
JANUARY 27, 2022

Hybrid Integration Project: “Day-in-the-Life” – Co-located and Integrated Hybrid Facilities

Webinar Participation (including audio)

- To interact, click the “Show Conversation” icon (message bubble symbol) to submit a written question or click on the “Raise hand” icon (hand symbol) at the top of the application window to indicate to the host you would like to speak
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- This webinar is conducted according to the [IESO Engagement Principles](#)

Agenda

- Hybrids Recap
- Day-in-the-Life
- Market Design Features
- Next Steps

Purpose



- Walk through hybrid participation models using a “day-in-the-life” approach
 - Will provide a baseline understanding of IESO foundational hybrid participation models
 - Include a high-level review of the existing resource models utilized by the hybrids in the renewed market demonstrating that hybrid participation models will closely align with existing resource models
 - Share design considerations and discuss the implications of each hybrid participation model
- Solicit feedback on key design assumptions

Hybrids Recap

- As part of the Enabling Resources Program, the IESO is developing hybrid models to participate in the IESO-administered markets
- The IESO is utilizing two foundational models for its design – 1) Co-located and 2) Integrated
- The IESO plans to engage with stakeholders on a monthly basis until mid-2022 to complete the design for the two hybrid models

Month	Key Activity
Jan 2022	Present “day-in-the-life” participation models
Feb 2022	Present draft design models for stakeholder discussion; discuss feedback
March 2022	Address stakeholder feedback, as required; finalize design models
Q2 2022	Publish Hybrid Design Document

Co-located and Integrated Models

- Hybrid facilities consist of more than one resource/technology (e.g. generation, storage) operating behind a single grid connection point
 - Co-located Hybrid – two or more resources operating independently, mirroring future market participation of each of the individual resource types under MRP e.g. variable generator (VG), storage, etc.
 - Integrated Hybrid – two or more technologies operating as one dispatchable generator resource, similar to a quick start (energy can be provided within 5 minutes from an IESO dispatch instruction, even if not synchronized), and one dispatchable load resource offering net injection or withdrawals with the grid
- The IESO anticipates these models to be primarily used by VGs with storage

Day-in-the-Life Participation



- The foundational hybrid models utilize existing dispatchable generation and storage resource models to clarify how they can participate in the IESO market and facilitate participation in the long-term procurement
- In the upcoming slides the IESO will describe co-located and integrated models at a high level and describe how the individual resources would participate post-Market Renewal Program (MRP) implementation
- This will give stakeholders an indication of the design proposal to be shared in the upcoming engagement session, as well as highlighting some of the key considerations the IESO is working through

Key Market Participant Activities – Day-in-the-Life

- Generally, IESO Market Participants will need to perform the following activities in the daily participation in the energy market

Day Ahead Market (DAM) - Day before the dispatch day

- By 10:00 EPT day-ahead, participants should review market conditions and their facility's capabilities to submit energy bids and offers into the IESO day-ahead market, which determines financially binding schedules for the dispatch day
- The MW quantities submitted by the participant sets the Availability Declaration Envelope (ADE) value for the resource, which is the upper limit of their participation for the next day
- By the afternoon day-ahead (DA), the IESO will publish the DAM schedules; participants should review their results to prepare for the dispatch day

Key Market Participant Activities – Day-in-the-Life 2

Pre-dispatch - from 20:00 EST Day-ahead to right before dispatch hour

- The IESO runs its pre-dispatch market engine hourly to provide updated market information to Market Participants
- Participants should continuously monitor the market (prices, demand, advisory notices, etc.) and their facility's capabilities; reflecting any changes to their energy bids or offers
- For example, if a storage facility is scheduled in pre-dispatch and there is a change in their capability for the scheduled hours, the participant should be updating energy offer quantities

Real-time (RT)

- Participants to follow dispatch instructions from the IESO in real-time

The next section will walk through how the two hybrid models will participate through these market timeframes



Co-Located Hybrid Facility Model

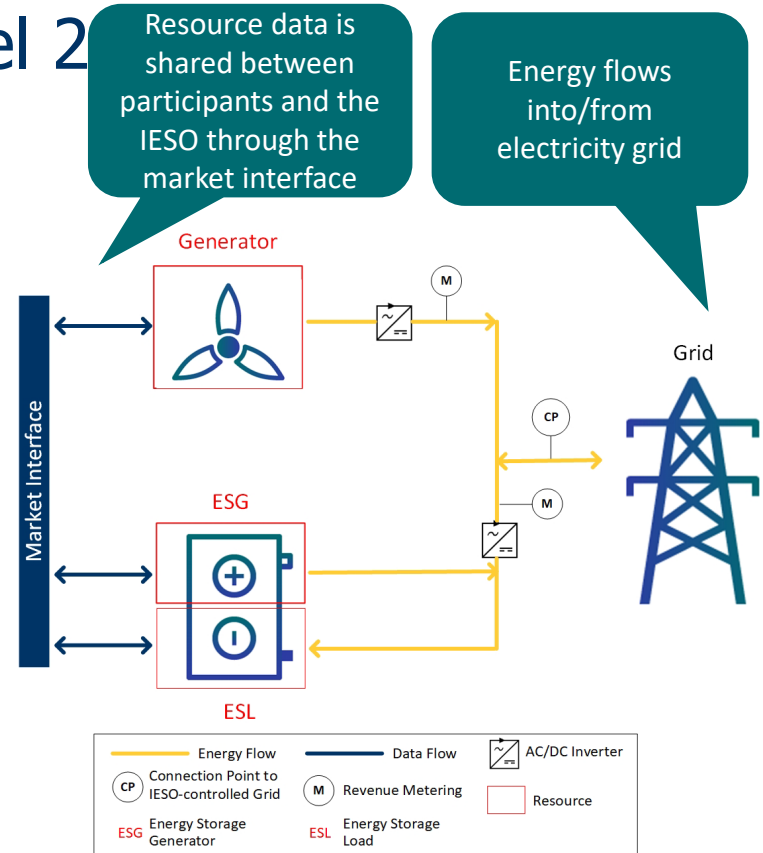
Co-Located Hybrid Facility Model




- This model is a simple way for a participant to increase its capacity value and flexibility to the grid, utilizing existing resource models
- Adding new storage to an existing generation facility (or vice versa) can utilize the same property and connection point to the grid as an existing facility, which may reduce time/cost to add capacity, flexibility & reliability compared to locating at a new location
- Resources using this model are expected to be dispatchable (meet IESO instructions in 5 minutes) and are eligible to participate in capacity, energy and operating reserve markets, as technologies/resource types currently allow

Co-Located Hybrid Facility Model 2

- Each hybrid facility would be registered in the markets as three separate resources:
 1. A dispatchable generator (one resource)
 2. An energy storage resource (two resources)
 - using the interim storage design which models a storage facility as two resources at the same site including 1) a dispatchable load and 2) a dispatchable generator
- Three resources would bid/offer into the market separately (one from the generator resource and two from the storage resource) and be settled separately





Example of Individual Resource Participation in a Co-located Hybrid Facility – Generation

Co-located – Generation Resource



- For a co-located hybrid facility, the generator resource would utilize an existing generator model (e.g. VG, quick start) and participate independent of the storage resource
- For example, a co-located hybrid using a VG resource will continue to participate as it would under MRP, utilizing centralized wind forecasting in energy market participation post-MRP, but can alternatively use their own forecast in the DAM
- Since VG resources do not have fuel costs, these resources are expected to offer energy at a low marginal cost (e.g. \$0/MWh)
- VG will need to consider Power Purchasing Agreement (PPA) implications, if applicable

Timeline – Co-located Generation



Day-ahead

Pre-dispatch

Participants submit offers according to their marginal costs to attain financially binding schedule

- DAM must-offer is a typical requirement of fulfilling contractual or capacity auction obligations
- The Availability Declaration Envelope (ADE) obligation is also applicable
- VGs may decide to use IESO centralized forecast or input their own forecast to set their schedules in the DAM

Participants manage offers to reflect resource capabilities and market conditions

- VG resources are economically scheduled, and the quantity evaluated by the Dispatch Scheduling and Optimization (DSO) tool is based on the lesser of the IESO's centralized forecasted value and the VG's energy offer

Timeline – Co-located Generation 2



Real-time

Settlement

Participants deliver upon their IESO schedules

- Generation resources must comply with 5-minute dispatch instructions from the IESO
- VGs generally operate based on ambient conditions, but are also required to follow mandatory dispatch instructions (reduce output) either due to reliability or economics

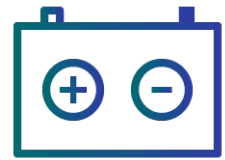
Participants are settled based on DAM position as well as real time injection

- Generators are subject to DAM two-settlement and, if applicable, they should consider the implications of their PPA



Example of Individual Resource Participation in a Co-located Hybrid Facility – Storage

Co-located – Storage



- The storage resource in a co-located hybrid facility utilizes the existing storage resource model - a dispatchable generator and dispatchable load
- Storage resources are fully dispatchable and can pursue opportunities to shift energy consumption and be available for flexibility needs
- Storage resources need to manage their state-of-charge (SoC) and reflect capability through their own participant-managed energy bids/offers

Market Timeline – Co-located Storage



Day-ahead

Pre-dispatch

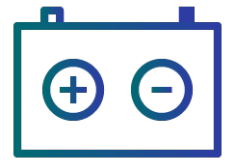
Participants submit 1) bids for charging from the grid; and 2) offers for injections to the grid

- Bid/offer into the DAM at marginal cost, establishing the ADE for real-time market and fulfilling any contractual or capacity obligations
- All charging is managed by the participant through the IESO market interface with market bids

Participant bids and offers are adjusted to reflect resource capabilities and market conditions

- Considering energy limitations, and managing SoC, storage can update their bids and offers in mandatory window (within two hours of the start of the dispatch hour) due to SoC changes that occur during that period

Market Timeline – Co-located Storage 2



Real-time

Settlement

Participants deliver upon their IESO schedules

- Inject or withdraw/charge according to 5-minute dispatch instructions from the IESO

Participants settled based on DA position as well as RT injection or withdrawal

- Will be settled separately for the generator and load resource
- Uplifts and global adjustment (GA) are applicable to a storage resource when withdrawing/charging from the grid as a load

Design Considerations – Co-Located



- Considering these resources will primarily be operating under existing resource models, with limited to no dependencies between the resources, there are limited design considerations required through the energy market
- Further details on the applicability of GA Regulation will be provided
- The hybrid facility design will provide transparency and clarity for participants and the IESO regarding the combination of storage, generation, and/or load resources that operate independently of each other but behind the same connection point



Integrated Hybrid Facility Model

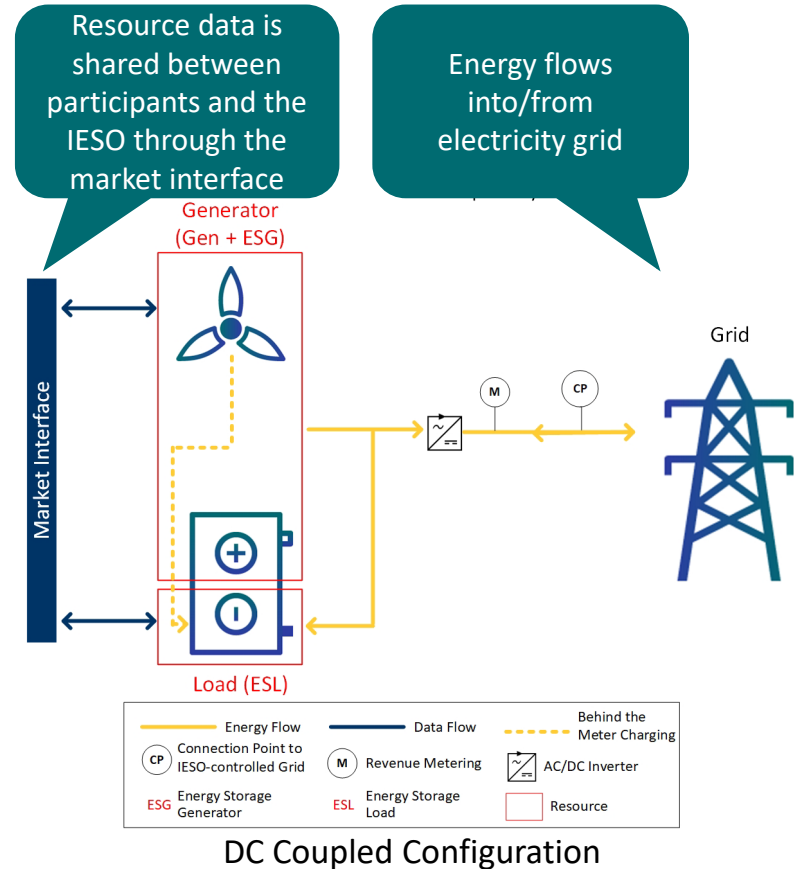
Integrated Hybrid Facility



- Integrated hybrid facility model utilizes storage technology for greater participant control, improving capability and optimizing performance
 - Storage technology paired with an existing generator can provide steadier, more predictable, and faster output capturing more opportunities while helping the grid address energy, flexibility and capacity needs
- Participants are better able to manage their energy bids and offers to decide when and how much to inject and withdraw
 - Flexibility to decide when to inject and when/how to charge from the facility (behind-the-meter) or from the grid
- Will be able to participate in capacity, energy and OR

Integrated Hybrid Facility 2

- Registered in the markets as two separate resources:
 - A generator resource registered together with a storage resource and represented as one larger generator resource, resulting in a new combined quick start generation facility at a single connection point with a single offer into the market
 - A dispatchable load resource used to allow charging from the grid
- Market participant responsible for managing all aspects of their energy offer/bid and forecasting



Timeline – Integrated



Day-ahead

Pre-dispatch

Participants submit 1) bids for charging from the grid; and 2) offers for injections to the grid

- Can submit multiple bid/offer laminations for a single generator (combined generator technologies) and a single load (storage load) to reflect price sensitivities
- Offer quantity and prices are reflective of costs, and also establish the ADE and fulfills any contractual or capacity obligations

Participant adjusts bids and offers to reflect resource capabilities and market conditions

- Load and generator can update bid/offer into the real-time market, up to ADE quantity in order to pursue energy and OR opportunities for the load and generator
- Bids and offers need to be updated before the mandatory window except for storage SoC reasons where changes are allowed until real-time

Timeline – Integrated 2



Real-time

Settlement

Participants deliver upon their IESO schedules

- Inject or withdraw/charge according to 5-minute dispatch instructions from the IESO
- Participant will use the combination of generator and storage to meet the dispatch instructions

Participants settled based on DA position as well as RT injection or withdrawal

- Separate settlement for combined generation resource and load resource
- Uplifts and GA are applicable to the load resource when withdrawing/charging from the grid

Design Considerations - Integrated Model



- Combining technologies to develop one generation resource and load for an integrated hybrid model could result in numerous dependencies and interactions among the technologies that the IESO will need to consider through its design
- Further details on the applicability of GA Regulation will be provided
- The hybrid facility design will provide transparency and clarity for participants and the IESO regarding the combination of storage, generation, and/or load resources that operate as one dispatchable generator resource and one dispatchable load resource behind the same connection point

Approach Recap – Foundational Models

- The two hybrid participation models are based on existing IESO resource types
- The IESO will leverage how these existing resource types currently operate in its market design as the starting point in this design work, where it makes sense
- The key areas of design are:



Market Design Features



Key design elements to be addressed as part of the design phase:

Design Module	Design Element
Capacity Participation	<p>How will qualified capacity be calculated for hybrid facilities?</p> <p>How will capacity obligation performance be assessed?</p>
Authorization and Registration	<p>How will prudential security be calculated?</p> <p>Is a new class of market participant required for hybrid facilities?</p> <p>What are the requirements for connection assessment?</p> <p>Are there any new data requirements for facility registration?</p> <p>What is the minimum size for the resources comprising the facility?</p> <p>Is a minimum ratio of generation to storage needed?</p> <p>How will the resources under the hybrid facility be metered?</p>

Market Design Features 2



Design Module

Design Element

Energy and Operating Reserve Market Participation

How will the hybrid facility participate in the energy and operating reserve markets from DAM to RTM?

Is there any new dispatch data required for a hybrid facility?

Do the hybrid models have any unique consideration for market power mitigation?

Settlement

How do global adjustment and uplift charges apply?

Are there any other settlement implications?

Application of DAM two-settlement and make whole payments?

Next Steps



- The IESO will be bringing forward the high level design at the February meeting
- The IESO will use stakeholder feedback from this meeting to facilitate additional discussion

Stakeholder Feedback



- IESO questions:
 - Did you see any concerns from a participation perspective for co-located or integrated facilities?
 - Are there any dependencies between resources or technologies that make up the hybrid models that the IESO should be accounting for?
- Please use the feedback form found under the January 27, 2022 entry on the [Hybrid Integration Project webpage](#) to provide feedback and send to engagement@ieso.ca by February 17, 2022
- The IESO is able to meet with stakeholders to clarify information presented today, as well as discuss specific participant questions

IESO Available Information



- Additional details on existing participation models that were used for the “day-in-the-life” presentation can be found through the following links
 - VG generation and quick-start generation participation
 - MRP high level and detailed design documents - <https://www.ieso.ca/en/Market-Renewal>
 - Storage participation – Interim storage design and long term design vision - <https://www.ieso.ca/en/Sector-Participants/Engagement-Initiatives/Engagements/Completed/Energy-Storage-Advisory-Group>

Thank You

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