

Stakeholder Comment Matrix – November 22, 2018



Development of a Proposed New ISO Rule – Section 502.11, *Substation Technical and Operating Requirements*

<p>Period of Comment: November 22, 2018 through December 7, 2018</p> <p>Comments From: Consumers' Coalition of Alberta</p> <p>Date [yyyy/mm/dd]: December 7, 2018</p>	<p>Contact: Jim Wachowich, Dan Levson</p> <p>Phone: Jim (780) 429-0555 ext #223, Dan (403) 615-8886</p> <p>Email: jim@wachowich.com, dan@bema.ltd</p>
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The AESO is seeking comments from Stakeholders on the development of proposed new ISO Rule – Section 502.11, *Substation Technical and Operating Requirements* with regard to the following matters:

	Development of a Proposed ISO Rule	Stakeholder Comments and/or Alternate Proposal
1.	Do you agree or disagree that the issue identified requires the development of proposed new ISO Rule – Section 502.11, <i>Substation Technical and Operating Requirements</i> ? Please comment.	<p>Disagree.</p> <p>There are similarities between the content of the proposed Section 502.11 and the existing Section 502.2. For example, the AESO is proposing 50-year and 100-year return period weather-related loads for equipment design at normal and major substations, respectively. This was recognized as one contribution (among many) to a substantial increase in transmission line costs in Section 502.2, and the AESO committed to reviewing that rule.</p> <p>Further detail is needed to understand how this rule would apply to brownfield substation modifications and greenfield projects.</p> <p>It is premature to approve the proposed Section 502.11 for a number of reasons that are set out in the CCA Supplemental submission to this Stakeholder Comment Matrix. Without addressing a number of issues, including whether a cost-benefit test has been applied to various provisions in the rule, it is unclear whether the proposed requirements are in the public interest or provide value to ratepayers.</p>
2.	Do you agree or disagree with the potential objective or purpose of proposed new ISO Rule – Section 502.11, <i>Substation Technical and Operating Requirements</i> ? Please comment.	<p>The potential objective or purpose of the proposed Section 502.11 to standardize requirements should be limited to those that pass a cost-benefit analysis or relate to environmental or safety requirements in legislation or standards.</p> <p>Elements that are primarily economic or reliability driven need to be assessed on a cost-benefit basis and should consider the objective of providing value to ratepayers.</p>

		Some elements, such as standard transformer sizes, may pass cost-benefit analysis but this should still be analyzed. Other requirements appear less likely to pass a cost-benefit analysis, such as the 50-year and 100-year return period.
3.	Do you agree or disagree with the proposed form of consultation and timelines? Please comment.	Consultation timelines should be adjusted to address the concerns raised in the Supplemental submission attached to this Stakeholder Comment Matrix.
4.	Do you intend to participate in any related consultation? OR Do you agree that no consultation group is required for this rule development? Please comment.	Consultation is needed but it must be informed by the review of Section 502.2, a cost-benefit analysis of the requirements, a review of practices in other jurisdictions and the other issues raised in the CCA's Supplemental submission.
5.	Do you have any additional comments?	Please refer to the CCA Supplemental Submission included with this Stakeholder Comment Matrix.

Stakeholder Comment Matrix – November 22, 2018

Supplemental Comments to ISO Rule – Section 502.11, Substation Technical and Operating Requirements

(prepared in response to question 6, “Do you have any additional comments”).

Prepared by the CCA, December 10, 2018

Introduction and Context:

1. The CCA is responding to the AESO’s November 22, 2018 Letter of Notice for Development of a Proposed New ISO Rule, Section 502.11. This submission is a supplemental response to the Stakeholder Comment Matrix provided separately.
2. The CCA is comprised of the Consumers’ Association of Canada (Alberta Division) and the Alberta Council on Aging. The CCA is a coalition of two public interest groups and, as a collective, is concerned with the tariffs, rates and charges of the various public utilities operating in Alberta and regulated by the Commission.
3. Those at the AESO and on the Working Group familiar with the CCA’s participation in the Alberta utility industry will be aware of the CCA’s concerns about the high level of transmission costs. The CCA’s consistent engagement in General Tariff Applications, Transmission Deferral Account Applications, Need Identification Applications and Facility Applications has been pursuing the need to find the optimal balance between cost and reliability, while meeting other legislated requirements related to safety, the environment and market structure.
4. The CCA has concluded that the cost of transmission in Alberta appears to be one of the highest cost transmission systems in the world. While depressed energy prices have masked the overall impact on customer bills, with the development of a capacity market and the expected return of capacity and energy prices to align with the cost of new generation in future years, the total customer bill will be of concern to many Albertans, whether residential or commercial customers or large industrial customers competing on a world-wide basis to sell their products.
5. Alberta has an unusually large amount of industrial load compared to other jurisdictions. A significant portion of that industrial load includes oil sands developments, including SAGD operations which often include cogeneration. A number of other large industrial loads can develop economic cogeneration or generation behind-the-fence. Distribution connected generation is also developing and is beginning to compete for load of smaller customers. These factors mean that some customers have options to meet their energy requirements and the high cost of transmission can become a major barrier to purchasing power from the transmission grid, thereby accessing the benefits of Alberta-wide generation.

6. Historically, the CCA has expressed significant concerns with the ISO rule on transmission lines (ISO rule section 502.2). The reason for the focus on transmission lines is obvious since transmission lines are the majority of the costs of the transmission system. However, substations are also a costly component of Alberta's transmission system. The AESO states:

Transmission substations have traditionally accounted for a considerable portion of the cost of transmission projects, and this trend is expected to continue into the future. For example, the AESO found that between 2005 and 2014, the cost of transmission substation equipment for major connection and system projects was approximately 30% of the total cost of all such projects. Proposed New Section 502.11 would allow better management of connection costs for transmission substations by providing consistent equipment performance requirements and ratings.¹

7. Substations are the second largest cost component of the transmission system and more substations will continue to be added in the future, even though the "Big Build" is coming to an end. New substations are needed to respond to increasing load at a regional level. Also, new or refurbished substations are needed when existing substations come to the end of their useful lives. Consequently, the costs associated with Substations need considerable attention to ensure there is an appropriate reliability cost trade-off.
8. The CCA notes both the functions of the TFO's and DFO's in Alberta are regulated monopoly providers of electricity transmission and distribution service. The concept behind regulation of monopolies is to use regulation as a proxy for competition. The CCA submit the rules should work in accordance with how a truly competitive market would either allow or not allow the building of a major capital asset such as a substation.
9. The CCA has reviewed the AESO Discussion Paper on the Proposed New Substation Rule (Section 502.11 of the ISO rules) dated November 25, 2016, the Terms of Reference for the Substation Rule 502.11 Workgroup (Final) dated September 18, 2015 and the November 22, 2018 Letter of Notice for Development of a Proposed New ISO Rule – Section 502.11, Substation Technical and Operating Requirements.
10. The discussion above is the context for which the following comments are now provided.

Concerns with the Stakeholder Process:

11. Substation design engineers can each bring a different focus and background when assessing the balance between cost and reliability. For example, within the engineering section of a TFO, there will be engineers who are specialized in design, others in project management and others in developing and implementing standards. Within these areas of expertise, there will typically be engineers who favor fit-for-purpose designs that optimize costs and reliability (but may require more engineering time and cost), whereas there will

¹ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 6.

be other engineers that seek to minimize the amount of engineering effort through the use of standards and modular designs, (but may end up with designs that may be more expensive since some projects cannot be optimized within a standard that is typically not fit-for-purpose). Obviously, any given engineer could operate along a spectrum between these bookends of engineering philosophy. Furthermore, a focus on standards versus a focus on fit-for-purpose designs may vary depending on what aspect of the substation is being designed.

12. Factors that can affect an engineer, or group of engineers, when choosing an engineering philosophy is their prior experience with managing the trade-off between reliability and cost. That trade-off can be influenced by the degree of impact of loss of load events in their experience, training in conducting cost/benefit analysis and engineering economics, the amount of design work being undertaken relative to the engineering resources available, the years of substation design experience of the engineer(s), and the emphasis the TFO's management places on growing rate base versus minimizing costs to ratepayers.
13. Another factor affecting engineering philosophy is whether the engineering work is largely undertaken by in-house engineers at a TFO or by an external engineering consultant under the supervision of a TFO. In-house engineering staff will tend to look at the long-term cost and reliability implications of an engineering design, including the operations and maintenance impacts. In contrast, external consulting engineers are assigned to work for a TFO but do not necessarily expect to work for the TFO in the long term and often have limited insight into the long-term cost implications of their project² which only one project among dozens of other projects over time. External consulting engineers are often driven by different motivations than in-house engineers at a TFO, including the number of manhours on a project (since they are normally "manhour shops") and maintaining a good relationship with their TFO client. Another factor affecting engineering philosophy is the degree of emphasis on complexity versus simplicity. Highly complex engineering designs can optimize the reliability cost trade-off but can also create problems for operations and maintenance staff over the longer term and do not lend themselves to the benefits of standardization.
14. When a TFO provides one engineer (with an alternate), the selection of this individual to represent that TFO will bring a measure of the corporate engineering philosophy and that individual's preferences into a Workgroup environment. From a ratepayer perspective, who are typically unable or not permitted to participate in a Workgroup, there is no awareness of what engineering philosophy the TFO members of the Workgroup advocate for during their discussions. What is known from the Terms of Reference is that they are to "act in a professional and open manner", "have sufficient technical knowledge, or carry a primary technical responsibility within their organizations, related to transmission substation

² Including long term impacts on operations and maintenance costs and on total revenue requirements.

design, construction, commissioning and operation” and are “willing to undertake investigations into specific technical issues as determined by the WG.”³

15. The role of the AESO on the Workgroup is presumably to protect the public interest, which includes the cost of the transmission system. However, if TFOs and the DFO unite on any particular issue, there is at minimum a challenge for the AESO to face so many Workgroup members who could apply considerable persuasion to get the AESO to agree with their position. There is also the issue of expertise power with the strong representation of TFOs and DFO. Customers rely on the AESO representatives on the Workgroup having a substantial depth of experience and resources to evaluate the trade-off between reliability and cost in the context of substation design. The CCA is also aware of the AESO’s resource limitations that are frequently expressed and appears to be a routine challenge for the AESO.
16. Regardless of the degree of bias or imbalance that may occur at the Workgroup regarding the reliability cost trade-off, a critical issue is that once the Proposed Rule is adopted by the AESO, it is now effectively the “law”. A TFO must follow the requirements of ISO Rule Section 502.11. Any challenge from interveners as to the cost benefit of decisions that comply with the Rule will very likely fail before the Commission. The CCA has experienced this in the context of ISO Rule Section 502.2 on Transmission lines. Hence, it is important to the CCA as a part of the Ratepayer community that the AESO get this right.
17. As noted earlier, the CCA’s primary objective is that there should be an optimal trade-off between cost and reliability in setting any new ISO rules (i.e. standards) for substations. Given the effort required to develop and approve a new ISO rule, the CCA expects that the new ISO rule should result in an improved optimization of the trade-off between cost and reliability. With that objective, the CCA is concerned with the following:
 - a. One way to review the reasonableness of the cost-reliability trade-off is to examine the minutes of the meetings of the Workgroup (WG) However, while the AESO ensured that minutes of the meetings were taken, the “minutes of the meeting will not be posted on the AESO website.”⁴ This decision appears to contradict the AESO’s consultation principles for ISO rule development, which states that the “ISO rules consultation process will be inclusive, transparent, fair and efficient and will be understood and accepted by all parties.”⁵ [emphasis added]
 - b. While the AESO indicates it has posted to its website “any data, analyses, or other material that the AESO considers to be relevant to the development of the proposed

³ Substation Rule 502.11 Workgroup Terms of Reference (Final) September 18, 2015, among other requirements.

⁴ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 29.

⁵ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 30, Appendix A, item 1.

new ISO rule Section 502.11”,⁶ the CCA has been unable to find any cost-benefit analysis, any indication of where the proposed rule could materially increase costs or substantive other supporting materials.

- c. The membership of the Workgroup was restricted on several criteria, including that a member must agree to “have sufficient technical knowledge, or carry a primary technical responsibility within their organizations, related to transmission substation design, construction, commissioning and operation” and “be willing to undertake investigations into specific technical issues as determined by the WG.”⁷ Such restrictions eliminate individuals from the ratepayer community who have some knowledge on substation design but do not “have sufficient knowledge” or “cannot undertake investigations into specific technical issues”. The CCA and its consultants would be disallowed on these two criteria even assuming they had resources for an individual to participate in the Workgroup.
- d. To the CCA’s knowledge, the only market participant representing interests of smaller customers that may have had funds to be involved in the Workgroup is the UCA. It does not appear that the UCA was involved in the Workgroup for Section 502.11.⁸
- e. The AESO stated that they encouraged “participation from all Transmission Facility Owners (TFOs) and major industrial customers that have ownership and direct involvement in transmission substation design, construction and operation.”⁹ However, with respect to larger industrial customers, it does not appear their interests were represented in this Workgroup. That is not surprising given it is well known the resource limitations of the two major large industrial ratepayer representatives, IPCAA and ADC. Furthermore, it is not clear if even their organization members would have internal staff that could be made available and would qualify for the requirements of Workgroup membership.
- f. For the reasons noted above, that appear to preclude ratepayer involvement, the CCA is concerned that the process followed by the AESO has contradicted the inclusive requirement for consultation: “The ISO rules consultation process will be inclusive, transparent, fair and efficient and will be understood and accepted by all parties.”¹⁰ [emphasis added]

⁶ AESO Letter of Notice for Development of a Proposed New ISO Rule – Section 502.11, Substation Technical and Operating Requirements (“Section 502.11”), page 3 under Stakeholder Comments.

⁷ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 28.

⁸ At one point in the development of ISO Rule 502.2 on transmission lines, the UCA did engage an expert to participate in the Workgroup for ISO Rule 502.2. This was a helpful addition to the process, although not fully satisfactory to the CCA.

⁹ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 28, under Membership.

¹⁰ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 30, Appendix A, item 1.

- g. When the CCA raised concerns about the ISO 502.2 rule development, one CCA consultant, not trained in design of transmission lines, was permitted to attend one meeting of the Workgroup and raise concerns.¹¹ The AESO, on behalf of the Workgroup, would not allow another CCA consultant, who had extensive training in transmission design to attend the Workgroup. This is a concern in the context of the AESO's public interest mandate. While it is understandable that TFO participants in the Workgroup may object to a dialogue with a CCA consultant who may also appear in a hearing as an expert witness, the participants in the Workgroup can also appear as expert witnesses in the same hearings. The scope of the Workgroup specifically states:

WG members will not be precluded from participating in the ISO Rule consultation process or in any related Alberta Utilities Commission ("AUC") proceeding in their own capacity, independent from the AESO;¹²

- h. This means that anyone on the Workgroup is free to testify in a proceeding and take any position they want in support of their corporate interests. However, if a CCA representative is not allowed to participate in the Workgroup for fear they may use some of the non-confidential information shared in the Workgroup, then this is procedurally unfair and contrary to the AESO's stated desire to hold an inclusive, transparent, fair and efficient consultation process.
- i. The ISO rules consultation process states that the "AESO will commence consultation early in the ISO rules consultation process to allow sufficient time for stakeholder participation and will provide stakeholders with complete, accurate, timely and comprehensible information."¹³ The Letter of Notice was issued November 22, 2018 with a deadline for Stakeholder comments by December 7, 2018. The AESO has given stakeholders 12 working days to respond in the middle of one of the busiest regulatory and policy development timeframes, with several major hearings underway and intensive efforts involved in the developing Capacity Market. The AESO Discussion Paper is dated November 25, 2016 and it is unclear why the AESO took two years to develop the Letter of Notice¹⁴ and then has only provided such a short timeframe to respond. Many stakeholders may not even know about this matter and the CCA has confirmed this with two major stakeholders.

¹¹ He also had subsequent meetings with the AESO, but not with the Workgroup.

¹² AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 29, Scope.

¹³ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 31, Appendix A, item 5.

¹⁴ Note that the Letter of Notice has very little content beyond that already provided in the AESO Discussion Paper and includes further very tight timeframes (15 calendar days) between posting a draft of the Proposed Rule and for written comments on the new ISO Rules 502.11.

- j. Finally, regarding the December 7, 2018 deadline, the AESO states that “Adherence to deadlines is essential to the integrity of the comment process, and as such, the AESO may choose not to consider any Stakeholder comments received after the deadline.”¹⁵ From the CCA’s perspective, it appears this tight timeline for responses is neither fair nor in the public interest. However, the CCA appreciates the extension for filing comments to Monday December 10, 2018 granted by the AESO.

18. All of these factors have contributed to concerns of the CCA as to whether the proposed rule consultation process has been conducted with sufficient rigor to ensure the public interest obligations of the AESO have been met. The next section addresses technical concerns, which are then followed by Recommendations.

Concerns with Technical Content of Proposed Substation Rule

19. Within the short timeframe available for comment, the CCA has undertaken an initial effort to identify various aspects of the proposed rule that stakeholders representing ratepayers need assurances that the Workgroup found the appropriate reliability cost trade-off. The following are some general considerations for the AESO’s consideration.

- a. With 80% of the 717 substations operating in the AIES at 138 kV or higher, some 80% are greater than 30 years old,¹⁶ it is expected that there may be a number of brownfield or greenfield substations in the coming years. Furthermore, AltaLink has initiated a Substation Refurbishment Program¹⁷ and it is unclear how this program relates to the Proposed ISO Rule section 502.11 and when substation refurbishment is to be initiated or if a new substation is to be built in place of an existing substation. The Discussion Paper mentions retrofitting existing substations and building new substations,¹⁸ but provides no guidance or principles to apply as to which of these options should be selected and when action should be taken.¹⁹
- b. The salvage of substations is potentially a very large cost item given the age of the majority of the substations. The next 10 years could see a lot of salvage/full abandonment and new substations being built all over the system. The CCA was unable to find any discussion of the cost of salvaging substations and opportunities to mitigate this cost in the AESO Discussion Paper. It is unknown if this was considered out of scope for the Proposed Rule.

¹⁵ AESO Letter of Notice for Development of a Proposed New ISO Rule – Section 502.11, Substation Technical and Operating Requirements (“Section 502.11”), page 3 under Stakeholder Comments.

¹⁶ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 5.

¹⁷ Proceeding ID 23848, Exhibit 23848-X0017, PDF page 150 to 159.

¹⁸ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 5-6.

¹⁹ If this decision is to be left to the discretion of the TFO, it is recommended that this should be stated explicitly, and reasons provided.

- c. Telecommunication equipment located at substations is another cost item which often requires fence expansion (and possibly new land) and expensive upgrades and moves of equipment within the existing site. The CCA was unable to find any discussion of the telecommunication facilities, including joint use, the costs involved and the opportunities to mitigate these costs in the AESO Discussion Paper.
- d. The AESO Discussion Paper proposes new substation categories, General and Major (referred to as a Type 1 substation). The Type 1 substation “will require enhanced equipment and system performance”. The Discussion Paper provides a vague assurance about cost increases when stating that “the categorization of transmission substations based on its impact on the reliability of the AIES generally aligns with current TFO design practices.”²⁰ In creating a new class of substation, the CCA would like to see evidence that existing major substation performance has been or is forecast to be insufficient from a reliability perspective as part of the justification for creating this new class of substation. Further, after providing evidence that reliability is insufficient, the cost impact of the proposed classification needs to be understood. While the Discussion Paper occasionally mentions urban versus rural substations, it is also not clear why there is not more consideration of the urban versus rural differences including expensive noise mitigation and other "upgrades" (aesthetic and otherwise).
- e. A number of the older substations have environmental contamination (both on and off-site) from historical use or prior conditions of the site. The Discussion Paper does not address this from a technical perspective including the practices when a TFO conducts a major upgrade or salvages the substation. The Discussion Paper mentions that pollution and contamination must be considered in transmission substation design²¹ but there is nothing specific beyond this general statement.
- f. The Discussion Paper states that “the AESO proposes that Proposed New Section 502.11 should be focused on the functional and performance requirements of equipment in transmission substations to achieve desired reliability, rather than customer-based performance targets such as the SAIDI, SAIFI and CAIDI indices”.²² Prior to this conclusion, the AESO provides an explanation of the difficulty of applying these widely used measures of reliability in the transmission system “other than individual delivery points.”²³ Customers are keenly interested in the reliability they see at delivery points, whether they are direct connected large

²⁰ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 9.

²¹ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 14.

²² AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 11.

²³ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 10.

industrials or whether they receive service through a distribution utility. Most importantly, these historical and widely accepted measures of reliability (SAIDI, SAIFI and CAIDI) are one key way to determine if there has been an appropriate trade-off between cost and reliability from a customer perspective. The replacement measure of proposing to maintain reliability in line with the Alberta bulk transmission system planning criteria appears to lack any specific measure or measures and results in assessments based on complex planning modelling that has no specific outcome that can be measured year to year and location to location. The planning criteria are deterministic in nature and therefore do not relate at all to requirements for 50-year or 100-year return periods, which are probabilistic requirements. It is unclear how the AESO developed these probabilistic requirements based on the planning criteria. Further, the AESO's strict and narrow interpretation of Alberta planning criteria has been guiding decisions on new transmission for many years and the CCA is concerned that its application has contributed to a very expensive transmission system.

- g. The Discussion Paper refers to a 2010 temperature study²⁴ that is now fairly outdated. Service conditions refer primarily to the “extreme adverse weather or environmental conditions that substation equipment are exposed to and within which they must be able to perform their intended functions.”²⁵ Alberta had a major flood in 2013 which directly impacted a number of substations and it is unclear if the Discussion Paper took this into account, along with other extreme weather conditions that Alberta may face due to climate change. At minimum, the AESO needs to update and supplement its 2010 study. The Discussion Paper states that “for transmission substation design and equipment specifications, the use of ambient temperatures that are more reflective of the local conditions may result in potential cost savings associated with equipment procurement, as a wider selection of equipment may be available.”²⁶ However, it is also possible that defining areas of the province by ambient temperature could trigger large scale equipment replacement that is unnecessary and costly. The CCA is also interested in weather loading on slack spans and the optimization of costs in this context.
- h. Another proposal to develop minimum design parameters is intended to “ensure reasonable compatibility and consistent functionality of equipment within each TFO’s service area and within the AIES.”²⁷ However, this type of standardization could trigger widescale equipment replacement and the CCA was unable to find any cost-benefit analysis to support this standardization. It should be noted that

²⁴ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 13.

²⁵ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 12.

²⁶ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 13.

²⁷ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 14.

existing substations have been developed over many decades and standards and engineering design philosophy has significantly changed over that timeframe. There may be many perfectly functional substations that can continue providing reliable service for many years to come. Imposing a standard could trigger unnecessary equipment replacement, particularly in a substation upgrade circumstance.²⁸ The CCA would like to better understand this proposal to ensure it does not result in unintended consequences.

- i. The Discussion Paper proposes to define a Type 1 substation as including “a 240 kV transmission substation having, or planning to have, at least six (6) bulk transmission line terminations and/or system power transformer terminations, as specified in the project functional specification.”²⁹ [emphasis added] The proposed definition means that a planner can materially impact the design requirements of a substation by, for example, specifying 2 transformers (fairly typical) and therefore only 4 bulk transmission line terminations. The number of potential future lines involves considerable judgement and such terminations may not occur for many years or decades into the future. However, once a substation is classified as a Type 1 substation, costs will be incurred during design to meet the higher-level criteria. The CCA is concerned that this provision could trigger unnecessary costs. A review of existing substations and the number of additional lines that the substation was planned for and when these additional lines were actually added to the substation or are currently planned to be added would be instructive. It would be beneficial if the AESO provided a list of existing substations that would be classified as Type 1.
- j. Some portions of the standards specify the functionality requirements for a given type of substation and some standards specify the criteria for standard equipment³⁰ for Type 1 and General substations. Specifying functionality requirements whenever possible may provide more opportunity for innovation and cost mitigation. For example, in the capacity market discussions, the standard for reliability was chosen to be the EUE standard at a certain specified level, thereby creating wide-ranging opportunities for service providers to meet the standard. If the standards are at the functionality level rather than at the equipment level, that may give more room for planning and design engineers to be innovative in coming up with designs that are cost effective and reliable. This approach could also be supplemented by carefully designed incentive mechanisms so that the planners and design engineers have the incentive to become innovative and efficient in each

²⁸ While the Proposed Rule is to be applied on a go-forward basis, when undertaking an upgrade to a substation, the engineering team could interpret the Rule as grounds to move all equipment up to standard, not just the addition associated with the upgrade.

²⁹ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 8.

³⁰ Equipment is used in the broad sense to include transformers, breakers, bus configurations, station service, grounding, insulation, shunt capacitors and reactors, etc.

situation. Even with functionality standards, it may be useful to identify the industry norms for equipment so they can be used as a starting point.

- k. Equipment life estimates are barely mentioned in the Discussion Paper. There is a mention of batteries being specified in other jurisdictions requiring a 20 year life.³¹ The initial transmission substation design is to ensure that "...all switching equipment has sufficient withstand capability for fault current and overvoltages for a specified substation life span". Determining a reasonable life expectancy (given the age of a piece of equipment) should be one key to any process of equipment replacement. Measures of the actual condition of the equipment is another useful consideration. Analysis of this important topic appears to be missing unless it was determined by the Workgroup that the TFOs would be responsible for these decisions.
 - l. Substation equipment has short-term rates and overload capabilities in addition to normal operating characteristics. Substation designers need to use these short-term ratings to optimize costs when suitable to do so and cost savings can be achieved.
 - m. The CCA is interested in obtaining further understanding on buswork spacing for breakers, including ground clearances and device-to-device clearances. Such parameters can impact costs.
 - n. Containment design on oil-filled devices such as transformers can become a material cost and does not appear to have been addressed in the Proposed Rule.
20. One matter for a more detailed review has been chosen for discussion below on the basis that it is not technically complex but can have a material impact on costs and can be used as an illustration of the types of reliability cost trade-offs that are made when designing a substation.

Providing for Future Expansion – An Illustration of Reliability Cost Trade-offs

21. When designing a substation, one of the issues that arises is to what extent the substation should include provisions for future expansion. Historically, the transmission system tends to expand over time with the construction of more transmission lines and substations to meet growing load and new generation connections. Load growth that leads to higher load densities or major generation additions are often served by facilities of a higher voltage class. The transmission system also tends to move to higher voltages over time, although lower voltages are still used. For example, the 500 kV transmission system was very limited in Alberta and for many decades only had the 500 kV BC Tie-line and the prebuilding of the KEG system at 500 kV. Now, Alberta has two 500 kV DC lines, the

³¹ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 22.

KEG system is now energized at 500 kV and the Heartland line is a double-circuit 500 kV transmission line.

22. To accommodate transmission growth, new substations will be needed, and existing substations will also need expansion. If an existing substation includes a provision for growth, this can, at least in theory, reduce costs in the future and improve reliability if an outage is required to add new transmission lines, transformers, breakers and other equipment to accommodate the system expansion. The amount of prebuilding will depend on a number of factors, but particularly the potential for future additions and when those additions are likely to occur. A major driver for the timing of future additions will be the load and generation growth in the area where the substation is located.
23. However, the pre-purchase of land or equipment has an upfront cost that must be weighed against the potential future savings of those decisions. Those upfront costs will be incurred as a result of the proposed Section 502.11, but the savings may or may not materialize depending on if the AESO's assumptions about future load growth and generation are accurate. The AESO's forecasts have often been overly aggressive and there is the potential to over-build the system in the near-term to meet future needs that do not materialize.
24. Set out below is a table that illustrates the level of pre-building that could occur and the considerations in deciding whether the pre-building is reasonable or not. The decision on the amount of pre-building should be tested by a cost-benefit analysis which would include a forecast of when future line additions will realistically be required on a project-by-project basis. It may not be prudent to implement a one-size-fits-all approach to all substations when the future needs for each substation could vary significantly and have different levels of uncertainty for those future needs.

Item	Degree of Pre-building – illustrative list of decisions	Considerations
1	No provision for future capacity	Lowest cost (i.e. no incremental costs involved). Historically, many substations were constructed in Alberta with this approach.
2	Purchase extra land	Purchasing extra land is usually a fairly economical step and can be returned to its former use until needed (e.g. agricultural) to minimize cost.
3	Expand the substation fence and ground grid for future line terminations, breakers, transformers and buswork.	Fencing substation land that may not be needed for many years creates both capital costs and operations and maintenance costs to ensure the ground grid is safe and the area (with gravel, etc.) is maintained in good condition.
4	Design and build a single bus or main and transfer bus layout that can	Further bays in a single bus or main and transfer bus layout without the breakers

Item	Degree of Pre-building – illustrative list of decisions	Considerations
	accommodate more breakers and line terminations, but do not install breakers (air break switches only).	or other costs requires additional capital and may or may not reduce future outages to install a new transmission line.
5	Design and build a ring bus or breaker and half bus with space for more line terminations, but no extra breakers.	This step usually includes significant incremental capital costs and the additional facilities may or may not improve reliability when in-service and may or may not reduce outage times when a line termination occurs.
6	Design and build a ring bus, a breaker-and-half bus or breaker-and-third bus with breakers installed that easily accommodate future line terminations.	This step includes even more significant incremental capital costs for extra space and breakers. The additional facilities may improve reliability when in-service but the additional reliability may not be justified. This pre-building should reduce outage times when a line termination occurs.
7	Design and build a double breaker layout with breakers installed that easily accommodate future line terminations.	This is the most expensive option ³² and if a transmission line is not actually built for many years, the pre-building of this layout would be very expensive and unnecessary.

25. There are a number of concerns with the AESO Discussion Paper provided by the AESO that need to be addressed and have been discussed in more detail above. The following is a partial list of issues that could benefit from further analysis, discussion and potentially from a cost-benefit analysis:

- a. What is the justification for the decision to create a Type 1 substation category, including the reliability and economic analysis? What is the criteria that should be applied to determine if a substation is a Type 1? Are there other classifications of substations that might be more useful?
- b. What is the degree of provision for future lines or transformers in the current design (from only purchasing additional land through to construction of a double breaker layout)?
- c. What is the basis for moving away from SAIDI, SAIFI and CAIDI and will the proposed replacement result in a more optimal trade-off between reliability and cost?

³² AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 37.

- d. What should be the basis for substation replacement or refurbishment to be undertaken?
 - e. What service conditions, informed by temperature and other studies, need to be addressed in substation design?
 - f. What are the requirements to safely and cost-effectively salvage substations?
 - g. How are telecommunications facilities integrated into substations?
 - h. What considerations (if any) relative to environmental contamination need to be included in the Proposed rule?
 - i. What role does equipment life and condition assessments play in equipment replacement, substation refurbishment and substation salvage/replacement?
 - j. What consideration has been given to short-term equipment and overload capabilities in minimizing design costs?
 - k. What is the basis for buswork spacing and spacing requirements for maintenance?
 - l. What are the design practices and parameters for containment design (e.g. for transformers)?
26. As a general comment, the CCA would like the AESO to identify all material changes to prior substation designs, with the reasons for the change specified and a cost-benefit analysis undertaken to demonstrate the change is justified and is in the public interest. The extent of the cost-benefit analysis should be a function of the degree of impact of the design change or new standard on cost and reliability.

Recommendations:

27. The AESO has a public interest mandate that means it needs meaningful involvement from all stakeholders, not just TFOs and DFOs. While the AESO works with TFOs and DFOs on a daily basis, TFOs and DFOs are typically for-profit or government-owned entities who carry shareholder interests. The entire transmission system has one ultimate purpose, to serve the needs of customers. Therefore, the ratepayer perspective is vital to any new rules or rule change that could have a material impact on cost or reliability. Put another way, ratepayer representatives, whether they are the UCA, CCA, AFREA, IPCAA, ADC, IPPSA or others are important stakeholders.
28. The ISO rules consultation process supports this perspective when it states:

In the ISO rules consultation process, the interests of individuals must be considered in the context of the reliable operation of the AIES and in the public interest as a whole.³³ [emphasis added]

³³ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 31, Appendix A, item 3.

The ISO rules consultation process will involve a full discussion of the views of the stakeholders in order to enable the AESO to make the best decision possible in the context of the AESO statutory mandate.³⁴ [emphasis added]

29. Recently, the Alberta Utilities Commission (AUC or Commission) was in the early stages of reviewing Proceeding ID 23757. The AUC, who also has a public interest mandate, acknowledged the importance of obtaining input from all stakeholders in the major change in market structure that is introducing a capacity market to Alberta. The Commission expanded its historical limitations on cost recovery to include a number of other interveners who typically are not permitted to obtain cost recovery. The main point being raised here is that the Commission acknowledged the importance of input from all stakeholders, not just those with deeper pockets and resources who can readily participate in the new ISO rules for the capacity market.
30. The CCA urges the AESO to consider the need to obtain fulsome input from all stakeholders affected by changes to ISO rules that could materially impact reliability and cost. For this reason and others discussed earlier, the CCA has developed three Recommendations for the AESO's consideration.

Recommendation 1: Independent Third-Party Review

31. In the scope for the Workgroup, there is a provision to address the CCA's concerns: "The AESO, in consultation with the WG, will determine if an independent or third party assessment of the entirety or a portion of the draft rule will be needed."³⁵
32. The CCA urges the AESO to obtain an independent third-party review of the proposed section 502.11 rule. An entity undertaking this review should not only have technical expertise, but should be able to undertake, or thoroughly review, any cost-benefit analysis supporting rules to ensure there is a reasonable trade-off between reliability and cost. The individual would preferably have extensive experience in substation design in other jurisdictions, including jurisdictions with similar transmission system characteristics³⁶ to Alberta, such as the US Midwest and western Canada.
33. This review needs to include the context of Alberta already having a very high cost transmission system, with significant surplus capacity in many areas of the transmission system and a reliability level, measured by SAIDI and SAIFI that appears to be equal or better than other Canadian jurisdictions.
34. Selection of an independent third-party should not be based on qualifications alone. The entity or individual should not be influenced by fear of offending TFOs due to the potential loss of future work. There is a small community of substation design experts and an

³⁴ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 31, Appendix A, item 6.

³⁵ AESO Discussion Paper, Proposed New Substation Rule (Section 502.11 of the ISO rules), November 25, 2016, PDF page 29, Scope.

³⁶ For example, not an area that is dominated by dense urban load such as California or some of the US east coast utilities.

assignment to conduct a third-party review cannot be accomplished effectively if the entity or individual fears the loss of work from TFOs or other utilities elsewhere by challenging TFO positions on engineering design issues.

Recommendation 2: Conduct Public Technical Session

35. Since the Workgroup only included TFO and DFO representatives, one way to obtain input from other stakeholders would be to conduct a Technical Session on the proposed rule. That Technical Session would allow all stakeholders to better understand the rule change and to ask questions on all matters, including the reliability cost trade-off and any cost-benefit analysis undertaken.
36. The CCA would be willing to send a representative to that meeting if given sufficient notice. It would also be helpful to all stakeholders if participants could join by phone.

Recommendation 3: Full Disclosure of Analysis

37. Some or all of the concerns raised by the CCA in this stakeholder input may have already been addressed in a cost-benefit analysis or by other means. The concern is that the CCA has not seen the work undertaken by the Workgroup and is therefore at a major disadvantage. To help remedy this, the CCA recommends that all working papers, cost-benefit analysis and meeting minutes be posted to the AESO website.

Conclusion

38. Substations are a large cost component of the transmission system and more substations will continue to be added and refurbished in the future. The CCA notes both the functions of the TFO's and DFO's in Alberta are regulated monopoly providers of electricity transmission and distribution service. The concept behind regulation of monopolies is to use regulation as a proxy for competition. The CCA submit the rules should work in accordance with how a truly competitive market would either allow or not allow the building of a major capital asset such as a substation.