

**JANUARY 2023**

# Hybrid Integration Project: Hybrid Design Vision

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# Overview of Presentation

- Recap of Enabling Resources Program
- IESO Enhanced Model Vision
  - Review of Models
  - Assessment and Results
  - Conclusions
  - Triggering Criteria for Implementation
  - Timelines & Next Steps

# Summary

- This document outlines the IESO's vision for an enhanced electricity market participation models for hybrid resources (storage + generation) that will build on foundational hybrid models currently being implemented
- Based on a benefits analysis and input from stakeholders/interested communities, the IESO will pursue an enhanced co-located model for implementation post Market-Renewal go-live
- The enhanced co-located model is expected to result in financial benefits for ratepayers and significant reliability benefits (for both hybrids and stand-alone storage) that will be important to enabling decarbonization and electrification in Ontario

# Recap: IESO's Enabling Resources Program (ERP)

- ERP is a five-year program to enable emerging resources to provide electricity services in the post-Market Renewable Program (MRP) electricity markets that they cannot fully provide in the current electricity market design; ERP will provide more options for Resource Adequacy
  - ERP is focused on enabling three emerging resource types: 1) hybrids (storage + generation pairings); 2) distributed energy resources (DERs); and 3) storage
- The IESO's development of a vision for an enhanced electricity market participation models for hybrid resources is a key initiative within the ERP (and a 2022 corporate performance metric)

## Recap: ERP Approach

- ERP takes an evolutionary, staged approach to the integration of emerging resources into Ontario's electricity markets
- **Foundational participation models:** will first be established that enable resources to provide required grid services with manageable implementation cost and complexity
- **Enhanced participation models:** will build on foundational models to unlock additional capability with investment of additional resources
- The IESO is currently implementing the co-located foundational hybrid model; this presentation outlines the IESO's vision for a further enhanced hybrid models



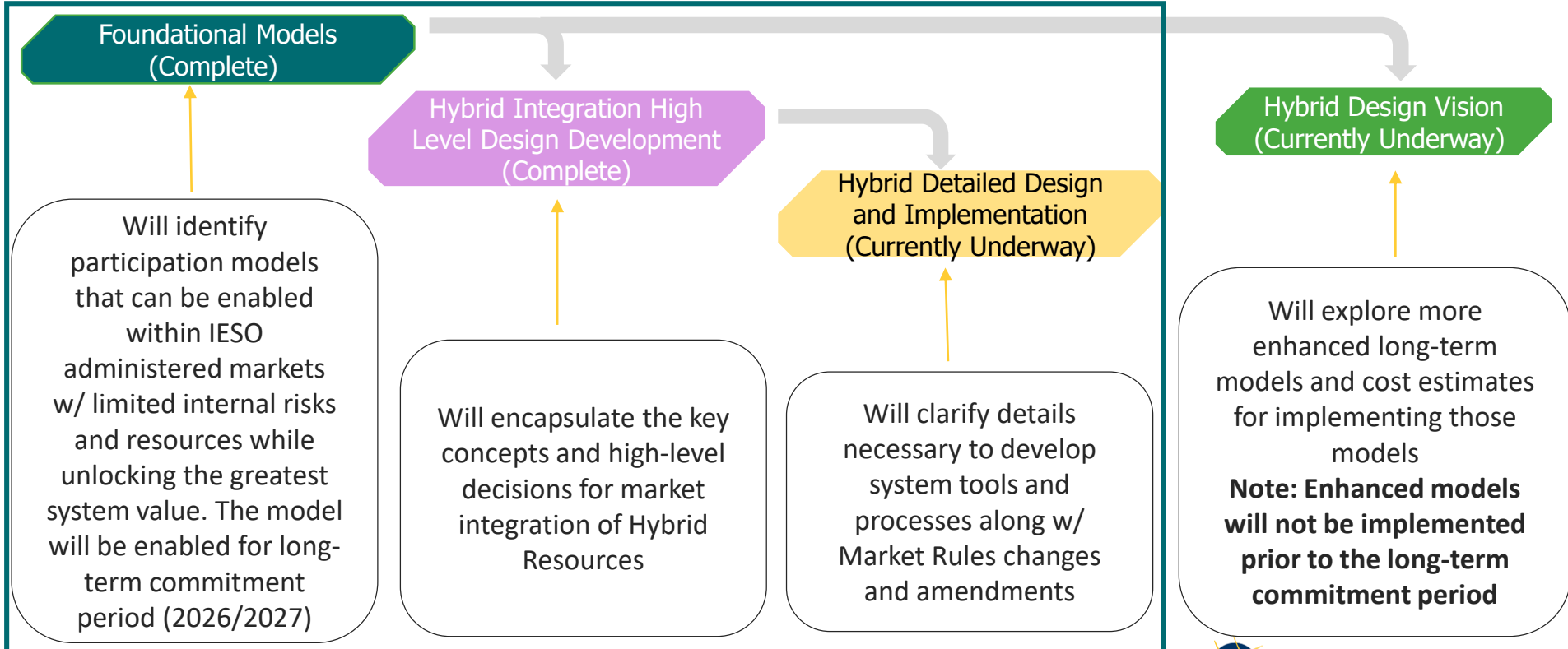
# Hybrid Design Vision & Enhanced Participation Models

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# Review: IESO Hybrid Integration Project Work Stages

## Foundational Models



# Review: Foundational vs Enhanced Hybrid Model Changes

Model	Foundational Model	Enhanced Model
Co-located	<p>Storage modelled with Interim Storage Model:</p> <ul style="list-style-type: none"> <li>• Two resource model with separate bid and offer required from the load and generator resources comprising the storage facility</li> <li>• Market participant manages state of charge through their bids + offers</li> </ul>	<p>Storage modelled with Enduring Storage Model:</p> <ul style="list-style-type: none"> <li>• Single bi-directional resource with single continuous bid-offer curve</li> <li>• State of charge modelled to help manage storage charge/discharge</li> </ul> <p>Ability to model constraints between the generator and storage resource</p>
Integrated	<p>Two resource model with separate bid and offer required from the load and generator resources comprising the hybrid facility</p>	<p>Single bi-directional resource used to model hybrid with a continuous bid-offer curve</p>

# Enhanced Models – Builds on Foundational in Key Ways

Design Element	Description	Benefits/Considerations
<p>1. Model State of Charge of Storage in Dispatch Tools</p> <p>(Enhanced Co-Located and Enduring Storage Models Only)</p>	<p>Ensure that the IESO's dispatch tools have view to level of charge in storage at any point in time</p>	<ul style="list-style-type: none"> <li>• Modeling state of charge in the dispatch tools will ensure that storage resources do not receive an infeasible dispatch instruction (i.e. one they cannot meet because their charge levels would not allow it)</li> <li>• Will enable resource owners and IESO to more efficiently optimize storage charge/discharge cycles in day-ahead and real-time</li> <li>• Will help ensure storage resources can meet their dispatch instructions and better manage their Operating Reserve offers</li> </ul>
<p>2. Single bi-directional resource with single continuous bid-offer curve</p>	<p>Storage resource will be modeled in IESO tools as a single resource that can inject (offer) or withdraw (bid) fluidly and seamlessly</p>	<ul style="list-style-type: none"> <li>• The foundational model repurposes resource types that will be built into the IESO's dispatch tool set defacto as part of Market Renewal; accordingly, storage resources under the foundational models will be modeled as 2 or 3 separate resources (capable of injection (offers) and withdrawals (bids)) which will require additional optimization and coordination in bid/offer strategy; this issue will be solved with the single bid-offer curve provided by the enhanced models</li> </ul>

## Enhanced Hybrid Model Vision – Benefits and Costs

- IESO engaged Electric Resource Power Institute (EPRI) to undertake a benefit analysis of enhanced hybrid models; EPRI modeled impacts on system energy and operating reserve costs, capacity value and other ancillary services of hybrids and storage competing under enhanced vs. foundational models
- Scenario development and modeling was initiated in March, 2022 and assumed scenarios in which 1,000 or 2,000 MW of stand-alone or hybrid storage were developed. Per the Minister of Energy's Oct. 6, 2022 directive, the IESO will procure up to 2,500 MW of storage to be in service by 2027 (accordingly benefits will be reassessed as per actual volumes of storage/hybrids procured)
- For complete details of EPRI's modeling and assumptions please see the compendium document to this vision entitled "Hybrid Resource Participation Model Benefit Assessment"

# Enhanced Hybrid Model Vision – Benefits and Costs

## Key Findings:

- Enhanced co-located model: analysis indicates model would increase hybrid energy output by **at least 4% per year**, resulting in an **annual benefit of \$2.6M/year**
- Enhanced integrated model: little benefit above foundational integrated model (due to the lack of state of charge modelling with either model)
- Implementation costs in the \$11-\$14M range and estimated two years to complete\*

## Enhanced Hybrid Model Vision – Benefits and Costs

- There are significant unquantified reliability benefits associated with the enhanced models that model state of charge
- Ensuring that storage resources (stand-alone or in hybrid configuration) receive feasible dispatch instructions will be increasingly important in a future where we expect to have more storage and hybrid resources
- Enhancements will also help make storage and hybrids more cost-competitive with natural gas generation which will support decarbonization

# Trigger Criteria: To Inform When to Implement Enhanced Model

The following criteria will help inform the IESO's capital planning process to determine **when** to implement the enhanced co-located model

- 1. Mandatory:** Completion of the IESO's Market Renewal Program as a pre-requisite
- 2. Mandatory:** Future procurement of hybrid/standalone storage resource capacity consistent with the values (1000 MW – 2000 MW) assessed by EPRI (per Minister's Oct. 6, 2022 Directive, the IESO is expecting to procure up to 2,500 of storage through procurements currently underway)
- 3. Optional:** Availability of external sources of funding for enhanced storage, hybrid and DER model implementation

**Optional** triggers may expedite when models are implemented after **Mandatory** triggers are met

# Enhanced Vision – Conclusions

1. Continue to implement the foundational hybrid models as planned (implementation of foundational integrated model subject to developer interest).
2. Implement enhanced standalone storage model per IESO's Storage Design Project.
3. Implement the enhanced co-located model (as one larger project with enhanced storage model to save on project costs) using the enhanced storage model as a base.
4. Do not pursue the implementation of enhanced integrated model at this time; this model will be considered during Distributed Energy Resources Market Vision & Design Project for potential to enable different types of DER aggregations.
5. Conduct future benefits assessment which models battery degradation and results from the IESO's Medium and Long-Term RFPs to fine tune EPRI study results.



# Next Steps for Enhanced Hybrid Vision

<b>Date</b>	<b>Deliverables</b>
Throughout 2023	<ul style="list-style-type: none"><li>Finalize criteria and timelines for enhanced model implementation through the IESO's capital planning process</li></ul>
Throughout 2023	<ul style="list-style-type: none"><li>Phase 2 of EPRI study which will re-run the benefits assessment model with the actual Long-Term RFP results and battery degradation costs</li></ul>

# Feedback

Please use the feedback form found under the January entry on the [Hybrid Integration Project engagement page](#) to provide general feedback and send to [engagement@ieso.ca](mailto:engagement@ieso.ca) by February (exact date TBD).

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# Thank You

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