Energy Storage Industry Learnings Forum Workshop 2

I. Purpose of this workshop

The purpose of the ESILF workshop is for members to share their expertise and key learnings on three topic areas that we believe the AESO would benefit from further discussion:

- Storage as a transmission alternative (SATA)
- Sharing learnings from other jurisdictions on legislation, regulations, and policy
- Market qualifications parameters, process models, and data (SCADA) requirements

II. Workshop agenda

Agenda Items	Est. time	Presenter
Welcome & Introduction	10 mins (8:30 – 8:40)	Ata Rehman
Topic: Storage as a transmission alternative (SATA)	30 mins (8:40 – 9:10)	Hao Liu Neil Cumming
Discussion	30 mins (9:10 – 9:40)	Luis Garrido
Topic: Sharing learnings from other jurisdictions on legislation, regulations and policy	30 mins (9:40 – 10:10)	Paula McGarrigle Evan Wilson
Discussion	30 mins (10:10 – 10:40)	Luis Garrido
Break	10 mins (10:40 – 10:50)	
Topic: Market qualifications parameters, process models and data (SCADA) requirements	30 mins (10:50 – 11:20)	Graeme Harrison Dan Gustafson
Discussion	30 mins (11:20 – 11:50)	Luis Garrido
Wrap up and next steps	10 mins (11:50 - 12:00)	Ata Rehman

III. Attendees

Attendees	Company
ABB (ASEA Brown Boveri)	Dan Gustafson
Alberta Energy	Michael Fabiyi

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Attendees	Company
Alberta Innovates	Maureen Kolla
AltaLinK	Hao Liu
ATCO	Jenny Wang
CanWEA	Evan Wilson
Chapman Ventures	Dan Chapman
ENMAX	Dallas West
Energy Storage Canada	Justin Rangooni
FortisAlberta	Neil Cumming
Market Surveillance Administrator	Derek Olmstead
Nutana Power	Graeme Harrison
Solas	Paula McGarrigle
TERIC Power	Craig Barnes
TransCanada	Michael Edwards
Utilities Consumer Advocate (UCA)	Luis Pando Lopez
WindRiver (TPG)	Kipp Horton
AESO	Ata Rehman
AESO	Biju Gopi
AESO	Terry Martin
AESO	Luis Garrido
AESO	Steve Waller
AESO	Noeline Kanagalingam
AESO	Ruppa Louissaint
AESO	Scott Fleming
AESO	Annie Nguyen
AESO	Kathryn Kuber
AESO	Maria Gray
AESO	JR Cabalo
AESO	Andrea Lamy
AESO	Ting Zhang
AESO	Ijeoma Ofodile

IV. Overall outcomes from the day

The meeting, led by Ata Rehman, began with a short welcoming of all attending members. Mindful of time and duration of the workshop, the presentations began on the first topic: Storage as a transmission alternative (SATA).

Because the workshop was designed for the AESO to learn from the members experience and expertise, each presenter was allotted 15 minutes, on their selected topic, to provide information they believed would add value to the AESO in integrating energy storage in Alberta. Once presentations for each topic had completed, a discussion was held, allowing the AESO and ESILF members to ask questions and obtain clarity on said topic.

After completing the first topic and the discussion period, the workshop resumed with topics two: Sharing learnings from other jurisdictions on legislation, regulations, and policy, and three: Market qualifications parameters, process models and data (SCADA) requirements, and corresponding discussion periods.

Workshop presentations can be found on the Energy Storage Industry Learnings Forum page of the AESO website, by scrolling down the page and clicking on the "Nov. 27, 2020 ESILF Workshop 2" accordion.

V. Discussions

Below are questions, statements, recommendations and concerns, and corresponding responses which occurred during the discussion periods after the presentations on each topic.

Storage as a transmission alternative (SATA) – presentations by AltaLink and FortisAlberta

- Question from the AESO to AltaLink storage can be used to maintain support and maintain stability, but in your opinion can these same be provided by storage that is owned by market participants?
    - AltaLink representative stated there is potential for this. An example is if storage is primarily used to address disturbance and stability issues then it would be considered a transmission facility, so it would take the transmission route. Having a third party become a Transmission Facility Owner (TFO) could make things more complicated than they need to be. CAISO went down this path of making the solution more complex than it needed to be. It is not clear if non-wire alternative (NWA) is more economic than transmission energy storage and cannot be known ahead of time. It would be based on hypothetical assumptions and studies. The best solution is to create both alternative options and allow the competition to decide which is the more economic, reliable, and most cost-effective.
- Question from ATCO Electric representative regarding AltaLink's NWA project and what the regulatory process was like for AltaLink.
    - AltaLink representative stated that lawyers and regulatory reviewed all Authoritative Documents (AD) and did not see that there are required changes in the current framework in terms of the application. The AESO will need to take the initiative to start the process by first developing a need application to the commission. The commission approval process will identify anything that was missed. But from AltaLink's perspective, no changes are required.

- Question from ATCO Electric representative regarding FortisAlberta's Waterton project, and whether FortisAlberta faced any regulatory issues within the current framework. Does the current regulatory framework allow for Distribution Facility Owners (DFO) to own storage?
    - FortisAlberta representative stated that there is definitely some uncertainty due to a policy vacuum as well as some concern. DFOs are obligated to provide the least cost and most reliable option that is the best result for customers. FortisAlberta has made the AESO and AUC aware of what is being done with this NWA. Since there is a policy vacuum there are no rules stating what can or cannot be done. So FortisAlberta will continue as a demonstration and sharing learnings throughout the process.
- Question from Chapman Ventures Inc. representative for AltaLink in reference to the presentation. In it is mentioned the difference between transmission storage and the NWA. And that one of the differentiating factors is that NWA tend to be sized in the 3 to 4-hour duration range. What is driving that sizing? Was the size due to a need?
    - AltaLink representative responded that the thought process is that a NWA developer will want to participate in the Energy and Ancillary Services markets. So, the offers become the driver for the 3- and 4-hour sizing which are ideal for the Energy market. Whereas helping in a transmission contingency in a wind zone, for example, have typically been much shorter durations.
    - Chapmen Ventures Inc. representative added that the projects being installed in the province serving Energy or Ancillary Service markets do not fit the parameters AltaLink had presented. Examples provided are TransAlta Windcharge at 2 hours, and Teric Rycroft at 1 hour.
    - AltaLink representative provided further clarification in stating that AltaLink is still in the early stages of sizing our projects. Over time, people will start getting the sizing right, what revenue streams they can benefit from, and how the storage facility could play multiple roles to maximize revenue. When looking at the California market, if storage tries to participate in the Energy and Ancillary Services markets, then the ideal size would just be 1 hour.
- Question from the AESO for AltaLink in regard to government funding, and whether it was only economic for a transmission asset if the asset received government funding. And how long is this expected to be the case?
    - AltaLink representative clarified that government funding is not necessary; it would just benefit the customers. The economics of transmission deferral projects are not tied to AI funding. AI funding is just the "icing on the cake" to make it more attractive.
    - Further question from the AESO for AltaLink on whether government funding is included during economic assessments.
    - AltaLink representative stated that when doing their economic assessments, they do both.
    - Additional question from the AESO for AltaLink on whether they see Battery Energy Storage System (BESS) as a long-term solution versus what FortisAlberta indicated it being a short-term option?
    - AltaLink representative responded that they see it as a 10-year option with many ways for making it an effective long-term solution.
    - FortisAlberta representative agreed with this response and added that from a technology standpoint, some are short term and others long term. Will based on a case by cases basis, and what the best solution is for each.

- Question from the AESO for AltaLink regarding an earlier statement around not seeing issues with the current legislation and policy with energy storage as a transmission alternative, and that no changes were required. There have been discussions in terms of storage being treated as generation, load or whether it can be formed as a transmission facility. Do you think there is a need to have some clarification in terms of facility type from a legislative or regulatory perspective?
    - AltaLink representative responded that they have done internal review on this. Clarification is nice to have, but not necessary. Because when looking at the legislation, it clearly defines what a transmission facility is. There is also an 'others' category which could be anything as long as you are providing or supporting a transmission function. In the legislation there is no definition for capacitor bank, SVC, or a vehicle or building, and all into the transmission facility category. The 'other' category is very broad. And although there has been discussion around generation, load or transmission, which is a good exercise, it really depends on the functions the asset is providing or supporting, which will qualify the asset for its specific category.
- Request from the AESO for FortisAlberta to provide details on the current NWA application in Waterton in regard to the ownership of operations and the cost recovery mechanisms. Is that embedded in the tariff?
    - FortisAlberta representative stated that Waterton is being developed with Parks Canada who will own the solar asset located beside the battery. FortisAlberta is acting as a vehicle and is not obligated to own a generation asset. FortisAlberta will own the battery and the microgrid control system and will be used under normal operations budget of system improvements and reliability. It will be treated as a normal distribution asset used to provide reliability. As for cost recovery, it will be included in rate base just like any other distribution asset to provide reliability.
- Concern from the UCA representative with regard to energy storage and how market participants can be approached to provide services versus the DFO or TFO owning the asset. There needs to be a method for consumers to provide flexibility as wire costs are increasing and energy storage and distributed energy resources become more important solutions.
    - AltaLink representative agreed, there should be a method to allow customers to participate with a process for regulated solutions and non-regulated to compete in solutions.
    - FortisAlberta representative also agreed stating that we need to provide power to our customers in the most cost-effective manner possible and need to explore technologies to help with this
- Question from the AESO for AltaLink on whether there are criteria to determine the best solution for grid congestion and grid optimization with the current constraints faced by regulations.
    - AltaLink representative stated that due to poor definition there is a vacuum on the non-wire side, and it is difficult to determine criteria. What all stakeholders need to do is work together to define what a NWA is in our regulations as well as in contracts of operation. Once defined, the best outcome will come out from the competition between wires, storage and non-wire storage. These parameters will define what non wire storage can do.
- Question from the AESO in reference to the presentation and the recent FERC order that approved changes to the MISO tariff to allow energy storage as a transmission only asset. One of the criticisms to that order was by assigning transmission state to storage facilities that are performing a generation function and providing the benefit of guaranteed cost and profits to that transmission facility owner. And wondering what the response to that criticisms would be. Also, how we would avoid having these

criticisms in Alberta if you have transmission owned energy storage competing against market participant owned energy storage, and the transmission owned energy storage having that benefit of guaranteed cost recovery?

- AltaLink representative stated their understanding of the MISO SATA proposal is that transmission storage assets are not participating on the market side. Alberta essentially has the same idea of proposal as the MISO proposal, where transmission energy storage is not participating in the market in any way. Its operation is no different from the typical transmission operations.

Sharing learnings from other jurisdictions on legislation, regulations and policy – presentations by Solas Energy Consulting Inc. and Canadian Renewable Energy Association

- Question from the Alberta Energy representative for Solas regarding the unique structure of Alberta and whether other jurisdictions, such as Texas, have been looked at. And there any learnings to be shared.
  - Solar representative suggested to look at what is happening in New York who are way ahead of the pack, and PJM is close behind. Texas is notorious for having very low regulatory hurdles for any kind of generation. The Texas energy market is different from California. Texas does not have an aggressive need for storage compared to California (in achieving "carbon free" targets). Texas has had renewable with large amounts of wind. Texas is not a jurisdiction to look at because it does not have as much of energy storage compared to renewable. The east coast jurisdictions are more advanced from thought process point of view and can be learned from.
- Question from the AESO for Solas on how Alberta is doing in comparison to other provinces and jurisdictions.
  - Solas representative stated that the premise of Ontario's approach for their initial RFP for energy storage was to learn by doing, which is a great concept. Compared to other provinces, Alberta is behind. Alberta has minimal projects and there are still barriers for energy storage. Having Ontario do a RFP, gave them a huge advantage. Most energy storage companies are in Ontario because they have the experience with the technology because of learning by doing. Alberta can learn from other jurisdictions, not necessarily from their results, because each result is specific to that market, but we can learn on the process. To keep thinking if energy storage is load or gen, is simplistic, and we need to move beyond that Solas thinks Alberta is playing a bit of catch up.
  - Canadian Renewable Energy Association representative added that Saskatchewan and Quebec are taking the same approach of deploying pilot projects. Saskatchewan is using the desire to manage the flows between Saskatchewan and Manitoba as an opportunity to see how energy storage can be further utilized. Saskatchewan power is looking forward to seeing what else they can do with storage and are excited to see the trickle-down benefits of putting batteries in place.
- Question from the AESO for Solas on whether transmission access charges in California is similar to DTS and STS in Alberta, and whether energy storage have to pay transmission access charges in California.
  - Solas representative responded that transmission access charges are only for end user load. Given that energy storage is not an end user, transmission access charges do not apply to

energy storage in California. In Alberta, we have it as a pseudo transmission energy download rather than an end user load with some exceptions.

- The ASEO further questioned on other jurisdictions (ERCOT or PJM) and whether energy storage need to pay transmission access charges or something similar.
- Solas representative advised that information was not readily available but could be provided to the forum.

- Question from ABB representative for Solas on how other jurisdictions have used battery energy storage to reduce CO2 emission, and how will they be able achieve 80% below previous levels, when the actual amount of CO2 used in manufacturing all these batteries is a limiting factor to that achievement. Is California looking at the manufacturing as part of the emissions for their targets?
  - Solas representative stated they have completed a study for Alberta Innovates for greenhouse gas emissions associated with energy storage for 7 technologies, 16 use cases and 3 locations. The answers to these questions are quantified for Alberta for 2015 emissions exactly. When looking at a project case and ask is there a greenhouse gas emissions reduction associated with that. And it depends on what the grid emission of the grid is. If the grid is a dirty grid, and you have at best 95% efficiency on energy storage including pumped hydro, there would be some losses with emissions associated with that. Except for in the event that renewable energy was curtailed, in those events it would be emissions reductions. The point of ES integrated in California is to enable significant integration of renewable energy, and that is the primary reason. On a project by project basis, they are integrating energy storage to provide resource adequacy to help with reliability that overall requires less spinning reserve and fossil fuel emission power. The National Renewable Energy Laboratory (NREL) has a meta-study that is done for energy storage that covers the total lifecycle of energy storage. In addition, the National Research Council (NRC) has a study on this topic.
- Follow up question from the AESO for CanRea on how energy storage was considered a renewable resource, but as described by Solas, it is not a renewable resource but rather a facilitator of renewable resources.
  - CanRea representative stated that yes, we do not consider it a renewable resource. We do have it as one of the technologies that we deal with at CanRea because it facilitates integration and penetration of renewables.
- Question from the AESO for CanRea around the point made in the presentation regarding Quebec and whether there are pilot specific rules in Quebec, or are they exempt from the regulations while running the pilot?
  - CanRea representative stated that information was not readily available but would report back to the forum.
  - Solas representative added that California has added interim rules that are specific for a period.
- Question from UCA representative on whether Solas was aware of study by the New York University of Law with respect to greenhouse gas emission and storage which states it is not necessarily true that increased energy storage guarantees a decrease in carbon emissions. Particularly in consideration of whether the type of generation used to charge the energy storage is cleaner than the type of generation avoided when the storage is used, and secondly the amount of additional energy needed to make up for the efficiency losses from storage. The report covers marginal emission and efficiency losses related to storage. Is Solas considering these factors?

- Solas representative stated that they had a similar study done in 2017 and had the exact same conclusion as the NYU of Law study. It all depends on the emissions intensity of the grid and the efficiency of the storage as well as the use application. Specific to ALBERTA2015 grid, in some use cases there are emissions reductions, and in others there are not, or it is neutral. The second aspect is whether energy storage enable higher integration of renewable energy, and the answer is Yes. Does this then allow for reduced emissions on the grid, and the answer will depend on the specific metrics of the jurisdiction.

Market qualification parameters, process, models and data (SCADA) requirements – presentations by ABB and Nutana Power

- Question from the AESO for ABB on what factors and conditions are used to improve the cybersecurity of the public systems.
    - ABB representative stated that there are two things that ABB does, islanding or suspended isolation, where we had a one directional pipeline of data leaving the site and was non reversable. And an entire server dedicated to internet connection for individuals to remote log in, who were then acknowledged by the ECS specialist on site before being provided access. Another way of ensuring cybersecurity is if you have a BESS system and information is shared, remove SCADA control. If hacked, the hacker will only have visibility and not control. The second method is password layering and enforcing different passwords for every layer. Cybersecurity is inheriting with everything done in design. We have methods in place to ensure the layered approach in limiting control.
    - Further question from the AESO around the cost of a project and whether the cost of SCADA is significant compared to the cost of the total energy storage project.
    - ABB representative stated that the SCADA cost would be determined by the size of the system. A big system that is all customized would increase cost significantly, and vice versa for smaller systems.
- Question from the AESO for ABB on experiences with commissioning or installing a hybrid configuration consisting of energy storage with solar or wind. And what would the best approach would be in terms of the control scheme for that control system.
    - ABB representative stated that they have configured such configurations. What happens in ABB SCADA system is all components are in libraries which allow for fast program modifications. Control schemes are engineered, and we advise the clients on this to ensure optimal operations. There is a benefit to have a PLC over top of a windows server as the windows servers still crash, while PLC's hardly ever crash.
- Question from Solas representative for ABB on working with vendors in California (TESLA and SAMSUNG), as Solas sees provisions of either integrated or non-integrated packages. Is ABB seeing a trend towards equipment only supply versus fully integrated packages including EMS and HVAC?
    - ABB representative responded that TESLA generally offers a full integrated package because they are more technical and lean towards control systems. Samsung is more about the batteries than they are about the control. This is why there is more flexibility with Samsung batteries vs TESLA batteries. It is dependent on the business model of each company.
- Request from the AESO for ABB to provide clarity on DC coupled configurations for energy storage and solar projects in Alberta. The AESO assumes implementing the ability to retrieve SCADA data for

the battery itself independent of the solar panel, and not as a net, would be very expensive and unreasonable for a provider to do so.

  - ABB representative stated that there is a significant cost to isolate each component for communications. The SCADA system itself is not costly, however, the project will require a customized solution which will significantly drive up the cost of a project. We are working on creating combiner boxes as a heavily customized solution.
  - Solas representative added that this is being seen in California because for the DC coupled configurations there is a 6% improvement with regard to losses. The cost of the solution will need to be weighed against the loss reduction and improved energy production.
  - ABB representative also added that CSA sees 1,500 voltages as medium voltage, and container boxes become an issue because they will require physical heat and short circuit rate testing, which will also drive up costs.

- Observation by Chapman Ventures representative regarding an earlier reference that a battery would be inferior to a large pumped hydro or a wire solution when looking at longer lifetime applications. And although this may hold true in many cases, the forum should be cautious around such broad statements without considering costs, technology advancements, and capacity enhancements on a battery. It could be the lowest cost solution for a long time, and we should keep an open mind. Also, conventional hydro (reservoir-based hydro) is not necessarily a battery, but rather a replenishable dispatchable resource similar to wind and solar being replicable dispatchable resource. However, pumped hydro which takes electricity from a source to use as a charging element to create stored energy at the top of a reservoir, could be labeled as a battery.
- Solas representative revisited the topic of response time and would like to reference Texas as they have limited energy storage to 5 cycle response time, which effectively excludes all flow batteries from the market because they do not have as quick of a response time. Solas encourages the AESO to have as many technologies incorporated as possible, but was just wondering if there are any comments to cycle response?
  - Chapman Ventures representative responded that the whole response depends on point of measurement and where the signal is being received to trigger a dispatch; and then the responsiveness of the technology itself. It is more where is the signal originating and where is the responsiveness being measured that will impact how quickly a technology or a device can respond. The AESO should consider what response time would be useful for products that aren't currently available, and what technologies can achieve that. As far as storage technologies go, the fastest response time is conventionally from a Lithium-nickel-manganese-cobalt-oxide (NMC) battery, the next fastest is a Lithium-iron-phosphate (LFP) battery. Then there are other technologies which require initiation actions which have a more latency lag to getting up to their full potential. It would be good to discuss what is necessary and what would provide value to the electric system.
  - The AESO advised that the approach is to define the Alberta grid requirements and identify who can meet those requirements regardless of the type of storage or technology.

All mentioned studies and reports to be shared with the group.

VI. Wrap Up and Next Steps

The session summary and the third workshop topics and schedule to be published on the AESO website at www.aeso.ca. Any further questions can be sent to the Energy Storage inbox at energystorage@aeso.ca.