# Energy Storage Industry Learnings Forum Workshop 1

## 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: Market opportunities in the energy and ancillary services markets, or other potential revenue streams; Connection options; and Energy Storage configuration options.

## II. Workshop agenda

| Agenda Items | Est. time | Presenter |
|---|---|---|
| Welcome & Introduction | 10 mins (8:30 – 8:40) | Ata Rehman |
| Topic: Market opportunities in the energy and ancillary services markets, or other potential revenue streams | 30 mins (8:40 – 9:10) | Paula McGarrigle<br>Travis Lusney |
| Discussion | 30 mins (9:10 – 9:40) | Luis Garrido |
| Topic: Connection options | 30 mins (9:40 – 10:10) | Akira Yamamoto<br>Graeme Harrison<br>Neil Cumming |
| Discussion | 30 mins (10:10 – 10:40) | Luis Garrido |
| Break | 10 mins (10:40 – 10:50) | |
| Topic: ES configuration options | 30 mins (10:50 – 11:20) | Dan Gustafson<br>Kipp Horton<br>Alex Nasiff |
| 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 |
| Alberta Utilities Commission | Olexandr Vasetsky |
| AltaLinK | Hao Liu |
| ATCO | Alex Nassif |
| ATCO | Jenny Wang |
| CanWEA | Evan Wilson |
| Chapman Ventures | Dan Chapman |
| Emissions Reduction Alberta | Christophe Owttrim |
| ENMAX | Dallas West |
| Energy Storage Canada | Justin Rangooni |
| FortisAlberta | Neil Cumming |
| Market Surveillance Administrator | Derek Olmstead |
| Nutana Power | Graeme Harrison |
| Power Advisory | Travis Lusney |
| RMP Energy Storage | Robert Stewart |
| Solas | Paula McGarrigle |
| Suncor | Daniel Visser |
| Suncor | Keith Taylor |
| TERIC Power | Craig Barnes |
| TransAlta | Akira Yamamoto |
| TransCanada | Michael Edwards |
| WindRiver (TPG) | Kipp Horton |
| AESO | Ata Rehman |
| AESO | Nicole LeBlanc |
| AESO | Biju Gopi |
| AESO | Terry Martin |
| AESO | Luis Garrido |
| AESO | Mahdi Hajian |
| AESO | Steve Waller |
| AESO | Noeline Kanagalingam |

## IV. Overall outcomes from the day

The meeting began with a short welcoming of all attending members and was lead by Ata Rehman. Mindful of time and duration of the workshop, the presentations began on the first topic *'Market opportunities in the energy and ancillary services markets, or other potential revenue streams'.*

Because the workshop was designed for the AESO to learn from the experience and expertise of the members, each presenter was allotted 10 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 which allowed the AESO and ESILF members to ask questions and obtain clarity on said topic.

After the completion of the first topic and the discussion period, the workshop resumed with topics 2 and 3 (*Connection options and Configuration options*), and corresponding discussion periods.

The AESO then discussed next steps and called upon presenters for the second workshop. A poll was provided to all attendees requesting feedback on the clarity of purpose and value of the workshop.

Workshop presentations can be found on the ES 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.

### *Market opportunities in the energy and ancillary services markets, or other potential revenue streams – presentations by Solas and Power Advisory Group*

- Question from the AESO regarding the application of energy storage for blackstart, and if this application exists in other jurisdictions or pilot projects.
    - Solas representative stated that energy storage can do blackstart but it will be a small market with regards to the frequency of use. Electrochemical storage requires augmentation over time because due to energy dissipation and would be an expensive solution. Therefore pump hydro would be a better option for blackstart.
    - Power Advisory Group and Energy Storage Canada (ESC) representative stated that there already exists enough capability in the system, that it is difficult for energy storage to compete. If energy storage were to partake in blackstart the charge would need to be readily available and may be sitting there for years without use. The energy storage that would make sense for blackstart would be pump storage. This is seen in New England with larger pump storage.
- Comment from AltaLink representative about long duration energy applications and the assumption that most projects would be in the short duration space.
    - Power Advisory Group and ESC representative responded that energy storage applications don't necessarily need to be long duration, it will depend on what transmission problem is being dealt with. It also may not be the solution long term. An example would be the AESO's current NID for the central east trans route, driven by curtailment risk for renewables and other generation in the area. It is not clear there will be projects developed, so storage can be the near-term solution through that uncertainty. Capturing curtailment energy as a transmission solution to avoid the building projects until you have the certainty that lots of wind and solar is being placed in the area. The difficultly in deploying ES under the current framework is how is

it put in the rate and rate base if it is not going to be long term. If the market participant's risk is being pushed from the rate payers how is that done when it's not utility owned. And how are those rates recovered?

  - Solas representative also commented by stating the following questions: When energy storage is sitting unused, how does it earn its rate of return? Can it provide additional services as it sits there? Can it be broken up into hours/schedule? What are the policies around this? Alberta is at the infancy of ES rules, and it will be different for all jurisdictions.

- Question from RMP Energy Storage representative regarding grid defection. Energy storage is incredibly potent in enabling grid defection, particularly inlocations that have onsite cogeneration, where storage can assure that is there as a UPS. Where do you think the grid defection is?
  - Solas representative responded having seen in other jurisdictions with cogeneration and storage, where energy storage was utilized when reliability on the grid was questionable. This alleviated the impact of chemical processes during interruptions with grid defection. On the residential side with power walls etc., it is a tougher sell because it is expensive. On the industrial side there is some risk of grid defection if the grid quality is poor; on the residential side it wouldn't be robust. The other thing is electrical vehicle charging; if everyone in the neighborhood is charging at the same time, do you need energy storage on a distributed basis to handle this? i.e. Managing "super/super peaks"?.
  - Power Advisory Group and ESC representative stated that when it comes to grid defection in locations where it is expensive to build distribution, microgrids would make more sense.
- Question from the AESO; in evaluating different applications what matrixes or metrics are used? Is it the same as Internal Rate of Return (IRR) and Net Present Valuie (NPV)? And is there any specific matrix used when evaluating energy storage?
  - Solas representative stated that it would be an IRR and NPV, but will also require the use case, the frequency of the use case, the price differential, capital costs, operating cost and augmentation cost will need to be evaluated
  - Power Advisory Group and ESC representative also responded that the use of IRR and NPV would depend on what the revenue streams are. None of these services are easy to put into longer term contracts that support fixed cost build. But if it is for Transmission and Distribuiton deferral, or end of life replacement, then that is a benefit to cash flow analysis. That can support volatile revenue opportunities.
- Question from Chapman Venture Inc. representative on whether industrials are prepared to pay for reliability and power quality? And if there have been industrials who have stated going on their own to enhance reliability?
  - Solas representative stated the assumption that an electricity supplier would be highly customer centric was not the case in an example provided. The electricity provider advised a customer if increased reliability was required, then there would need to be investments upstream in the grid by that customer for the system to be upgraded. Solas suggested the customer identify cost impact for interruptions. Essentially, it would come down to the economic evaluation of costs when down, vs costs of investments to obtain the reliability.
  - Power Advisory Group and ESC representative stated that the system would need to be built from n-1, and from there try to improve n-1. Historically there was only one path, how to reinforce the wires. The Alberta Reliability Standards (ARS) is clear that enhanced reliability is

a cost to the customer. Energy storage provides a consistent alternative to meet that enhanced reliability.

- Question from the AESO regarding wholesale markets, specifically LSSi with no competition from traditional generation facilities. What level of interest would there be if LSSi was opened to energy storage?
    - Power Advisory Group and ESC representative stated that the interest in energy storage in LSSi is high, but would have to be part of a larger facility build. Where capacity is kept aside to offer LSSi and shrink unit cost of connection and operations by using the rest of the capacity of storage in other wholesale markets. Fast frequency is better than synchronous generation because it's a discreet action vs kinetic energy dumping.
    - Solas representative responded that each technology is different with regards to response time. ERCOT is now to 5 cycles for response, and that eliminates flow batteries, because with valves they cannot respond in time.
- Question from the AESO on the difference between deferral and forecast uncertainty.
    - Power Advisory Group and ESC representative responded that they are somewhat the same thing. Energy storage can address the uncertainty in the load forecast and should be the first step. As the load forecast certainty increases, the permanent solution can be adopted, and storage can pivot and perform different services, if designed to do so.
    - Solas representative also stated that energy storage can be picked up and moved somewhere else. It would be good to pilot in congested areas, and if not successful, move it elsewhere.
- Question from the AESO if the services to market would be paid out by tariff, if the services to generators would be paid by generators, and if the services to retail would be paid by the customer?
    - Solas representative stated that this is uncertain. But what is known, is that energy storage now is not easily economic. It needs multiple revenue sources, needs pancaking of services to offer, and needs to be flexible enough to determine how to manage it. (i.e. who owns it, how is it managed, who operates it, etc.)
    - Power Advisory Group and ESC representative added that it would need to be resolved down to a formula within a contract or tariff. Some multiple services are risks that are born by the service provider. And they assess how they manage giving a service to a TFO, or a wholesale market. An example is a wire solution which is perfect for delivering capacity where a Non-Wire lternative (NWA) has a potential to not be there, however, a wire solution can fail. So, it's recognizing planning is a probabilistic exercise, not a deterministic. How could it be placed into service agreements that are appropriate for TFO and DFOs to enter without losing out on options for more capitalized assets. And what about the proponents that are offering the services: are the provisions clear, and are the penalties for not meeting provisions adequate to influence them to properly meet the services. So peak capacity and doing RR is a 1 by 1 value stacking. Can do RR in off peak and during peaking. The key point is it doesn't need to be perfect, but there is a need to have flexibility in innovation and in how you apply it.
    - Solas representative provided a different opinion that it would need to be dealt with contractually. If you are providing reliability at its highest price, this can be handled commercially in contracting, and is done every day with other assets. From a value proposition of what energy storage provides for Transmission and Distribution services, the cost savings are amazing in comparison to building a transmission line and saves on time of build of a transmission line.

- Question from Enmax representative regarding the economic viability of aggregated storage solutions (e.g. VPP).
    - Power Advisory Group and ESC answered that it is a big opportunity seen in other jurisdictions. The recent ruling by FERC (order 1222) is a big step forward in DER's aggregation to be able to offer services. In ERCOT storage is being placed in different locations but being run as a centralized optimization package. That makes sense when delivering to end user customers. You've seen storage as part of community solar activities, behind the meter, but have a centralized storage to aggregate that all together.
    - Solas also answered by stating it is similar to NEST selling services in California. Providing load turn down services, where air conditioning and scheduled air conditioning occurs, and doing that on an aggregate basis. Expect to see some new commercial market products coming out with distributed energy storage, distributed energy generation. Also expect to see players getting into this market that have never participated in the electricity market before but have product models that can be easily adopted. Non utilities will be coming into the energy storage market to provide services on a distributed basis.

### *Connection options*

- Question from RMP Energy Storage representative on if there is a way to have interruptible rates in place for distributed storage so that these types of assets could be placed where it's red on the map (*See FortisAlberta presentation*) so it's not a DG?
    - FortisAlberta representative responded by stating the way FortisAlberta plans for any generation or any export capability is on top of normal load forecasting. FortisAlberta plans for maximum capacity of all assets at any time, which is not the most efficient way. Nothing is currently set up, but they would want to set up a market or contractable demand to increase system capacity. Whether that is strictly from a contract perspective or a specific rate, there's definitely some opportunity to do so in the future. Distribution inquiry has covered some of that.
- Question from the AESO on whether FortisAlberta anticipates expanding their distribution system significantly as a result of DER and storage.
    - FortisAlberta representative responded no, that is not the case. Generally, the DER customers are connecting to places with available capacity and close to a substation, and with mostly local transmission, there is not a lot of major build required. Customers are looking where the system can host new sites. FortisAlberta is not anticipating a major system change or build to the distribution grid.
- ATCO Electric representative requested elaboration on how Transmission and Distribution integrated planning would look like from Fortis perspective.
    - FortisAlberta representative responded that it is something yet to be developed. The goal of Transmission and Distribution integration planning is to get a better understanding of what is on the system, what the capabilities from DERs are, and how they are being contracted, and making sure they can participate in all AIES market functions efficiently. More visibility and collaboration, in terms of forecasting, is required. Ultimately that'll lead to the best use of all these technologies on that system. The goal is better integration and communication between the groups. Current state we have contracted through DTS and STS, but there is another level in understanding what is on the system and how it will impact the transmission grid. That added level of detail will help utilize all these technologies in the future.

- Question from the AESO regarding drivers and reasons to connect a storage asset in a specific location. And statement that energy storage's different sizes, when aggregated, could create grid reliability issues that will need to be sorted out between the 3 different levels of coordination.
    - TransAlta Corporation representative stated this is a big challenge causing concern. The signals from transmission and distribution are not aligned. Looking to pair with an existing generator, dictated location selection. Developers seek out locations that have best opportunity to create a commercially viable project. If there are locational signals with distribution credits, then they will look in the distribution system. If none of the incentives are in the transmission system, then it would not be considered. Locational signals will determine where storage would be considered.
    - Nutana Power representative also stated that project developers and owners are driven based on economics. They look for locations and connection options that provide the most attractive economics over the project lifespan. There are interests in looking at ways to create value at the transmission or distribution level that aren't subject to regulation (i.e. how can interconnection costs, uncertainty, and interconnection time be reduced? Are there opportunities to gain new revenue streams or contractual arrangements that are outside of the current regulated structure of Alberta?). These types of things are drivers from the main project side.
- Question from the AESO on whether the type of connection is guided by who the carrier is (example of TransAlta with their generator). Also, could there be a situation where constraints or reliability issues in the grid that need to be aligned on in the 3 levels of coordination?
    - Chapman Venture Inc. representative responded that the type of connection is based on how to maximize economics and revenue potential on a site. This also depends on what kinds of technologies and assets are being paired. If energy storage is paired with a gas fire generator, there will be two dispatchable assets. There is a question of whether to have both assets providing full value and full output to monetize peak prices, or offer full value on Ancillary Services (AS), if that type of connection is available. If it is to augment and balance a variable resource, the size may be fashioned in a manner where the maximum of the renewables is captured, and energy storage used outside those periods. However, there can be commercial drivers where a market participant would want solar generating at the same time they are injecting from the storage device. So, it is difficult to give a rule of thumb answer. It depends on what services are offered, and how costs are being recovered and revenue generated. It is difficult today to make decisions based on the system of tomorrow.
    - Nutana Power representative also responded that there are a lot of regulatory policy commercial drivers that interact with one another based on collocation. Currently standalone storage does not play under the current tariff rate structure (other than exotic configurations that could get around it) would not be capable of earning money. Alberta will most likely see significant collocation. There is broad range of questions about how storage can be used for entities that have DTS contracts and are looking to reduce wires costs. From a load perspective, there are many different individual circumstances related to characteristics of load. There isn't a one size fits all.
    - Chapman Ventures representative also added that in the past, generation basically served a role to deliver energy to the transmission system and distributed by the retailor; now an asset is introduced that can serve any location/position along the electricity value chain. And we are seeing at industrial loads collocation at the generator that now require a customized solution as to how to apply value, and all the customers have different drivers and concerns. If the market is crafted correctly, there could be value stacking across different customers.
    - RMP Energy Storage representative added that there are exotic interconnection options. There are ways energy storage is participating in the market through other mechanisms. BC Hydro and SaskPower are putting power in and out of the system using hydro assets; this is how

storage is currently participating in our market. We can expect storage to participate in a similar manner. Having an interruptible rate structure is the critical piece for enabling energy storage to participate in as many of the markets as possible. (Exotic interconnection options include interties)

### *Energy storage configuration options*

- Question from the AESO regarding Fort Chip and Peace Point systems. Is there a chance they will be connected to the Alberta grid or remain completely isolated systems?
    - ATCO representative responded that they are completely isolated at the moment. In Fort Chip, load is growing, but not to the point to justify for a transmission line build to it. As for Peace Point, it is a small community, and growing slowly. There is no case to connect either.
    - ATCO representative mentioned the example of Astoria in Jasper. Astoria was the hydroelectric generating station supporting that isolated system before Jasper connected to transmission system.
- A question from Alberta Energy representative regarding the market design system in other jurisdictions and how they enable the pancake effect to take place, and how that differs to Alberta's system? Secondly, when considering legislation and design of the system, how can we best and most effectively enable this technology to play within the different systems while being mindful of the overall system today?
    - TransAlta Corporation representative responded that battery storage is more prevalent in markets in the east coast which are capacity markets or CAISO markets. In terms of how the department may reduce barriers to entry of energy storage, may be the use of batteries for non-wire alternatives. However, there isn't a lot of policy guidance on how that is enabled, and that policy clarity could unlock an additional layer of energy storage integration. How do non-wire alternatives come to the table is a policy question, and not one the AUC or the AESO can determine. How will the department want to help?
    - Solas representative stated that If there was a credit-worthy counter party that would provide a long-term contract for use cases for energy storage, we will see a great response similar to renewables in the past. When there is an increase of interest, barriers will start to be removed. An RFP with a long-term offtake or long-term contract that is commercially driven and competitive, would be a solution.
    - Enmax representative also added that there are jurisdictions globally that are further along in energy storage integration, which should be leveraged for different market designs to contemplate for Alberta. For example, Fast Frequency Response.
    - Solas representative also added that first the use cases will need to be determined, and then contract for it. A lot of technologies will quickly come to the forefront, and in order to reduce uncertainties associated with it, there would need to be some form of long-term offtake.
- Question from the AUC representative directed at ATCO regarding obtaining the most value and smoothest operation of resources with DFO coordination. Does this mean working with the storage resource upfront to figure out the best siting and let them operate from there? Or that the DFO will be issuing dispatching and coordinate ongoing?
    - ATCO representative suggested a two-prong approach. One, a technical approach which is easier to overcome. If we want to defer investment on a transformer and don't want to overload, then we need to be able to control the battery to offset that load, which is easier done if the

DFO is the owner, but not impossible to do otherwise. And two, which is more critical as it is regarding reliability, is the customer who owns a battery in need of repair, if it is the utility owned, then the repair will be done right away to ensure the customer does not have to be shed to avoid damaging equipment.

- Question from the AUC representative directed at Turning Point Generation in regard to the mentioned pump hydro system, which is a closed loop system, and wondering if there is an equivalent of a round trip efficiency. Assuming there would be water loss in the process, was a calculation made of how much water would need to be topped up regularly, and whether that is paid for?
    - Turning Point Generation representative responded that studies have been run around the active conditions of Alberta. There is not a huge evaporation loss in Alberta and have a precipitation gain, so based on analysis, the balance is even over the long term. Top up is needed from time to time but doesn't appear to be a limiting factor for us.
- Question from CanWEA representative regarding the coordination of DFO and how would that conversation be initiated; do storage customers go to the DFO, or does the DFO go to the market?
    - ATCO representative responded that sending a price signal is not going to solve the problem of deferment of investment.
    - ATCO representative stated that they are not suggesting energy storage developers approach the DFO, they are not in the market to interfere with market behavior. The service that would be offered is when the distribution to the system has been compromised. Lots of things need to be debated and considered before we can answer that.
- AltaLink representative commented that in order to create an environment for storage to provide in the highest value to customers, both the configuration application and the stacking should be considered. Avoid a one size fits all approach. If a merchant developer can justify their business case based on the market priced signals and based on the rules, which clearly define what is NWA is, and how it can be done, we should encourage both to happen. Then we can deliver low cost to customers.

## VI. Wrap Up and Next Steps

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