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Enabling Resources : Hybrid Integration Project Foundational Models

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Agenda

1. Reviewing Stakeholder Feedback
2. Hybrid Foundational Participation Models – Final
3. Foundational Models - Market Design & Integration
4. Foundational Models – Long-term Procurement Considerations

Summary

- IESO and stakeholders have worked together since June to identify and evaluate potential foundational models for hybrids that balance unlocking sufficient capability to enable robust competition in near-term Resource Adequacy procurements with implementation risk and resource requirements
- Based on this evaluation and input, the IESO will move forward with the implementation of two foundational models: 1) Interim Storage + Generator; 2) Single Resource with Dispatchable Load (aka Integrated Hybrid Model)

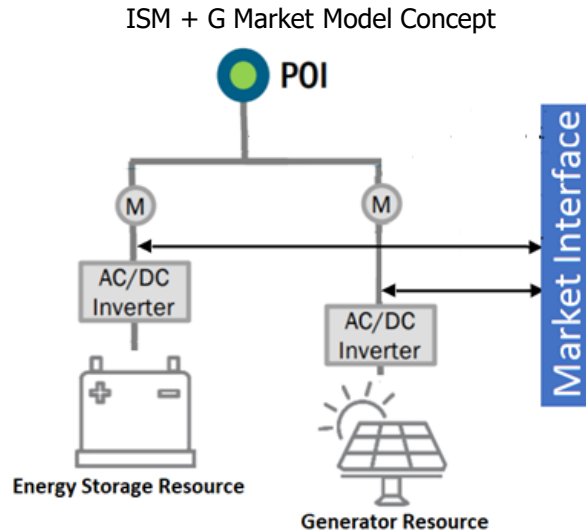
September Stakeholder Engagement Feedback Summary

Common Themes/Input	IESO Response
Unanimous support for implementing both foundational models	The IESO will proceed with the design and implementation of both foundational models.
Clarity around the eligibility of ancillary services	Both foundational models will move immediately to the design phase where many of the details regarding ancillary services will be clarified.
Clarity around the treatment of Global Adjustment (GA)	GA application is determined by regulation; the IESO will share this feedback with the Ministry of Energy for their consideration.

Recap: Two Potential Foundational Models

- The next few slides recap the two potential foundational models that the IESO has originally short-listed: 1) Integrated Storage + Generator and 2) Single Resource Model w/ Non-Dispatchable Load (NDL)
- During further review of the Single Resource Model w/ Non-Dispatchable Load (NDL) model, the IESO identified a significant limitation on the ability of the model to enable charging from the grid; the IESO has identified and evaluated a variation of this model that will eliminate the constraint

Review: Interim Storage Model + Generator Resource (ISM+G)

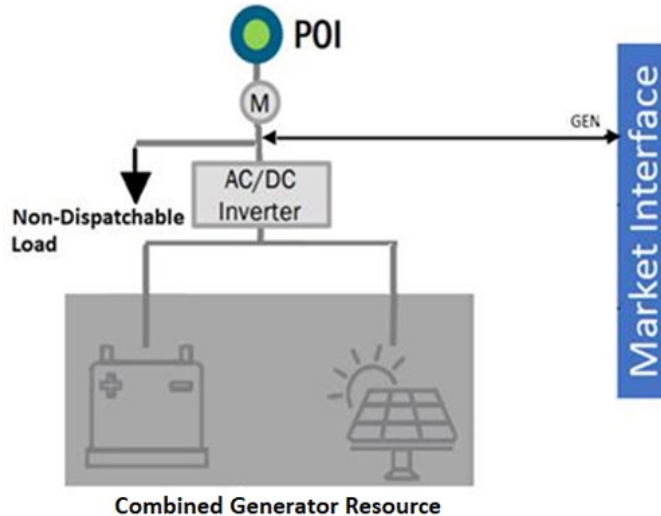


POI = Point of Interconnection to IESO-Controlled Grid
M = Revenue Metering

- 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
- 3 resources would bid/offer into the market separately (1 from the generator resource and 2 from the storage resource) and be settled separately

Review: Single Resource w/Non-Dispatchable Load (Risk Identified)

Single Resource w/ NDL Market Model Concept

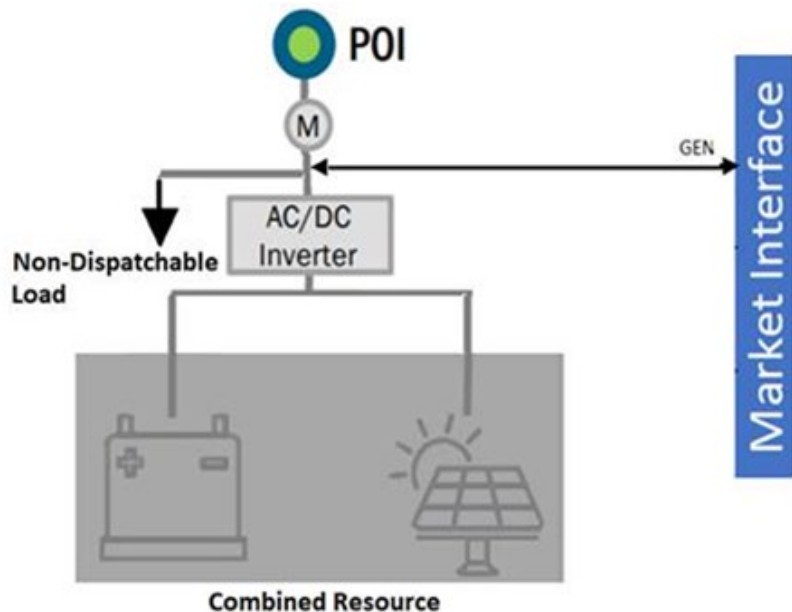


POI = Point of Interconnection to IESO-Controlled Grid
M = Revenue Metering

- Generator resource registered together with 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
- Implementation is simplified by the **market participant being responsible for managing all aspects of their energy offer and forecasting**
- Non-dispatchable load at the site used to **allow charging from the grid**

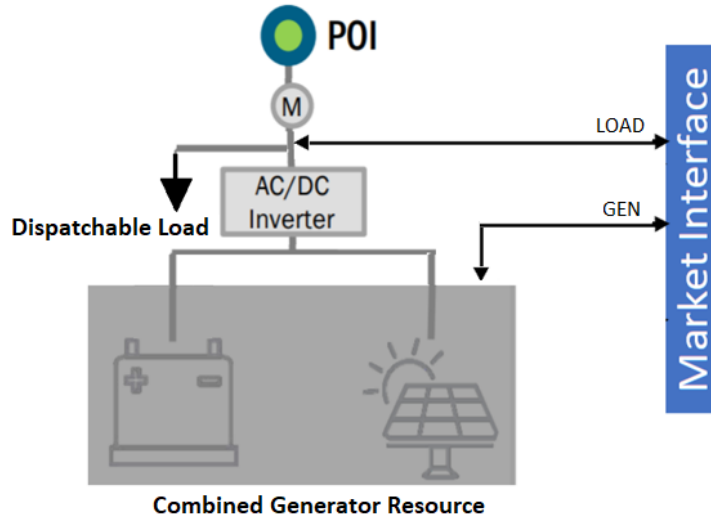
Hybrid Non-Dispatchable Load (NDL) Issue

- Hybrid charging would not necessarily follow a daily pattern like other NDLs that the market information system (MIS) is designed to handle
- Regardless of whether or not the hybrid is charging, MIS will assume there is a load withdrawing energy at a value determined by the load predictor
- When the hybrid injects, MIS does not know that the NDL should be zero
- In the day-ahead and pre-dispatch timeframes, these errors will act similarly to demand forecast errors and can impact market efficiency (incorrect unit commitment and pre-dispatch nodal pricing)



Revised: Single Resource w/ Dispatchable Load (Integrated Hybrid Model)

Integrated Hybrid Market Model Concept



POI = Point of Interconnection to IESO-Controlled Grid
M = Metering

- Each hybrid facility would be registered in the markets as two separate resources:
 1. 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
 2. A dispatchable load resource used to **allow charging from the grid**
- Implementation is simplified by the **market participant being responsible for managing all aspects of their energy offer/bid and forecasting**
- No overlapping of bids and offers

Technical Comparison of the Two Foundational Models

	Interim Storage + Generation	Integrated Hybrid
Registration	<p>Modelled as 3 separate resources</p> <ul style="list-style-type: none"> • Energy storage = (1) Dispatchable Generator + (2) Dispatchable Load • Generator = (3) Dispatchable Generator 	<p>Modelled as 2 separate resources</p> <ul style="list-style-type: none"> • Energy storage (injection) & Generator = (1) Large dispatchable generator • Energy storage (charging) = (2) Dispatchable Load
Bids/Offers	<ul style="list-style-type: none"> • Energy storage will submit offer for injection and a bid for charging • Generator will submit an offer for injection • State of charge for storage managed by participant through bids and offers 	<ul style="list-style-type: none"> • The large generator will submit an offer that represents net energy injection of the facility • The energy storage will charge via bid as a dispatchable load • State of charge for storage managed by participant through bids and offers
Settlements	<ul style="list-style-type: none"> • One settlement for each resource (3 settlements total) 	<ul style="list-style-type: none"> • One settlement for large generator and one settlement for charging
Forecasting	<ul style="list-style-type: none"> • Continued use of IESO's centralized forecasting for variable generators 	<ul style="list-style-type: none"> • Participant manages their own forecasting to determine their dispatchable generator offer



Foundational Models: Market Design & Integration

Market Design and Integration Phase

- The next phase of the Hybrid Integration Project (HIP) is to develop the market design for the two foundational hybrid models, providing clarity on how each model will participate in the IESO-administered markets
- The IESO targets to provide clarity on the key design elements by the end of Q1 2022 and publish the design document by the end of Q2 2022
- Key deliverable is the design document for the co-located and integrated hybrid models

Approach

- The design and integration of the two hybrid models will be organized in a chronological “bid-to-bill” format
- This engagement will work in close alignment and coordination with the Long-Term Procurement engagement, which will address procurement-related questions
- Plan to engage stakeholders on a monthly basis, with more focused discussions available, as needed
- Models will be designed in alignment with the Market Renewal Program: locational marginal pricing, day-ahead market, enhanced real-time unit commitment, and market power mitigation

Approach – 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:



Foundational Model #1 - Co-Located Hybrid

- The co-located model is a simple way to add incremental capacity and flexibility value to existing generation resources
- The Co-located Hybrid model is the combination of two independent facilities operating from the same connection point
- Co-located hybrid will be a combination:
 1. Dispatchable generator (e.g. variable generator); and
 2. Interim storage resource (i.e. dispatchable generator, dispatchable load), operating independently

Foundational Model #2 - Integrated Hybrid

- The integrated hybrid model provides the opportunity for participants to optimize their resource's capabilities and output as they see fit
- For the IESO, this integrated model can provide fast and predictable output, helping address energy, flexibility, and capacity needs
- Integrated hybrid resource will be a combination of:
 1. Dispatchable "quick start" generator; and
 2. Dispatchable load (used for charging from the grid)

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>

Market Design Features – cont'd

Design Module

Design Element

Authorization and
Registration (cont.)

How will the resources under the hybrid facility be metered?

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?

January Stakeholder Day

- Present foundational design models using a “day in the life” approach
- Review how existing resource types (variable generation, interim storage, quick start) will participate in the renewed market from day-ahead through the pre-dispatch to real-time, and settlement
- IESO is interested in understanding the practical implications of each approach
 - e.g. the future role of centralized wind forecasting
- Solicit feedback on key design assumptions

Timelines

- 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
Dec 2021	Introduction and overview of Design Phase
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 Design Document



Foundational Models: Procurement

Adam Butterfield

Senior Manager, Resource Development and Procurement

Foundational Models – Procurement Considerations

- As development begins towards the Long-Term (LT) RFP, the IESO has begun to assess the potential applicability of the foundational models to the procurement. The foundational models are anticipated to apply to the LT RFP in two distinct scenarios:

Co-Located Hybrid

- Should existing resources with active contracts during the LT RFP commitment period be eligible to participate, the IESO believes the Co-Located Hybrid model to be preferred from a procurement and contracting perspective.
- Would allow contracting with a new storage resource through the LT RFP, while maintaining the existing resource's active contract.

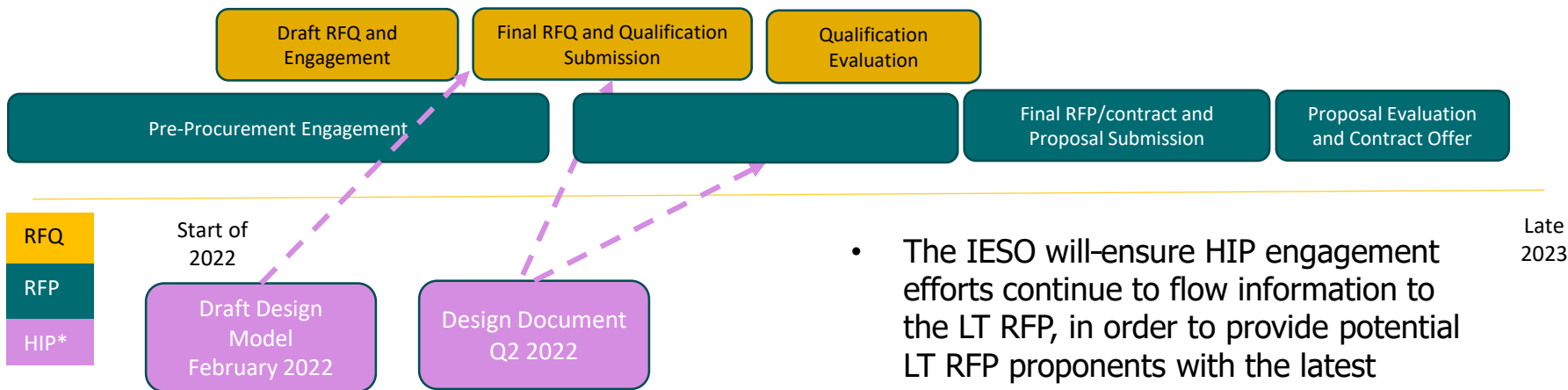
Integrated Hybrid

- For existing off-contract resources and new-build resources eligible to participate in the LT RFP, the IESO believes the Integrated Hybrid model to be preferred from a contracting perspective.
- Would allow a single contract for the entire hybrid resource.

Foundational Models – LT RFP Considerations

- As the IESO continues to develop the design elements for the LT RFQ and RFP, input from the Hybrid Integration Project will help inform the procurement criteria and contracting requirements
- The IESO will be engaging with stakeholders on the core RFQ design elements and criteria in the first quarter of 2022; in the meantime the IESO will provide stakeholders with information to define the need in the same period

Foundational Models – LT RFP Timing



- The IESO will ensure HIP engagement efforts continue to flow information to the LT RFP, in order to provide potential LT RFP proponents with the latest information.

*HIP: Hybrid Integration Project

Stakeholder Feedback Requested

- Does the content presented today reflect your understanding of the market design work required for the foundational models?
- Are there any elements to the market design work missing?
- Indicate if you would like to set up a one-on-one call with the IESO team to discuss specific concerns with the Market Design work.
- What are stakeholders thoughts with regards to the procurement considerations for the foundational participation models?
- Please use the feedback form found under the December 2021 entry on the [Hybrid Integration Project webpage](#) to provide feedback and send to engagement@ieso.ca by January 10, 2022

Next Steps

- 2022 Monthly Stakeholder engagement sessions for Hybrid Market Design work
- Enabling Resources: Hybrid Vision Work and cost-benefit analysis for Enduring participation models to continue in 2022

Thank You

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