Energy Storage Industry Learnings Forum Workshop 5

I. Purpose of this workshop

The purpose of this session is to learn from the experiences and expertise of the ESILF members and guest speakers on their presented topics.

- Learning Exchange
- Topic Discussions

II. Workshop agenda

Est. Time	Agenda Items	Presenter
9:30 – 9:35	Welcome & Introduction	Ata Rehman Director, Grid Planning & Operations Engineering
9:35 – 10:00	Presentation 1: Energy Storage Standardized Solutions: Bridging the gap between traditional and renewable sources	Dan Gustafson ABB
10:00 – 10:25	Discussion	Luis Garrido
10:25 – 10:30	Break	
10:30 – 10:55	Presentation 2: Storage on the California Grid	Gabe Murtaugh California ISO
10:55 – 11:20	Discussion	Luis Garrido
11:20 – 11:25	Wrap up and next steps	Rob Davidson Vice President, Grid Reliability Projects and Planning
11:25 – 11:30	Quick Poll	Luis Garrido

III. Attendees

Company	Attendees
ASEA Brown Boveri (ABB)	Dan Gustafson
Alberta Department of Energy	Nicole Spears
Alberta Department of Energy	Robert Hendren
Alberta Utilities Commission (AUC)	Olex Vasetsky
Alberta Innovates	Christophe Owttrim

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Company	Attendees
AltaLink	Hao Liu
ATCO	Jenny Wang
CAISO (California ISO)	Gabe Murtaugh
Chapman Ventures	Dan Chapman
Energy Storage Canada	Justin Rangooni
Enfinite	Jason White
Enmax	Jorge Villena
FortisAlberta	Evgeniy Gorelov
FortisAlberta	Kevin Noble
Hitachi Energy	Omar Osorio
Solas Energy	Paula McGarrigle
TERIC Power	Craig Barnes
TERIC Power	Kevin Gilbank
TransAlta	Maria Gray
AESO	Alireza Zare
AESO	Ata Rehman
AESO	Brad Coleman
AESO	Galen Lam
AESO	Jodi Darragh
AESO	Jordan Mitchell
AESO	Kasey Abdallah
AESO	Leon Weinstein
AESO	Luis Garrido
AESO	Robert Davidson
AESO	Ralph Liu
AESO	Ray Li

IV. Overall outcomes from the day

The workshop was designed for the AESO and ESILF members to learn from the experience and expertise of the guest speakers. Each speaker was allotted 25 minutes to provide information they believed would add value to the AESO in integrating energy storage in Alberta. Once presentations had completed, a discussion was held which allowed the AESO and ESILF members to ask questions and obtain clarity from each presenter.

The meeting began with a short welcoming of all attending members and guest speakers and was led by Luis Garrido. Mindful of time and duration of the workshop, the presentations began with the first speaker Dan Gustafson from ABB (ASEA Brown Boveri), who presented on '*Energy Storage Standardized Solutions: Bridging the gap between traditional and renewable sources'*.

After the completion of the first presentation, and the discussion period, the workshop resumed with the second presentation *'Storage on the California Grid'*, presented by Gabe Murtaugh from California ISO.

Workshop presentations can be found on the Energy Storage Industry Learnings Forum page of the AESO website.

V. Discussions

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

Energy Storage Standardized Solutions: Bridging the gap between traditional and renewable sources – Presentation by Dan Gustafson from ABB

- Question from the AESO regarding fire risks and events that occurred due to failure of HVAC systems, and whether there are other reasons which may cause a fire to occur.
    - ABB representative responded that finding the cause of the fire during the investigation is difficult to determine, this is due to extreme high temperatures melting everything. However, main reasons were determined to be due to HVAC and grounding vaults. The BESS systems were on isolated floating ground (were not grounded on a 'negative'), and either the ground or the positive gets pulled to ground, which results in a loop current. This combined with high outdoor ambient temperatures were cause for majority of the fires which occurred.
- Question from the AESO regarding the services provided by energy storage systems, specifically inertia primary frequency response. What is the percentage of batteries providing inertia or primary frequency response compared to delayed transmission or smoothing out the ripples?
    - ABB representative responded that by smoothing out the ripples is probably the biggest one, which goes back to power factor control. When motors are running, there will be a power factor, and if the power factor starts to go down to 0.7-0.75, It will need to be brought back up to 0.9. This is what is most commonly see with industrial customers (e.g., oilsands producer or a pipeline).
- Question from the AESO in reference to the fire events caused by temperature issues. What percentage of the overall capacity of the system would be dedicated towards auxiliary loading like HVAC/cooling systems, on a utility size battery energy storage system?

- ABB representative responded that HVAC systems are leaning more towards water cooling, which include pumps, radiators, and fans. The auxiliary loads will be proportionate to how big the area is but could be as high as 15% in a worst-case scenario and are generally much less. One of the main reasons it could be this high, is because in Alberta there can be a scenario of -40C with no load, and the batteries could freeze. However, if temperature is at -40C and the lithium-ion batteries are being used quite a bit, they produce their own heat as well as off-gas. This off-gas will need to be released and in turn release much of the produced heat. Fresh air will need to be brought in, and at -40C, it will need to be heated first. These are all factors which contribute to the 15%.

- Comment from Solas Energy representative on their experiences working in California and that HVAC is a key component for energy storage particularly for cold temperatures at night and very high temperatures during the day. Another important component is a good filtration system ensuring sand from the desserts is not brought in.
    - ABB representative agreed and added that once a large filter is placed on an HVAC system, that HVAC system must do twice the amount of work to push the air through that filter. In a desert scenario with extreme high temperatures to begin with, a battery could be used to full capacity resulting in the release of a lot of heat. Fresh air will need to be cooled to counteract the heat produced by the battery. In this scenario, the 15% mentioned previously could be even higher.
- Question from the AESO regarding the seriousness of supply chain issues and delays, and how these issues have impacted costs? Do we see supply chain issues being alleviated in the near future?
    - ABB representative responded that there are huge supply chain issues with Lithium-ion batteries mainly due to the Lithium availability. Lithium mines are growing at a rate similar to the rate of BESS system implementations, to supply the world need for batteries used in homes, electric vehicles, etc. Lithium is not easily mined, so the supply issue does not seem to be getting better any time soon. With decreased availability, the prices have nearly tripled.
- Question from the AESO to all ESILF members on their experiences with trends and pricing.
    - Members had no additional comments to the ABB representative's response on the topic.
- Question from the AESO whether a control is implemented in the system to limit battery output when, for example, the ambient temperature is too high, or if there are leaks in the cooling system?
    - ABB representative responded that in every Lithium-ion battery there is a system. There is an electronic circuit that monitors the battery, and ensures the battery cuts out if necessary. However, if the circuit fails then heat issues could be experienced. There are also ways to limit the inverters from drawing too much, so there are safety protocols that can be implemented there, or protocols around room temperature monitoring.
- Question from the AESO stating that there was an assumption that the increase of energy storage penetration would result in reduced cost of the technology. Now that costs are higher due to supply chain issues, will the rate of energy storage penetration reduce?
    - ABB representative responded that the supply chain issues are a short-term pain, but a long-term benefit, because they really help to force new ideas around technologies.
- Question from the AESO regarding fast frequency response and how BESS systems are significantly faster than any other generators/assets, but it has been found that sometimes it is not the speed of the battery that counts, but rather the speed of the system as a whole.

- ABB representative responded that is all about the design, which is why decisions on what is needed should be made before designing begins. There are cases where the inverter and the battery system are going to be so inefficient because it is not able to manage what it's expected to do. It is best to decipher the need, and work backwards from there because the efficiency of the system is dependent on what is put in.

Presentation 2: Storage on the California Grid– presentation by Gabe Murtaugh from California ISO

- Questions from the AESO, that there are concerns from an operational perspective of applying too much of this technology. Are there any concerns on market impacts and how these concerns should be addressed?
    - CAISO representative stated that the responses are along the same lines for operational and market impacts. Resources do not really care what prices are in the market at any specific time. They care about the price to buy and the price to sell. Today there is 3500MW of storage on the California system, which might set prices occasionally but does not happen very often. For the most part storage resources are price takers, and they are buying during those low prices and selling during high prices. There are default energy bids and market power mitigation rules that are in place for storage resources. It is a complicated question which may entail how CAISO markets and market clearing work today. Could be an interval-by-interval process.
- Question from the AESO if CAISO has seen other types of technology outside of the standard battery storage systems?
    - CAISO representative responded that in the last two years there has been about 3000MW of new storage in the system, nearly all that storage is Lithium-ion, and nearly 4-hour duration. It is quite homogenous. There is a requirement by 2024 for the system to have at least 1000MW of long duration storage . Some of these solutions may be compressed air in salt caverns underground, gravitational potential, and other techniques of metal and non-metal combinations that can be used to store electricity.
- Question from Solas Energy representative as to whether CAISO is using storage for transmission and distribution deferral?
    - CAISO representative responded yes; the California ISO does a transmission study every year which looks at areas that require improvements to transmission. When CAISO engineers are doing the studies, they are considering non-wire solutions. There are some local areas that are dependent on storage resources if several contingencies occur.
- Question from Solas Energy representative as to what had occurred in Moss Landing.
    - CAISO representative responded that it was labeled as a fire-related or smoke incident. The resource had trouble with over-heating and the fire suppression system was triggered and were offline for a lengthy period of time to do improvements and reset. However, most of the storage capacity in the state of California is doing very well and experiences very low incidents of outages. There have not been any wide-spread fire issues but rather isolated incidents.

VI. Wrap Up and Next Steps

As the session came to an end, Rob Davidson, VP of Grid Reliability Projects and Planning at the AESO, introduced himself as the new chair of the ESILF and thanked the members for their participation.

The poll questions, which were administered at the end of the session, demonstrated that the purpose of the session was clear, the information was presented in a clear manner, and that members considered the session valuable.

The next ESILF session is planned for the Fall. AESO will confirm the date.

Any further questions can be sent to the Energy Storage inbox at energystorage@aeso.ca.