Katherine Sparkes
Director – Innovation, Research & Development
Independent Electricity System Operator
1600-120 Adelaide Street West
Toronto, ON M5H 1T1

July 14, 2021

Dear Katherine,

This submission responds to the Independent Electricity System Operator (IESO) June 23, 2021 presentation *Hybrid Integration Project*.[1]

The scope of this initiative is to produce vision and design documents to define how hybrid storage-generation resources ("hybrid projects") will be integrated within the IESO Administered-Markets (IAM). The Hybrid Integration Project (HIP) is part of the broader IESO Enabling Resources initiative[2] that is also undergoing stakeholder engagement.

Power Advisory has coordinated this submission on behalf of a consortium of renewable generators, energy storage providers, and the Canadian Renewable Energy Association (the "Consortium"[3]).

The Consortium continues to support the HIP initiative, as evident within our submission commenting on IESO's April 21 presentation. Over the last few years, the Consortium has championed facilitating development and integration of hybrid projects within IAM. We have made this point within multiple submissions across many other IESO stakeholder engagement initiatives, such as the Resource Adequacy initiative[4], the previous Expanding Participation in Operating Reserve and Energy (EPOR-E) initiative[5], and the past Non-Emitting Resources Sub-Committee (NERSC)[6] of the former Market Renewable Working Group (MRWG).[7]

[1] See https://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Hybrid-Integration-Project

[2] See https://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Enabling-Resources

[3] The members of the Consortium are: Canadian Renewable Energy Association; Axium Infrastructure; BluEarth Renewables; Boralex; Capstone Infrastructure; Cordelio Power; EDF Renewables; EDP Renewables; Enbridge; ENGIE; Evolugen (by Brookfield Renewable); H2O Power; Kruger Energy; Liberty Power; Longyuan; NextEra Energy Canada; Pattern Energy; Suncor; and wpd Canada.

[4] See https://www.ieso.ca/Sector-Participants/Engagement-Initiatives/Engagements/Resource-Adequacy-Engagement

[5] See https://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Completed/Expanding-Participation-in-Operating-Reserve-and-Energy, and applicable Consortium submissions can be found at https://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Completed/Market-Development-Advisory-Group

[6] See https://www.ieso.ca/en/Market-Renewal/Stakeholder-Engagements/Non-Emitting-Resources-Subcommittee

[7] See https://www.ieso.ca/en/Market-Renewal/Stakeholder-Engagements/Market-Renewal-Working-Group

Within the HIP initiative and within these other initiatives, the Consortium commented on the uptake and integration of hybrid projects within wholesale electricity markets across the U.S. and in Alberta.

The subsections below provide high-level comments regarding some of the key components that were presented by IESO during the June 23 webinar, and answers to IESO posed questions.

Hybrid Projects in Connection Queues

On slide 8, IESO lists the following table identifying hybrid projects in connection queues across select Canadian and U.S. wholesale electricity markets.

Deliverable	Hybrid Facility MW Generation in Build Queue As of 2020	Total MW of Generation in Build Queue as of 2020	% Hybrids In Build Queue as of 2020
AESO	1,531	17,493	9%
CAISO	46,840	122,434	38%
ERCOT	16,097	107,880	13%
ISO-NE	474	23,843	2%
MISO	12,219	92,057	13%

The Consortium believes the volume of hybrid projects within the above listed connection queues provide clear indication of increasing development of hybrid projects – indicating a growing and lasting trend.

The Consortium requests that IESO provide similar data and information for hybrid projects within connection queues in the following Canadian and U.S. wholesale electricity markets administered by: IESO; NYISO; PJM; and SPP, along with explanations why material deviations in the volume of developing hybrid projects may exist from market to market.

IESO Grid Innovation Fund

On slide 13, the Consortium is very pleased to learn that through its visioning process IESO plans to work with stakeholders to determine potential scope for its Grid Innovation Fund to administer a procurement for hybrid project proposals (i.e., via Request for Proposals (RFP) resulting in contracts). The Consortium encourages IESO to provide more information on this potential initiative, including timing for any such RFP(s).

IESO First Hybrid Research Project

On slide 23, IESO notes the following research has been initiated through:

- Understanding current hybrid project growth in U.S. and what it means for upcoming work of the HIP initiative;

- Learning from early-stage implementation efforts already taking place by U.S. Independent System Operators (ISOs)/Regional Transmission Organizations (RTOs) within their respective wholesale electricity markets; and

- Conducting one or more proof-of-concept hybrid project 'field' studies in Ontario.

The Consortium appreciates IESO providing some information regarding the above listed areas of research, and requests IESO to provide more information within a future HIP stakeholder engagement meeting before the end of 2021.

IESO Requested Stakeholder Feedback

Listed below are IESO posed questions from the June 23 webinar, followed by high-level responses.

What types of hybrid pairings (technology and storage-to-generation ratios) are most likely to be developed in Ontario? Why?

Response: As stated in previous Consortium submissions to IESO, hybrid wind and solar (i.e., variable) generators (VGs) paired with energy storage will provide significant pairing opportunities in Ontario – especially considering over 8,000 MW of operating distribution- and transmission-connected VGs. Additional to hybrid VG and energy storage projects, there will also be opportunities to pair hydroelectric generators with energy storage.

For example, in a recent article, Hatch states that

> *"In addition to wind and solar energy, the province of Ontario also has hundreds of small run-of-river hydro plants with limited re-regulation capability, and some of these facilities are located in remote communities providing them with carbon-free, affordable power. The ability to store energy during periods of low demand, to be used in periods of high demand, can be an important asset for managing the smaller run-of-river hydro plants reliably and efficiently.*
>
> *Batteries are cost-effective at delivering small amounts of stored energy over a short time at high power levels. They also offer a flexible and modular solution and have few limitations on installation location. The fast response time and high versatility makes the combination of existing smaller hydro with batteries worth exploring. Energy storage systems are also easy to construct and have low environmental impacts.*
>
> *Battery energy storage is a rapidly growing technology and is becoming known as the most versatile technology on the grid. With the falling cost of batteries, we can expect to see more hybridization of storage with any type of generation. By combining generation with storage, we can take advantage of the beneficial performance characteristics of batteries. Including fast response, high efficiency, low maintenance costs, and zero emissions, while using the generation asset to address the storage's limited energy duration. Smart dispatch software technology can*

also help with the optimal use of the hydro-battery combination to meet the various changing conditions, deciding on the best timing, and amount to store, versus release energy at single or multiple locations.

The batteries can capture excess energy produced by the hydro turbines, which would have been otherwise spilled due to low demand or excess waterflow. Energy associated with spilled water used to recharge the battery can also be used during periods of high demand to serve the community or generate additional revenue during high price periods if there is a grid connection. In addition, storage offers the ability to provide operating reserve and other ancillary services, such as frequency and voltage support. This results in the overall facility having a more versatile offering to the grid operator, whether the grid is isolated or connected to the national grid. A main benefit of battery energy storage systems is the ability of a single installation to provide multiple services, value stacking, both at different times and simultaneously if market conditions allow. This value stacking approach significantly improves the project economics, as it allows for multiple benefits and revenue streams."[8]

Are the Vision questions appropriate given IESO's intent to pursue a foundational participation model?

Response: Yes. The Consortium looks forward to working with IESO and other stakeholders within the HIP stakeholder engagement.

The Consortium will be happy to discuss the contents of this submission with you at a mutually convenient time.

Sincerely,

Jason Chee-Aloy
Managing Director
Power Advisory LLC

[8] See https://www.hatch.com/About-Us/Publications/Blogs/2021/07/Pairing-hydropower-with-battery-storage

cc:
Leonard Kula (IESO)
Chuck Farmer (IESO)
Candice Trickey (IESO)
Shawn Cronkwright (IESO)
Barbara Ellard (IESO)
Edward Arlitt (IESO)
Pat Lo (IESO)
Sasoon Assaturian (IESO)
Brandy Giannetta (Canadian Renewable Energy Association)
Elio Gatto (Axium Infrastructure)
Roslyn McMann (BluEarth Renewables)
Adam Rosso (Boralex)
Greg Peterson (Capstone Infrastructure)
Paul Rapp (Cordelio Power)
David Thornton (EDF Renewables)
Ken Little (EDP Renewables)
Lenin Vadlamudi (Enbridge)
Carolyn Chesney (ENGIE)
Julien Wu (Evolugen by Brookfield Renewable)
Stephen Somerville (H2O Power)
JJ Davis (Kruger Energy)
Deborah Langelaan (Liberty Power)
Jeff Hammond (Longyuan)
Cheryl Dietrich (NextEra Energy)
Rob Campbell (Pattern Energy)
Chris Scott (Suncor)
Ian MacRae (wpd Canada)