BC Hydro Resource Options Update
Energy Storage Technical Workshop

Summary Notes for February 4, 2020

Includes post-session comments and consideration of feedback

AGENDA

- Define generic configurations of energy storage technologies viable as capacity resource in B.C.
- Review high level technical and financial characteristics of energy storage technologies.

ATTENDEES

- BC Hydro: Alex Tu (Technical Lead),
- Representatives from the National Research Council, Sunfield Energy, Convergent Energy + Power, and independent consultants.

SUMMARY NOTES

Alex welcomed participants and reviewed the agenda and purpose of today, which is to outline a proposed approach to characterizing the energy storage resource in B.C., and to collect technical experts' feedback, critiques and refinements. Comments captured below are organized based on slide number of the session presentation "Resource Options Engagement – Energy Storage Estimates, February 4, 2020"

Slide 2-5 – Review of Technical and Financial Attributes

- Alex indicated the confusion and complexity of incorporating energy storage resources into conventional energy resource planning processes. By virtue of energy storage being technically capable of providing many different services (supply capacity, frequency control, T&D investment deferral, customer reliability, customer demand charge reduction, etc.), but many of these services can only be provided in a partial manner compared to conventional generation, or can only be provided if the energy storage facility is located in an appropriate grid location. Some additional categories of technical and financial attributes have been added to the Resource Options Database (RODAT) to accommodate some of the features of energy storage required to perform system modelling.

Slide 6-11 – Identifying Energy Storage resource types appropriate for IRP

- Alex described the various configurations of energy storage. By virtue of the IRP resource planning process, appropriate energy storage configurations must be able to provide dependable system capacity. Those that are not appropriate for this service will be filtered out of contention for this IRP, but we recognize these other configurations may have merit in other planning exercises e.g. Non-Wire Alternative analysis or Non-Integrated Area planning.

- Comments received questioning the viability of compressed air energy storage in the B.C. context. In the absence of confirmed geological reservoirs appropriate for underground compressed air storage and the lack of private sector interest in developing underground storage in B.C., it is suggested that compressed air energy storage be removed from further consideration in this IRP and instead be moved to the list of emerging resources.

Slide 12-22 – Characterization of Bulk-Transmission Connected Energy Storage Resources

- Alex outlined the research into U.S.-based lithium ion and flow battery energy storage systems at the relevant scale.
- For the large lithium ion capital costs, one advisor noted the costs are generally consistent with the costs he has seen in the B.C. market, although may be optimistic when real on-the-ground issues and challenges in installation and integration are ultimately faced.
- The Planning period for large scale resources is about right at ~2 years, however it should be noted that these timelines are likely only possible on private land such as that already permitted for similar use at a generation station or within the fence of transmission infrastructure.
- While permitting of large energy storage at existing grid infrastructure streamlines the planning process, it must be noted that the interconnection of energy storage into a substation can require a lot of engineering work that is costly and time consuming.
- Round Trip Energy Efficiency may be slightly higher than reported here – low 90 % is common.
- With regard to lifetime, the components of energy storage have different life cycles. Cells typically must be replaced at 10 years, while BOP will last for 20 years. Alex agreed, and noted the cost of cell replacement is characterized as an OMA cost under the ‘augmentation’ category. On this topic of augmentation, the rate of cell replacement would be very dependent on the frequency of discharge i.e. a daily cycling energy storage system must be replaced more frequently than one that is used for emergency stand by.

Slide 23-28 – Renewable Co-Located Energy Storage Resources

- Alex described the approach to estimating the cost of co-located storage, where the common infrastructure or expenses for a typical solar project (e.g. inverter, permitting, interconnection studies) is ‘discounted’ from what would be the equivalent greenfield energy storage facility.
- Advisors suggested co-location with solar is much more common than co-location with wind by virtue of the largely predictable energy generation pattern of solar as opposed to the variable from one hour to the next with wind.
- Commenters suggested these combined projects could be viewed as a dependable capacity project offering up to 12 hours dependable capacity in the summer months.
- Combined projects could also provide a range of additional system benefits beyond those listed on the slides, such as transmission deferral or energy security

Slide 29-34 – Substation Energy Storage Resources

- Alex described an emerging trend in other jurisdictions to locate energy storage facilities inside the fence of existing substation infrastructure. Lithium ion facilities are modular and relatively easy to install.

Slide 35-39 – Behind the Meter Energy Storage Resources

- Alex described that, despite being typically shorter duration, these resources could be seen as contributing towards system adequacy when aggregated.
- Advisors recognized that these resources functionally reduce customer load, and are therefore appropriately looked at as a load displacement rather than energy supply resources.

Session closing

- Alex thanked the participants for their time and comments today. If people have further comments, please send to Alex by next Friday, February 7th.

POST SESSION COMMENTS

- One written comment received that voiced support for the assumptions outlined in the presentation.

CONSIDERATION OF FEEDBACK

Feedback	BC Hydro's consideration of feedback
Consider removing Compressed Air Energy Storage from further consideration at this time due to the lack of reliable geological information.	Agreed – BC Hydro will remove CAES resources from the resource option analysis and will consider it among the emerging resources.
Increase the round-trip efficiency of lithium ion resources.	Agreed – as a forward-looking appraisal to 2020, we will adopt a 90% energy efficiency for lithium ion resources.
Consider characterizing the augmentation cost of battery cells as a cost per MWh dispatched in order to account for correlation between cell degradation and cell dispatch.	This is a logical suggestion; however, the existing dispatch model is structured to recognize this as a sustaining capital cost rather than a variable cost. The sustaining capital cost may in future vary based on the projected duty cycle of the energy system being modelled.
Create an additional resource type called "solar + storage" that can provide dependable capacity.	From a system modelling point of view, whether the energy storage is co-located at the solar site or another grid location is irrelevant – the model will seek to optimize the capacity resources and energy resources as a whole. This may make sense from a contracting point of view, but it is not necessary for this energy planning exercise.
Consider applying a two-year planning period only for resources located within the fence of existing utility or generation infrastructure.	Agreed – for resources outside of existing footprint of pre-permitted facilities, planning period will be extended by an additional year.