-related parameters, subsection 9 insulation requirements, subsection 11(10) bus arrangement, subsection, 12 alternative current (“AC”) station supply service system, and subsection 13 direct current (“DC”) station supply service system. Of those requirements listed, the AESO indicated the “major substation” requirements that a substation designated as major substation would need to meet at time of initial construction, even if it were not initially a major substation need to meet. The AESO explained that, when determining this, it balanced future expandability versus incremental costs.
- There was a discussion that followed regarding this list:
  - EPC asked, for substations that are designated as “major substations”, why an extra disconnect is needed if the bus is getting exchanged.
  - The AESO explained its rationale for this requirement, that when there is a new substation, that will have 6 terminations down the road, the designer may first design the substation with a breaker and a half with 1 diameter (or bay). The AESO further explained that there needs to be space available for more diameters at the substation, and if there were disconnect switches installed, the substation can be expanded without shutting down any existing equipment.

### Weather Loading Return Periods

- The AESO presented its alternatives and rationale, specifically that it chose 100-year return period for a major substation, and 50-year return period for all other substations because it reduces failure of a

major substation, which has significant reliability impact; and aligns with Section 502.2, *Bulk Transmission Line Technical Requirements* (“Section 502.2”), which also stipulates 100 years for critical transmission lines and 50 years for other transmission lines.

- There was discussion regarding the difference between life expectancy and environmental loading:
  - Capital Power expressed its concern regarding building a substation to a 50-year or 100-year return period when the life expectancy of the substation can be only 30 years.
  - Capital Power explained that after the life expectancy of a wind farm can be only 30 years, the tower or wind turbine may change after 30 years, but the power generating facility and substation will still be there. The biggest one is around 5 MW. In 2 years, the wind turbines have gone from 3.6 MW to 5 MW, so they change all the time. One cannot really salvage and reuse unless old turbines are used.
  - The AESO explained that the life expectancy is a different matter than environmental loading levels.
- There was a discussion about what a 50-year and 100-year return period means:
  - The CCA asked what the difference was between a 50-year and a 100-year return period and what the cost implications were. The CCA also asked for clarity if the discussion is about wind velocity that could occur once in 50 or 100 years, and what other weather measures are there.
  - AltaLink mentioned that snow and ice is also considered.
  - The AESO explained that they are asking on environmental loadings, which would apply to all the structures and equipment within the yard, including bus work, dead ends, and buildings. The AESO further explained that the substation must withstand a once in 50-year or 100-year event and not collapse and that once designed, it is expected that the facilities will be monitored and maintained. The AESO also noted that the requirement is for the life of the facility and that it is no different than transmission line requirements.
  - Capital Power noted that a control building is a minor item, even though it expects a control building to last 30 years, the control building can easily pass 50 years weather loading. Capital Power also noted that everything it puts outdoor is steel which can last for a long time. Capital Power gave an example of the wind farm in Kansas, with substations that are built to withstand 30-50 tornadoes, and noted that the same material used to build those substations are used in its substations in Alberta.
  - AltaLink commented that the material is the same, but how they are constructed may be different.
- There was a discussion about the alternative chosen:
  - Capital Power asked why the AESO picked a 50-year return period versus a 100-year return period.
  - AltaLink asked if instead of a system-based approach to handling freak events, if the TFO can determine how to deal with it.
- The AESO reviewed the takeaway on the weather loading return periods, which are to consider requirements for radial versus system substations. The AESO also asked if AltaLink is aware of its current design on environmental loading.
  - AltaLink commented that their substations do have standardized designs.
- The AESO then described subsection 5(2) and 5(3) of the proposed new Section 502.11, the gust wind and wet snow and wind loading requirements must either be based on the *Gust Wind Loading* and the *Wet Snow and Wind Loading* maps that are available on the AESO website or on local historical weather data. The AESO also explained that it chose this requirement to ensure the safe and reliable operation of the AES; alignment with Section 502.2, and to provide market participants with the ability to use more precise weather data, if available.
- The AESO noted that there was an error on Slide 28: the slide should have said that if the “return periods for outdoor substations transmission facilities must be based on local historical weather data, or, if not available, be based on the *Gust Wind Loading* map and the *Wet Snow and Wind Loading* map available on the AESO website.

- ATCO Electric asked some clarification questions that the AESO answered:
  - ATCO Electric asked if the maps the AESO is referring to are the same maps as those associated with Section 502.2 that are currently on the AESO website and also asked how the market participant would determine which data to use: the AESO maps or the local weather data.
  - The AESO confirmed that the maps it is referring to are the same maps that are currently posted on the AESO website for Section 502.2. The AESO also explained that, if available, the TFO can use local environmental data. If none exists, then the TFO is required to use the AESO's maps.

## Grounding

- The AESO provided a description of the proposed new Section 502.11 grounding requirements. It noted that the AESO must provide, in the project functional specification, the forecasted short-circuit levels for the substation: at the commissioning date and forecasted at least 7 years after the commissioning date. It also explained that the substation grounding design 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. The AESO also provided its rationale for having a grounding requirement, which is to ensure safe step and touch for workers.
- The AESO also discussed the importance of managing the system and ensuring action is taken when the short-circuit levels are exceeding the capability of the grounding system design. The AESO provided the examples of Calgary and Fort Saskatchewan which are approaching those levels and noted that unless action is taken, those numbers will be exceeded.
- There was concern from AltaLink and Capital Power regarding the term “upgradeable” that was used in the Slide deck (slide 29):
  - AltaLink explained that the term “upgradeable” means that it must be ready to upgrade at any time and that grounding design is related to the equipment being added, so forcing facility owners to be able to upgrade the ultimate rating is typically more than equipment sizing.
  - Capital Power also expressed concerns that the grounding system would need to be upgraded.
  - The AESO clarified that the word “upgradeable” was not used in the subsection 6(2) of proposed new Section 502.11, which states that “the legal owner of a substation transmission facility must...review and upgrade the grounding grid to accommodate the short-circuit current levels up to the maximum short circuit current levels provided in the functional specification for that substation...”.
  - There were no stakeholder concerns with the language in the proposed new Section 502.11.
- There was a discussion around the ultimate short-circuit levels provided by the AESO and concerns regarding the AESO's role in the grounding system design:
  - AltaLink wanted to know what is meant by ultimate short-circuit levels.
  - Capital Power noted that the ultimate short-circuit level is dictated by the AESO and asked if the AESO is asking the TFOs to build something to reach that very ultimate number. Capital Power also explained that it conducts a study on its substations every 5 years and usually takes the highest number and adds 10% to use as their design for common practice. Capital Power noted it does not think it is necessary for the AESO to specify a design and also asked the AESO if it checks the grounding system regularly.
  - The AESO explained that if the ultimate short-circuit levels provided in the project functional specification are 20 years down the road, and the initial short-circuit levels are very low, the market participant has an option of reducing the scale of grounding needed initially, and then, 15 years down the road, it can update to the ultimate level as opposed to installing the grounding initially with the ultimate level. The AESO noted that in most cases, if not all, the grounding grid will be designed with the ultimate level of grounding needed because it is very costly to upgrade. The AESO noted that it provides the information to market participants to give them the flexibility of how they deal with short-circuit levels and also explained that the values provided are a prediction, and that things may change, but market participants have programs and practices in place to stay ahead of fault levels.

- The AESO explained that it wanted something in writing regarding grounding requirements, that it had no particular concerns that it was trying to address; however, it is only asking that market participants stay ahead of the current fault level and designs the grounding grid such that the forecasted ultimate short-circuit levels can be accommodated.
- The AESO also responded to Capital Power’s question noting that it expects the substation owner to regularly check the short-circuit levels of its facilities.
- There was a question regarding why it is proposing to provide its estimated short-circuit levels “at least 7 years into the future from the in-service date”:
  - EPC asked if the AESO is proposing to change its project functional specification practice of providing the estimated short-circuit level 10 years in the future.
  - The AESO explained that the rule is not intended to change current project functional specification practice and that absolute minimum it will provide is 7 years, but it still plans on generally providing 10 years into the future. It provided its rationale was that by putting “7 years into the future” in the proposed new Section 502.11, the AESO has flexibility when information is unavailable.

### Lightning and Other Surge Protection

- The AESO presented its description of lightning and other surge protection system requirements outlined in proposed new Section 502.11. It noted that 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 their materials. The AESO also presented its rationale for choosing these requirements, including that it: ensures that substation equipment have adequate protection against lightning strikes; aligns with existing ISO rule requirements; aligns with current TFO design practices in Alberta; and aligns with IEEE recommendations.
- The AESO also presented its description of surge arrester installation requirements, specifically noting that surge arrestors must be installed at: all exposed terminals of transformers and gas insulated switchgear (“GIS”), each shunt capacitor and shunt reactor, and at each transmission line entrance. The AESO presented its rationale for these requirements that it ensures that substation equipment has adequate protection against lightning and switching surges.
- There was a discussion regarding the surge arrester installation requirements outlined in subsection 7(6) and 7(7) and how it aligns with current substation design practice:
  - Capital Power asked that ATCO Electric provide its surge arrester installation practice.
  - ATCO Electric did not know what it was, but would take it away.
  - The AESO suggested that if ATCO Electric has concerns with this section that it bring its concerns back to the next meeting.
  - Capital Power noted that for most utilities an entry line arrester has been common practice for the last 30 years.
- There was a discussion regarding the cost versus benefits of surge arrestors:
  - The CCA asked if the costs were worth it and further asked to see the evidence that one practice is better than the other and that one has lower reliability than the other. The CCA also asked the statistics of putting an arrester on a shunt reactor and what the cost and benefit were.
  - EPC noted it recently had lightning strikes blow out the breakers as a result of not having surge arrestors. EPC explained that there are situations where a lightning strike can be transferred through a transformer. EPC described an event that was a good example of this because the lightning strike jumped a line and blew a 138 kV transformer down the line. EPC noted that in terms of cost, the cost of a surge arrester is inconsequential when compared to a new transformer.
  - EPC also noted that it has run studies on bus-tie breakers, and that there was approximately a \$2 million customer impact because the ultimate savings would be above what the cost of the breaker is. EPC noted the cost of a surge arrester per phase is \$2,000, whereas a breaker replacement is more than \$120,000; therefore, the surge arrester is relatively a small cost.

- Capital Power emphasized the fact that not having a surge arrestor will do permanent damage to major substation equipment.
- The CCA noted the fact that not having a surge arrestor will do permanent damage is not obvious and asked how transformers will be saved from destruction by having a surge arrestor. The CCA stated that it would like to see the numbers, noting that just because there is a cost saving doesn't mean the current practice is worth it.
- AltaLink noted they have both options, and still have failures across the board. AltaLink also mentioned that the practice has changed and that it would like to see requirements based on system performance because insulation coordination is not done at this level. AltaLink also noted that surge arrestors are not only for surges but also work with direct stroke.
- There was a discussion regarding the level of reliability that the AESO is targeting:
  - The CCA asked the AESO what level of reliability they are targeting and asked where it is indicated. The CCA also asked if the cost is worth the reliability we are getting.
  - The AESO explained that when it first set out to create technical rules it wanted to know if it could simply specify a reliability number, for example 99.999% availability. On further analysis and discussion with market participants, it was determined that establishing an availability figure on certain aspects of transmission system performance would be complicated for the TFO to quantify and for the AESO to enforce. The AESO is instead proposing to set minimum requirements that are measurable and critical to system reliability as part of the proposed new Section 502.11.
  - The CCA asked what the minimum technical requirements were to achieve this reliability standard and noted that the AESO is assuming that substations will meet an acceptable level of reliability by setting the minimum requirements based on industry standards and TFO practice. The CCA further noted that reliability has to be evaluated and measurable to be part of data.
  - The CCA further asked if the AESO has found utilities that try to work out the contribution to reliability of various decisions they are making.
  - The AESO explained at the time of the workgroup discussions, a fair bit of time was spent discussing if something like a System Average Interruption Frequency Index ("SAIFI") or System Average Interruption Duration Index ("SAIDI") could be introduced for transmission system reliability, which is something that has been around for a while to describe distribution system reliability. The AESO further explained that the workgroup concluded that those are just not possible for transmission. Many things are really not quantifiable, and reliability is too broad a word. As a result, the AESO looked at: current TFO practice, the AESO's expectation in terms of planning and operations, and what others jurisdictions are doing. The AESO also noted it surveyed 154 utilities specifically on lightning arrestors, and it has not found any exception of a utility that does not require an arrestor to be installed.
- The AESO asked TFOs for performance data related to surge arrestors:
  - The AESO noted that the standards collected did not have that background information. The AESO asked if one of the TFOs has performance data related to having lightning arrestors on equipment, including the lines that can be put on the table.
  - EPC noted it does not have studies specifically around surge arrestors, that most of their analysis is on breaker additions.
  - The AESO asked EPC if they would be willing to share their studies, and, if so, to please share them for next meeting.
  - EPC noted it can provide fault information.
  - AltaLink added that if the AESO is talking about all the different cost benefit analysis that goes into an overall substation design, a lot of those decisions are based on historical practices. The biggest savings are when TFOs can play with designs and not be forced into a specific design. Give the TFO the requirements and let them design as opposed to giving them the design and letting them figure out requirements.

- AltaLink and ATCO Electric noted their performance data is provided to the Canadian Electricity Association (“CEA”) in their submission.
- The AESO said it would see if it could find that data.
- The AESO presented its insulation coordination study requirement and noted that 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, because it ensures shunt capacitor, shunt reactors, and reactive power resources are protected in the event of a lightning strike or switching surge; and that it aligns with current AESO functional specification practice.
- There was some concern regarding the requirement to perform an insulation coordination study for every substation:
  - The AESO clarified that the requirement only pertains to reactive power resources and asked if AltaLink had any further concerns.
  - The AESO also noted that it does not see issues with using a generic study and if the substation designer is satisfied that the input parameters are the same for the substation as was used for the generic design.
  - AltaLink stated that they would have to think about it.
- There was some information provided by TFOs regarding when they study surge arrestors:
  - AltaLink mentioned that it is not necessary to study surge arrestor design for every substation. It can be run once instead of every time as opposed to making it a mandatory requirement.
  - EPC explained that, in order to install surge arrestors, EPC would run studies regardless of being required to do so. EPC further explained that it partially agrees with AltaLink in situations where a particular piece of equipment is being modified.
  - EPC further explained that, as long as you are speaking of same base fault level at substation, you can use the same study for other substations, however fault levels are often different at different substations, for example, downtown Calgary substations are different from other neighborhoods.
  - EPC currently has a practice in place to refresh its TRV studies at each substation every 5 years. These studies do not often result in the discovery of violations that had not been considered, and they came down to individual breakers at individual substations. EPC found relatively few issues but it has found issues.
  - Capital Power asked if EPC was referring to a short-circuit study as opposed to an insulation coordination study and that, if it is a common design, it doesn’t need to be studied every time.

### Continuous Operating Voltage Range

- The AESO explained that the substation must be designed such that the substation components are capable of operating continuously within the minimum and maximum voltage levels provided in their presentation.
- There was a discussion around whether or not it was still necessary to operate part of the transmission system at 260 kV:
  - The CCA stated that they had heard that operating part of the system at 260 kV is no longer needed because there isn’t as much distance between substations in northern Alberta as there once was. The CCA stated its impression is that this costs extra money.
  - The AESO stated that it would be a massive and costly undertaking to review and bring down 260 kV facilities to 240 kV.
  - AltaLink commented that there is a difference between equipment rating and operating rating voltage level. AltaLink further commented that Alberta has the weirdest voltage system in the world and that there are many operational considerations other than just switching over for controlling voltage.
- There were no concerns expressed by attendees regarding the continuous operating voltage range requirements outlined in subsection 8 of proposed new Section 502.11.

- EPC noted the International Electrotechnical Commission (“IEC”) and Institute of Electrical and Electronics Engineers (“IEEE”) standard is only tested on 145 kV, but because of the test the manufacturer can give you a guarantee that the equipment can operate at 150 kV and will change the nameplate to 150 kV. EPC further noted that the nameplate cannot be changed to 152 kV, so EPC procure equipment that is rated for the next acceptable level up, which is 170 kV. EPC also noted that it had received different quotes and that the price difference is not that big.

### Insulation Required

- The AESO presented the proposed substation insulation requirements outlined in subsection 9 of the proposed new Section 502.11. This included presenting the basic lightning impulse levels (“BIL”) and basic switching impulse levels (“BSL”) requirements. The rationale was also presented and included that requiring BIL and BSL levels for all equipment greater than 100 kV ensures coordinated protective levels between all substation equipment, ensuring insulation is designed in a manner that ensures safe and reliable operation of the substation, such that flash over is minimized.
- There was a discussion about the 72 kV substation component requirements.
  - TransAlta noted that in Section 9(3), 72 kV substations will be an exception to the proposed rule applicability of substations over 100 kV.
  - The AESO explained that the applicability section will determine which substations the rule requirements apply to and if you have facilities in that substation at these voltages, you would be obligated to meet it. The AESO further explained that if the highest voltage in the substation is 240 kV, the requirements would apply, and that 72 kV equipment should meet the BIL requirements shown in the table. The AESO also noted that this can perhaps go into an information document.
- There was a question about the disconnect switch and 240 kV substation component requirements:
  - Capital Power asked why the AESO is proposing lower BIL on disconnect switches (in Table 3).
  - The AESO explained that these values are based on the current AESO functional specification practice and the IEEE recommendations.
  - Capital Power stated that 900 kV is common practice for 240 kV / 280 kV systems, one other thing to consider is when the gap is open you need enough insulation to create isolation. Capital Power explained that if the gap is 900 kV, you may not get clearance; therefore, it always designs to 1050 kV BIL to make things easier on construction.
  - The AESO stated that the values could be lowered from 1050 kV to 900 kV for 240 kV / 260 kV equipment.
- There was a discussion regarding GIS and indoor substation component requirements:
  - Capital Power also asked where the high voltage GIS requirement values came from, explaining that the only high voltage GIS is the EDTI Bellamy station and it is at around 900 kV or 950 kV.
  - The AESO noted that, as the workgroup meeting minutes show, there were many values considered and that they relied on input from EDTI and EPC to determine the minimum GIS BIL and BSL equipment values.
  - AltaLink asked whether the GIS BIL requirement is the same as the minimum for outdoor equipment and explained that the GIS enclosure should be no different than outdoor equipment. AltaLink also mentioned that if the AESO is going from a minimum requirement or if they have the capability or want to, it should break apart the requirements each equipment needs, instead of specifying a single number of 1050 kV.
  - Capital Power explained that the advantage of going indoors is that it is a controlled environment and that, in typical practice, you would be able to lower the BIL significantly to save your costs, but in this case there is no saving, even in a gas insulated environment. Capital Power noted that it believes common practice is that you can lower the BIL.
  - The AESO explained that the pressure of the SF6 gas keeps going up and the trend they see is manufacturers making standards higher than this.

- The AESO requested information on GIS data on BIL at existing facilities from the city utilities, EPC and EDTI.

#### **Additional Discussion**

- Question about subsection 14.
  - ATCO Electric asked a question about subsection 14.
  - The AESO mentioned that this question could be discussed after the AESO presents its slides for subsection 14 and that this would likely be at the September 24, 2019 Stakeholder Session.

#### **Closing discussion**

- The AESO stated that it was time to wrap up, and that the next session would start up with introductions, an overview of the session, and then the presentation would move to subsection 10 of the proposed new Section 502.11.
  - TransAlta noted that there was not a discussion on 9(5) (which was presented on Slide 36).
- There was a discussion regarding the start time of the next meeting:
  - Capital Power requested that the next meeting start early and finish later.
  - The AESO asked attendees if 9 am would work for them.
  - All in person attendees agreed that it would work for them.
  - The AESO said that it would look into it and get back to the team.
- There was a round table and a few stakeholders provided final comments:
  - Depal noted its observation that there was a lot of cost discussion: the AESO is talking about one cost and the CCA is talking about a different cost. Depal also asked what the benefit was of the proposed new rule and mentioned that when it thinks about it, none of the conversation is around the benefit. Depal also asked the AESO to take action around reviewing the cost and benefits and used the example of surge arrestors that had been discussed earlier.
  - The CCA stated it wasn't clear on which rules have significant cost impact from all the rules the AESO has. It is interested to drill down on the ones that have a large cost influence as opposed to those that do not. The CCA also asked how it can distinguish which requirements have large cost impacts from those that do not.

ENDED here at 2:56pm.