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Dear Barbara,

At the April 2, 2020 meeting of the Independent Electricity System Operator (IESO) Market Development Advisory Group (MDAG)¹, the IESO led a discussion on its new initiative – Expanding Participation in Operating Reserve and Energy (EPOR-E). This initiative will provide recommendations to potentially expand the complement of resources (e.g., wind and solar generators, energy storage, hybrid projects, etc.) that have capabilities to supply energy and OR within the IESO-Administered Markets (IAM) among other things.

Power Advisory LLC has coordinated this submission on behalf of a consortium of renewable generators, energy storage providers, and industry associations (i.e., the “Consortium”²) providing high-level comments on the *Expanding Participation in Operating Reserve and Energy Scope of Work* (i.e., the “Scope of Work”) and responses to specific questions posed by IESO during the April 2 meeting relating to the supply of OR and hybrid projects.

GENERAL COMMENTS AND SUPPORT

Overall, the Consortium is supportive of this initiative. This initiative is consistent with, and builds upon, the following previous IESO projects.

In April 2018, by way of amendments to the IESO Market Rules, IESO became enabled to increase the amount of 30-minute OR to help meet Ontario’s power system flexibility supply needs³. This clearly signals the need for more OR supply within Ontario, which could be supplied from multiple resources.

Work from the IESO Non-Emitting Resources Sub-Committee (NERSC) of the Market Renewal Working Group revealed the ability of multiple resources (e.g., wind and solar (i.e., variable) generators (VGs), energy storage, etc.) to supply multiple ancillary services (A/S), including OR, through market participant

¹ See <http://www.ieso.ca/Sector-Participants/Engagement-Initiatives/Engagements/Market-Development-Advisory-Group>

² The members of the Consortium are: Axiom Infrastructure; BluEarth Renewables; Boralex; Brookfield; Canadian Wind Energy Association; Capstone Infrastructure; Cordelio Power; EDF Renewables; EDP Renewables; Enbridge; ENGIE; H2O Power; Kruger Energy; Liberty Power; Longyuan; NextEra Energy Canada; Pattern Energy; Suncor; wpd Canada; and, Canadian Solar Industries Association.

³ See final IESO proposal included within the December 8, 2017 meeting of the Market Renewal – Enabling System Flexibility stakeholder engagement, located at <http://www.ieso.ca/en/Market-Renewal/Stakeholder-Engagements/Enabling-System-Flexibility>

and stakeholder responses to an IESO Request for Information (RFI). The final report of the NERSC, *Participation in Ontario's Future Electricity Markets* (April 25, 2019)⁴, stated that:

"The NERSC modelling exercise illustrated how an improved market design with maintained and enhanced participation from non-emitting resources can deliver significantly more efficient outcomes. Across the wide range of scenarios explored, model results demonstrated how accurately signalling the need for the right services in the right location at the right time can incent participation from non-emitting resources (NERs) and provide substantial benefits relative to today's market."

Enhancing participation of NERs (e.g., VGs, energy storage, hybrid projects, etc.) to supply multiple A/S, including OR, will improve the reliability and efficiency of Ontario's power system and market.

COMMENTS ON EXPANDING PARTICIPATION IN OR AND ENERGY SCOPE OF WORK

The Consortium is generally supportive of the Scope of Work and offers the following comments.

Stakeholder Engagement – Interrelated Work

The IESO rightfully lists several IESO and Ontario Energy Board (i.e., through the Market Surveillance Panel) initiatives relating to the EPOR-E initiative. However, it is not clear how these initiatives will be coordinated regarding respective scopes of work, recommendations, and direction for all interrelated initiatives.

In particular, it is recommended that IESO provide more clarity in future MDAG meetings, and other IESO stakeholder engagements, on how the EPOR-E initiative will be effectively coordinated with the Market Renewal Program (MRP) and initiatives within the Energy Storage Advisory Group (ESAG) (e.g., Energy Storage Design Project). For example, as recommended within the Consortium's March 6, 2020 submission commenting on the *Energy Storage Design Project Draft Design Document for Stakeholder Comment*⁵, the Consortium recommended that this initiative be included within MRP, and if it remains to not be included how then will this initiative be coordinated with MRP. These comments also now apply to EPOR-E relating to coordination with MRP and the Energy Storage Design Project.

⁴ See <http://www.ieso.ca/Market-Renewal/Stakeholder-Engagements/Non-Emitting-Resources-Subcommittee>

⁵ See <http://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Energy-Storage-Advisory-Group> for the Consortium's submission

Approach – Areas for IESO Exploration and Project Phase 1: Requirements and Participation

Within the Scope of Work, IESO is correct in reviewing and examining:

- Current energy and OR market participation requirements and IESO processes designed to facilitate scheduling and dispatching of resources;
- IESO tools to determine potential misalignments and areas of opportunities in allowing resources from meeting requirements and providing energy and OR; and
- Potentially enabling regulation service providers to supply OR.

Further, IESO has listed multiple resources (e.g., VGs, storage, hybrid projects (defined by IESO as generator or load utilizing storage), etc.) to examine and review their participation models and how they align (or not) with IESO market participation requirements.

The Consortium recommends that the Scope of Work should include benchmarking existing IESO market participation requirements and IESO tools to other jurisdictions that already enable greater numbers of resources to supply OR along with initiatives that are presently exploring changes to participation requirements (including participation models) to enable supply of multiple electricity products and services (including OR).

The following areas are examples that address the above benchmarking recommendation.

- *VGs Supply of OR in Ireland and Germany* – Within Ireland’s wholesale electricity market, wind generators are listed as being eligible to supply OR (i.e., Primary OR, Secondary OR, Tertiary OR)⁶, where OR (and other A/S) is procured through a program called DS3⁷. Within Germany’s wholesale electricity market, OR (and other A/S) is procured through tenders⁸.
- *Ability of OR Supply from Solar PV Generators in California* – Based on a California ISO (CAISO) sponsored study, *Using Renewables to Operate a Low Carbon Grid: Demonstration of Advanced Reliability Services from a Utility-Scale Solar PV Plant* (2018)⁹, it was determined that spinning and non-spinning OR could be supplied to the CAISO wholesale electricity market by the operating solar PV generator used within the study¹⁰.

⁶ See <http://www.eirgridgroup.com/site-files/library/EirGrid/DS3-System-Services-Proven-Technology-Types.pdf>

⁷ See <http://www.eirgridgroup.com/how-the-grid-works/ds3-programme/>

⁸ See <https://www.regelleistung.net/ext/?lang=en> for OR (and other A/S) procurement requirements and resource eligibility

⁹ See <http://www.caiso.com/Documents/UsingRenewablesToOperateLow-CarbonGrid.pdf>

¹⁰ See pp. 52-53 in the CAISO sponsored study *Using Renewables to Operate a Low Carbon Grid: Demonstration of Advanced Reliability Services from a Utility-Scale Solar PV Plant* (2018)

- *CAISO and New York ISO (NYISO) Stakeholder Engagements Exploring Integration of Hybrid Projects* – These two initiatives should help determine ability to supply OR from hybrid projects (i.e., mainly relating to ‘pairing’ VGs and storage). In 2019, CAISO launched a Hybrid Resources stakeholder consultation¹¹ by issuing a Hybrid Resources Initiative Paper. After receiving submissions from stakeholders, CAISO is presently working with stakeholders to finalize a Straw Proposal towards a late Q3/early Q4 2020 submission to their Board of Governors. In January 2020, NYISO launched a Hybrid Storage Model stakeholder consultation¹². The objective of this consultation is to explore and propose a participation model to integrate: i) renewable generation co-located with small energy storage; ii) renewable generation co-located with large energy storage; iii) thermal generation co-located with energy storage; and, v) renewable and thermal generation paired with energy storage via bilateral contracts. NYISO is presently working with stakeholders to develop a participation model with plans to finalize it for a stakeholder vote later in 2020.
- *Submissions Responding to U.S. Federal Energy Regulatory Commission (FERC) Order 841* – FERC Order 841 (issued February 15, 2018) mandated the U.S. wholesale electricity markets under FERC’s jurisdiction¹³ to file proposed changes to their respective market designs and rules toward fully integrating energy storage within these markets. Independent System Operators (ISOs)/Regional Transmission Operators (RTOs) have since filed submissions with FERC and some have since been endorsed by FERC. Compliance with Order 841 should enable the ability to supply OR from storage projects.

The last two examples overlap with aspects of MRP and the ESAG Energy Storage Design Project, and therefore are examples for needed coordination across IESO initiatives, including the EPOR-E.

In addition to CAISO and NYISO stakeholder engagement initiatives regarding integration of hybrid resources, as regularly reported on by the Energy Storage Association¹⁴ in the U.S., other U.S. ISOs/RTOs are undertaking work to integrate hybrid resources. These ISO/RTO initiatives should also help determine ability of hybrid projects to supply OR (and other A/S), including the development and integration of hybrid projects within the U.S. wholesale electricity markets.

¹¹ See <http://www.caiso.com/StakeholderProcesses/Hybrid-Resources>

¹² See https://www.nyiso.com/documents/20142/10252714/Hybrid%20Storage%20Model_MIWG_Jan%2013%202019.pdf/caf29abe-a431-a2d1-358d-43326153824a

¹³ ISOs/RTOs within FERC’s jurisdiction that have filed proposed changes to their market design and rules to integrate energy storage within their respective wholesale electricity markets are CAISO, Southwest PowerPool (SPP), Midcontinent ISO (MISO), PJM, NYISO, and ISO-New England (ISO-NE).

¹⁴ See https://energystorage.org/wp/wp-content/uploads/2020/04/ESA-Policy-Summary-on-Hybrid-Resources-Across-RTOs-and-ISOs_4_10_20.pdf

We also note that FERC recently announced a technical conference to be held on July 23, 2020 regarding hybrid resources¹⁵. This technical conference will discuss technical and market issues regarding hybrid resources, focusing on paired generators and storage. IESO is encouraged to incorporate relevant findings from this technical conference within the work of the EPOR-E study and engagement with market participants and stakeholders.

Development of hybrid projects are rapidly increasing in the U.S., as evident by approximately 69 GW of hybrid projects listed in connection queues across the ISO/RTO wholesale electricity markets¹⁶. An excellent and timely resource for the most recent analyses and studies regarding development, integration, and valuation of hybrid projects are the presentations and discussions from the Energy Systems Integration Group (ESIG) 2020 Spring Technical Conference¹⁷.

There are a few key highlights from the ESIG 2020 Spring Technical Conference relevant for the EPOR-E study. First, a recent Lawrence Berkeley National Laboratory study found that between \$26/MWh to \$29/MWh (\$US) of value results from pairing storage to VGs in the CAISO wholesale electricity market¹⁸, resulting in savings to customers. Second, analysis shows that depending on how hybrid projects are configured and integrated within power systems and wholesale electricity markets, complicated participation models may not be required. This outcome can be achieved if hybrid project operators assume greater responsibilities to optimize hybrid resources behind interconnection points to the grid, therefore actually simplifying market design and rules relating to integrating, scheduling, and dispatching hybrid projects¹⁹.

¹⁵ See

<https://www.ferc.gov/eventcalendar/EventDetails.aspx?ID=13759&CalType=%20&CalendarID=116&Date=07/23/2020&View=Listview>

¹⁶ See slide 6 from Will Gorman (Lawrence Berkeley National Laboratory) presentation, *The Rise of the Hybrid Power Plant*, from the ESIG 2020 Technical Conference located at <https://www.esig.energy/event/2020-spring-technical-workshop/> (see Session 9 dated April 23, 2020)

¹⁷ See Session 9 (April 23, 2020) located at <https://www.esig.energy/event/2020-spring-technical-workshop/> for the ESIG 2020 Technical Conference and <https://www.youtube.com/watch?v=VxawEUfnANY&feature=youtu.be> for delivered presentations along with questions from conference attendees and answers from presenters

¹⁸ See slide 9 from Will Gorman (Lawrence Berkeley National Laboratories) presentation, *The Rise of the Hybrid Power Plant*, from the ESIG 2020 Technical Conference located at <https://www.esig.energy/event/2020-spring-technical-workshop/> (see Session 9 dated April 23, 2020)

¹⁹ See Session 9 from Mark Ahlstrom (President, ESIG Board of Directors, and VP, Renewable Energy Policy, NextEra Energy Resources) presentation, *HyFlex – Simplifying the Operation of PV Hybrids*, from the ESIG 2020 Technical Conference located at <https://www.esig.energy/event/2020-spring-technical-workshop/> (see Session 9 dated April 23, 2020), particularly his comments made that can be heard via YouTube located at <https://www.youtube.com/watch?v=VxawEUfnANY&feature=youtu.be>

QUESTIONS FROM APRIL 2, 2019 MDAG MEETING

Below are responses to the specific questions posed during the April 2 MDAG meeting.

Hybrid Participation Questions

Is our current focus of generator/load with BTM storage solution consistent with stakeholder expectations of “hybrid participation”?

Front-of-the-meter (FTM) storage within hybrid projects (e.g., with VGs) should be included along with behind-the-meter (BTM) storage within hybrid projects. Flexibility should be permitted to enable hybrid participation through FTM and BTM storage applications within hybrid projects. This will be important for Ontario considering the significant potential of hybrid projects, where storage can be paired with operating VGs. Based on the multiple configurations of metering and connections to the grid for operating VGs, flexibility (either FTM or BTM) will likely be required to efficiently co-locate storage where feasible.

It is acknowledged that the scope within the ESAG’s Energy Storage Design Project addresses co-locating FTM storage within hybrid projects. However, this scope is very limited because the energy withdrawal and energy injection components within hybrid projects will be modeled separately, and therefore not accounting for optimizing the two as one single resource. Therefore, additional work will be needed to determine more accurate participation models for hybrid projects, which will impact the ability to supply OR and other A/S.

Building on the above point, the Consortium believes there is an important distinction between ‘co-locating’ storage and VGs (or any other generation resource) and true ‘hybrid’ pairing of storage and VGs (or any other generation resource). This distinction is driven by technology, configuration, and application of invertors within hybrid projects, along with hybrid operators assuming greater responsibilities to optimize their hybrid resources behind respective interconnection points to the grid²⁰. Compared to co-located projects, true hybrid projects will result in greater efficiencies and optimal operations, resulting in enhanced power system flexibility and reliability while improving market efficiencies that will result in savings to customers.

²⁰ See slides 3-5 from Mark Ahlstrom (President, ESIG Board of Directors, and VP, Renewable Energy Policy, NextEra Energy Resources) presentation, *HyFlex – Simplifying the Operation of PV Hybrids*, from the ESIG 2020 Technical Conference located at <https://www.esig.energy/event/2020-spring-technical-workshop/> (see Session 9 dated April 23, 2020), particularly his comments made that can be heard via YouTube located at <https://www.youtube.com/watch?v=VxawEUfnANY&feature=youtu.be>

Do stakeholders have experience with hybrid participation in other jurisdictions? If so, are there any learnings we should be considering from other System Operators?

The above points provide further evidence for IESO to carefully review the CAISO and NYISO stakeholder engagements, and other ISO/RTO initiatives, regarding enabling participation of hybrid projects within their respective wholesale electricity markets.

Some Consortium members have experience developing hybrid projects throughout the U.S. and will be happy to discuss developing and integrating these projects with IESO.

Appendix A provides a select list of announced hybrid projects in the U.S., and considering the size of many of these projects, FTM applications likely apply.

Additional Questions for Stakeholder Feedback

Are the requirements to participate in energy and OR clear and understandable?

The requirements to participate in supply of energy and OR within the IAM are clear. As recommended above, these requirements should be benchmarked with other jurisdictions that presently permit, or plan to permit, supply of OR from VGs.

Based on the models and opportunities presented, is it clear what could be limiting a resource from participating?

To truly enable participation in supply of OR from resources that have ability to do so but not presently permitted to, IESO should work with market participants and stakeholders to not only benchmark these requirements that permit supply of OR within other jurisdictions but also provide more technical reviews of compliance requirements set by applicable North American electricity reliability authorities (e.g., North American Electric Reliability Corporation (NERC) and Northeast Power Coordinating Council (NPCC)) and related flexibility to meet NERC and NPCC requirements.

In line with points made above, IESO should also work with market participants and stakeholders to enable true hybrid projects and not just enable co-location of storage and generation.

Based on the information that was presented, are your resources or a subset of your resources capable of meeting our current requirements?

As stated above, through the NERSC RFI process, many Consortium members indicated capabilities to supply OR and other A/S. Therefore, we are hopeful that the EPOR-E scope of work and future recommendations will address barriers to enable this supply. Again, we encourage IESO to work with stakeholders to better understand how other jurisdictions and ISOs/RTOs are enabling supply of OR (and other A/S) from multiple resources or are in the process of exploring how to do so.

Have you come across similar issues for participation in other markets?

Please see applicable points and responses throughout this submission.

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

cc:

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Stephen Somerville (H2O Power)
JJ Davis (Kruger Energy)
Patrick Taylor (Liberty Power)



Jeff Hammond (Longyuan)
David Applebaum (NextEra Energy)
John O'Neil (Pattern Energy)
Chris Scott (Suncor)
Ian MacRae (wpd Canada)
Wes Johnston (Canadian Solar Industries Association)

Appendix A – List of Select Announced U.S. Hybrid Projects

- Arizona Public Service and First Solar – solar (50 MW) and storage (135 MWh)
- Portland General Electric and NextEra Energy – wind (300 MW) and solar (50 MW) and storage (30 MW)
- Kauai Island Electric Cooperative and AES – solar (28 MW) and storage (100 MWh)
- Kauai Island Electric Cooperative and SolarCity – solar (13 MW) and storage (52 MWh)
- Tucson Electric Power and NextEra Energy – solar (100 MW) and storage (30 MW)
- Dong Energy and ORSTED – solar (420 MW) and storage (40 MW)
- Nevada Energy and EDF Renewables – solar (200 MW) and storage (75 MW)
- Nevada Energy and 8Minute Solar – solar (300 MW) and storage (135 MW)
- Nevada Energy and Quinbrook Infrastructure/Arevia Power – solar (690 MW) and storage (380 MW)
- 21 utility members/other customers of Western Farmers Electric Cooperative and NextEra Energy – wind (250 MW) and solar (200MW) and storage (800 MWh)
- Helios Energy and GE – solar (3 MW) and storage (12 MWh), and solar (2 MW) and storage (8 MWh)
- Capital Dynamics and 8Minute Solar – solar (400 MW) and storage (300 MW)
- Los Angeles Department of Water and Power and 8Minute Solar – solar (200 MW) and storage (150 MW), and solar (200 MW) and storage (150 MW)
- EBCE and EDP Renewables – solar (100 MW) and storage (30 MW)
- Florida Power & Light Babcock Ranch – solar (74.5 MW) and storage (10 MW)
- Florida Power & Light Manatee Energy Storage Center – solar (409 MW) and storage (900 MWh)
- Nevada Power and Crescent Dune Solar – solar (110 MW) and storage (110 MW)
- Kauai Island Electric Cooperative and AES – solar (14 MW) and storage (14 MW)
- Hawaiian Electric and AES – solar (30 MW) and storage (30 MW)
- Maui Electric and AES – solar (60 MW) and storage (60 MW)