Stakeholder Feedback and IESO Response

Hybrid Integration Project – September 21, 2021

Following the September 21, 2021 engagement webinar on the Hybrid Integration Project (HIP), the Independent Electricity System Operator (IESO) received feedback from participants on market participation, development investments and operational or implementation considerations, and likely scenarios if implementation of both participation models is possible.

The IESO received feedback from:

- Canadian Renewable Energy Association (CanREA)
- Consortium of Renewable Generators, Energy Storage Providers and the Canadian Renewable Energy Association (The Consortium)
- Energy Storage Canada (ESC)
- Essex Energy
- Evolugen by Brookfield Renewable (Evolugen)

The presentation materials and stakeholder feedback submissions have been posted on the Hybrid Integration Project webpage. Please reference the material for specific feedback as the below information provides excerpts and/or a summary only.

Notes on Feedback Summary

The IESO appreciates the feedback received from stakeholders. The IESO has provided a summary below, which outlines specific feedback or questions for which an IESO response was required at this time.

Market participation and development investments

"How would your willingness to participate in IESO markets and invest in the development of hybrid facilities vary under each proposed model?"

All stakeholder submissions included commentary on participation in IESO markets and investment in the development of hybrid facilities, and how willingness to do so may vary depending on the selected model. Four stakeholders advocated for both models, noting the potential benefits of each depending on the particular situation. All stakeholder submissions included additional commentary on the benefits of one model over the other. The following table summarizes the main submission points.

Feedback	**IESO Response**
CanREA, the Consortium, ESC, and Essex Energy indicated that both models have benefits, and advocated for both to be pursued. The following points summarize the key considerations: • CanREA: Model 1 requires the market participant to manage multiple bids/offers while Model 2 requires the management of a single bid and undispatched load, and individual proponents will have different preferences for how to manage their projects. • CanREA: To limit participation on one model or the other could prevent otherwise viable projects from entering the market. • Consortium: strongly recommends the IESO maintain both Model 1 and Model 2 as distinct Foundational Models. • ESC: Ontario investors with existing assets will need to understand how each model would impact, or not, their existing IESO-contract (e.g. Model 1 may not require contract amendments for implementation if the metering at the existing site is not impacted.) • Essex Energy: there are resources throughout Ontario that can be adapted more easily to one model or the other, and so both models are required.	Given the strong preference and valuable feedback expressed by stakeholders, the IESO will proceed with the implementation of both foundational models with updates to the models provided at the next stakeholder engagement session in December. Now that the decision to proceed with both models has been made, both foundational models will move immediately to the design phase where many of the details that stakeholders seek (ancillary services, contracting details, interconnection requirements) will be clarified.

Feedback	IESO Response
The following points summarize the key benefits of Model 1 from stakeholder submissions: • Consortium: Model 1 best ensures that contract provisions will not need to be ammended regarding the generator portion of the hybrid project (for non rate-regulated generators under contract with IESO). • Essex Energy: Model 1 is more appropriate for storage and generation resources that are located on the same distribution feeder (with the POI being at the transmission station) as an example.	Model 1 does provide many advantages from a contracting perspective. It allows the possibility of different contracts for the standalone hybrid assets as well as the flexibility of allowing different owners/operators for each asset at the co-located facility. As mentioned in previous engagements, the Hybrid Integration Project will limit distribution connected hybrid facilities to those with a single point of interconnection into the distribution network. Facilities with multiple points of interconnection (either on the same feeder or behind the same transformer station) are considered DER aggregations and will be explored under the IESO DER Roadmap.
The following points summarize the key benefits of Model 2 from stakeholder submissions: • Consortium: Given the need to manage two offers and one bid, Model 1 would likely be more complicated to manage than Model 2, and as such, may preclude Market Participants from fully optimized utilization of their hybrid project to supply multiple electricity products and services. • Consortium: Model 2 provides enhanced capabilities for Market Participants to better manage their hybrid projects and fully optimize • ESC indicated a preference for Model 2, in that it would provide a generator and the IESO with the most flexibility to manage its offerings to the grid. • There are a number of draw-backs for Model 1 which is effectively a "three resource" model-and may prove to be challenge from a generator's perspective (e.g., multiple bids/offers to coordinate, three settlements, etc.).	Model 2 does provide better integration capability between the generation and storage resources at a hybrid facility. The complexity to manage each model, however, would vary on a facility to facility basis. While Model 1 does require the management of 3 separate resources, it retains all of the current operational practices for standalone storage and generation that market participants are familiar with. Model 2 requires the management of fewer resources but places the onus of managing the combined facility entirely on the market participant. In particular, there will be no centralized forecasting like currently provided for variable generators or any state of charge construct like proposed in the enduring energy storage design. In the current regulatory environment, there are Global Adjustment implications with both models. For the ISM + G model, the storage resource (whether it charges from the onsite generation or from the grid) would be subject to the existing process for Global Adjustment. During the base period, it would qualify as a Class B Energy

Feedback	IESO Response
• Essex Energy: In the case of Model 1, the daunting task of installing and managing two IESO metering installations coupled with a much longer return on investment will deter many potential market participants. Model 2 is likely a better fit for resources that are co-located. Essex Energy: If I could only choose one to start with, I would select Model 2 as the foundational model. From my perspective it would allow the market to access a greater amount of capacity. Then have Model 1 be included as one of the enhanced configurations. • Evolugen: If Storage Resources are subject to Global Adjustment, it will be practically impossible to justify investing under Model 1 (ISM+G). Storage development would therefore need to be done under Model 2 (Single Resource) to avoid charging from the grid. This will add significant constraints to storage development and reduce the economic viability of such technology. Global Adjustment remains a barrier to entry and we urge the IESO to consider alternative solutions.	Storage Facility and effectively pay GA on its losses only. After the base period, it could qualify as a Class A Load and be charged GA based on its peak demand factor. The exact language regarding GA applicability to storage resources can be found in Ontario Regulation 429/04. For the Single Resource Model, the combined facility cannot qualify as Class B Storage or a Class A Load and thus, would be subject to full GA in any instances where it charges from the grid. No GA would be applicable in instances where it charges from the onsite generator as this charging is done behind-the-meter. Developers would have to do their own analysis taking into account the installed capacity of their generation and storage assets, the overall size of their interconnection and the frequency with which they plan on charging from the grid or from their onsite generation to determine which model is more appropriate for their facility.

Operational or implementation considerations

"What other operational or implementation considerations should the IESO factor into its decision-making about which foundational model to implement?"

All stakeholder submissions included commentary on operational or implementation considerations the IESO should factor into its decision-making about which foundational model to implement. The table below summarizes the key considerations.

Feedback	IESO Response
CanREA suggested the IESO consider that the overall benefits to the system from enabling hybrid participation, especially in terms of increased flexibility, will far outweigh the cost and effort	We have taken this feedback under consideration, along will all the other valuable feedback we received and have decided to proceed with the implementation of both foundational models, with updates to the models

Feedback	IESO Response
required to enable both proposed foundational models.	provided at the next stakeholder engagement session in December.
Consortium: In some cases it may be easier to co-locate and integrate energy storage with separate meters for the storage portion of the hybrid project, and in others it may be easier to co-locate and integrate energy storage using the existing generator meter. Consortium: Neither model has advantages over the other with respect to supplying ancillary services.	The ability of Model 2 to provide ancillary services will be clarified during the design phase for foundational models. Model 2 makes a number of simplified modelling choices in order to make it viable as an easy to implement model. While the hybrid facility may physically be capable of providing ancillary services, these modelling choices limit the visibility and control the IESO would have for such a facility, which may or may not inhibit their implementation into existing tools and market rules for the purposes of offering all ancillary services. Model 1 can take advantage ongoing tool upgrades for standalone storage to provide ancillary services.
ESC stated that more information on the potential interconnection requirements of each proposed hybrid model would be beneficial.	Since the IESO will implement both models, both foundational models will move immediately to the design phase where interconnection requirements for hybrids will be more thoroughly explored. As a rough guide for what to expect, stakeholders can reference the existing "Requirements for Generation and Electricity Storage Facilities Connected to the IESO-Controlled Grid" found in Appendix 4.2 of the IESO Market Rules.
ESC requested clarity on what IESO believes Operating Reserve (OR) may not be feasible under Model 2.	The ability of Model 2 to provide OR will be clarified during the design phase for foundational models, where the market rules for hybrid facilities will be explored. Under the current market rules, variable generators are unable to offer OR while

Feedback	IESO Response
	standalone storage can offer OR because we are able to telemeter the SOC of the storage facility, giving us assurance that the storage resource can offer OR for the full hour. Since model 2 will be modeled as one single combined resource, it is still TBD what our telemetry requirements or capabilities will be at this time.
ESC requested clarity on why IESO believes the centralized forecasting of variable generators could not be utilized in Model 2.	Model 2 makes a number of simplified modelling choices in order to make it viable as an easy to implement model. One of these choices was to use our existing Quick Start Generator model to model the injection portion (generator + storage injection) component of the hybrid. While the IESO can still collect weather forecasting from the variable generator sites and use that forecast for its own operational purposes, due to the limitations of using the Quick Start model and not a variable generator model, there would be no way to determine a dispatch for the combined resource that utilizes the VG forecast. Under this model, the onus of determining a feasible offer into the market would fall on the market participant.
Essex Energy suggested the IESO reconsider the Model 2 configuration to remove the requirement that the hybrid resource must be co-located with a non-dispatchable load, suggesting Model 2 should be designed independent of a non-dispatchable load being incorporated.	Model 2 uses the IESO's existing Quick Start Generator model to model the generator and the injection only component of the storage. Since this Quick Start model is a generator within our tools, it has the capability to only inject and not withdraw. To have any sort of withdrawal capability from the grid, a separate load component is required. Without this separate load component, the storage at the facility would only be able to charge from the onsite generation which can be limiting for certain hybrid configurations and limit the amount of capacity that can be extracted from such a resource.
Evolugen recommended OR and other ancillary services be accepted by the IESO under Model 2	The ability of Model 2 to provide ancillary services will be clarified during the design phase for foundational models.

Feedback	IESO Response
given that the IESO controls the qualification process and can audit and verify performance.	Model 2 makes a number of simplified modelling choices in order to make it viable as an easy to implement model. While the hybrid facility may physically be capable of providing ancillary services, these modelling choices limit the visibility and control the IESO would have for such a facility, which may or may not inhibit their implementation into existing tools and market rules for the purposes of offering all ancillary services.

Participation Models

"If the implementation of both participation models is desirable from a stakeholder perspective, can stakeholders provide further clarity on: 1) scenarios when ISM+G Model are used in preference of the Single Resource model; 2) scenarios when Single resource model is used in preference over ISM+G Model."

Three stakeholder submissions included specific commentary on scenarios where either the ISM + G Model (Model 1) or Single Resource Model (Model 2) would be preferred over the other. A key theme throughout focused on flexibility, while one submission pointed out the Global Adjust charge with Model 1 as an economical impediment. The following table summarizes these points.

Feedback	IESO Response
CanREA noted the preference for one model over the other will depend on the preferences of the individual market participant and the details of the particular project. Some participants may see value in using the IESO storage participation mechanisms via the ISG+M model while others will see more flexibility in the ability to use the Single Resource model.	This is one of the key considerations for why the IESO will proceed with the implementation of both foundational models.
ESC recommends providing flexibility to market participants to choose their desired configuration where possible, and stated that it is common for market operators to provide such flexibility (e.g., ISO NE and CAISO each provide both co-located hybrids and integrated hybrids.)	Given the strong preference and valuable feedback expressed by stakeholders, the IESO will proceed with the implementation of both foundational models with updates to the models provided at the next stakeholder engagement session in December.

Feedback	IESO Response
Evolugen stated that if the ISM+G Model 1 is subject to Global Adjustment when charging from the grid, then only the Single Resource Model (Model 2) will make sense economically for developers.	As per the prior response, there are Global Adjustment implications with both models under the current regulatory framework. For the ISM + G model, the storage resource (whether it charges from the onsite generation or from the grid) would be subject to the existing process for Global Adjustment. During the base period, it would qualify as a Class B Energy Storage Facility and effectively pay GA on its losses only. After the base period, it could qualify as a Class A Load and be charged GA based on its peak demand factor. The exact language regarding GA applicability to storage resources can be found in Ontario Regulation 429/04. For the Single Resource Model, the combined facility cannot qualify as Class B Storage or a Class A Load and thus, would be subject to full GA in any instances where it charges from the grid. No GA would be applicable in instances where it charges from the onsite generator as this charging is done behind-the-meter. Developers would have to do their own analysis taking into account the installed capacity of their generation and storage assets, the overall size of their interconnection and the frequency with which they plan on charging from the grid or from their onsite generation to determine which model is more appropriate for their facility.

General Comments/Feedback

All stakeholder submissions included additional and/or expanded general comments for consideration. These points are summarized in the table below.

Feedback	IESO Response
CanREA • Both models presented by the IESO provide a viable opportunity for hybrid resources to participate in the Ontario market. Neither	Given the strong preference and valuable feedback expressed by stakeholders, the IESO will proceed with the implementation of both foundational models with updates to the models

Feedback	IESO Response
model requires extensive efforts from the IESO or adds excessive costs to implement. Therefore, the IESO should pursue implementation of both hybrid participation models to allow market participants the opportunity to choose the participation model that best suits their corporate and project needs. Developing both models provides the best opportunity to maximize investment in hybrid projects and contribute the associated system benefits.	provided at the next stakeholder engagement session in December.
The Consortium, with respect to the June 23, 2021 Hybrid Integration Project presentation • In reference to the data presented on slide 8, reiterated request for the IESO to provide similar data and information for hybrid projects within connection queues in the markets administered by: IESO; NYISO; PJM; and SPP, with explanations why material deviations in the volume of developing hybrid projects may exist from market to market. • In reference to the points on slide 23 summarizing the initiated research, requested more information regarding related research within future engagement meeting in 2021.	Slide 8 of the June 23rd presentation contains hybrid connection queue information for NYISO, PJM and SPP. The IESO currently does not have any hybrid projects in our interconnection queues. The reason why there are material deviations from market to market are due to different system needs, market conditions, and environmental characteristics which drive much different outcomes Given the large amount of material that will need to be covered regarding the foundational models during the final stakeholder engagement in 2021, updates regarding hybrid research activity will be provided in future 2022 engagements to prioritize critical work on the hybrid foundational model.
ESC • We commend the IESO on taking this initiative to outline the next steps and provide foundational models for the market to consider. We understand that the IESO's foundational models are not necessarily the "ideal state" given the IESO's current dispatch tools and network model, and that Model 1 and Model 2 are meant to be compatible with the IESO's current suite of	Work on "long-term" or "enhanced" hybrid models will take place next year as part of the Hybrid Vision Design work phase, which will be conducted in parallel with the design phase for the hybrid foundational model. The visioning work will look at more enhanced hybrid participation models as well as quantify the benefits these model can provide to the system to determine their suitability. It will also

Feedback	IESO Response
tools. IESO is leveraging the Interim Design for energy storage; the Interim Design has certain limitations in that IESO models separately a load and a generator, rather than a single energy storage resource as contemplated in the IESO's Long-Term Storage Design Vision. • In addition to these foundational models proposed, IESO should illustrate the desired future state for hybrid resources upon implementation of the Long-Term Storage Design Vision which models energy storage as a single resource. Despite uncertainty about the timeframe for when the Long-Term Storage Design Vision will be implemented, a view on the "long-term hybrid design" would provide additional confidence to investors. • We request the IESO to provide a timeline considering the upcoming RFPs per the IESO's Resource Adequacy Engagement. Specifically, when will IESO bring forward market rule amendments to implement the foundational hybrid design model? What will happen before MRP and after MRP? What market rules will be in place prior to the Long-Term RFP? • All that said, ESC encourages the IESO to move forward with long-term designs as soon as feasible to ensure that the full value of energy storage resources may realized within Ontario.	provide a holistic view for hybrid participation model implementation across the next decade. For future engagements, the IESO will release a broader Enabling Resources program timeline which will outline the dates for different hybrid and DER work phases and how those dates align with other major initiatives across the IESO including different procurements and MRP.
Essex Energy • I think this is a great topic to be engaging on, and very timely with the available technology coupled with the approaching capacity needs. Thank you for providing the feedback opportunity.	Thank you for the valuable feedback.

Feedback	IESO Response
Evolugen • Please confirm that in both Models, the withdrawal of grid energy to the storage resource would result in Global Adjustment charges.	As per prior responses, there are Global Adjustment implications with both models under the current regulatory framework. For the ISM + G model, the storage resource (whether it charges from the onsite generation or from the grid) would be subject to the existing process for Global Adjustment. During the base period, it would qualify as a Class B Energy Storage Facility and effectively pay GA on its losses only. After the base period, it could qualify as a Class A Load and be charged GA based on its peak demand factor. The exact language regarding GA applicability to storage resources can be found in Ontario Regulation 429/04. For the Single Resource Model, the combined facility cannot qualify as Class B Storage or a Class A Load and thus, would be subject to full GA in any instances where it charges from the grid. No GA would be applicable in instances where it charges from the onsite generator as this charging is done behind-the-meter.