
OCTOBER 24, 2022

Hybrid Integration Project: Implementation for Foundational Hybrid Facility Participation Models

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- This webinar is conducted according to the [IESO Engagement Principles](#)

Purpose



- Discuss with stakeholders the implementation timelines for foundational hybrid models and storage uplift allocation changes
- Review the design and implementation requirements to enable the co-located model in the current IESO-administered markets

Agenda

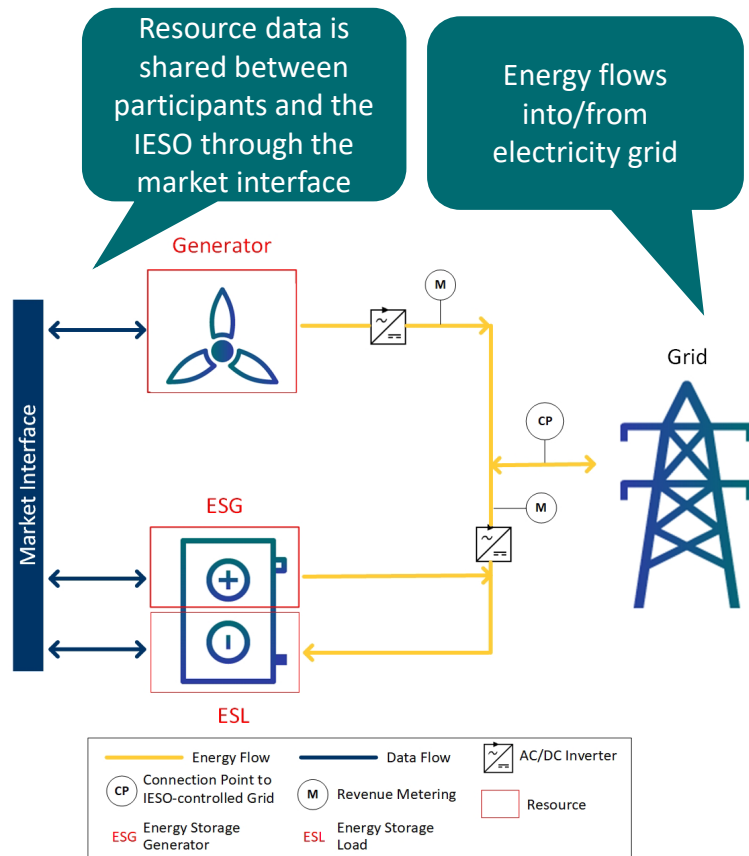
- Project Recap
- Implementation Planning
- Co-located Model in the Current Market: Market Design Decisions, Implementation and Participation
- Next Steps

Project Recap – Market Design

- Over the last year, the IESO worked with stakeholders to develop the foundational design for hybrid models in Ontario
- The market design phase completed the market design for the two foundational hybrid models, providing clarity on how each model will participate in the IESO-administered markets
 - This design was developed in coordination with procurement work, enabling facilities under hybrid models to participate in the Long-Term Procurement using existing resource models for generation and storage
- The design document for the co-located and integrated hybrid models under the renewed market was finalized in early September

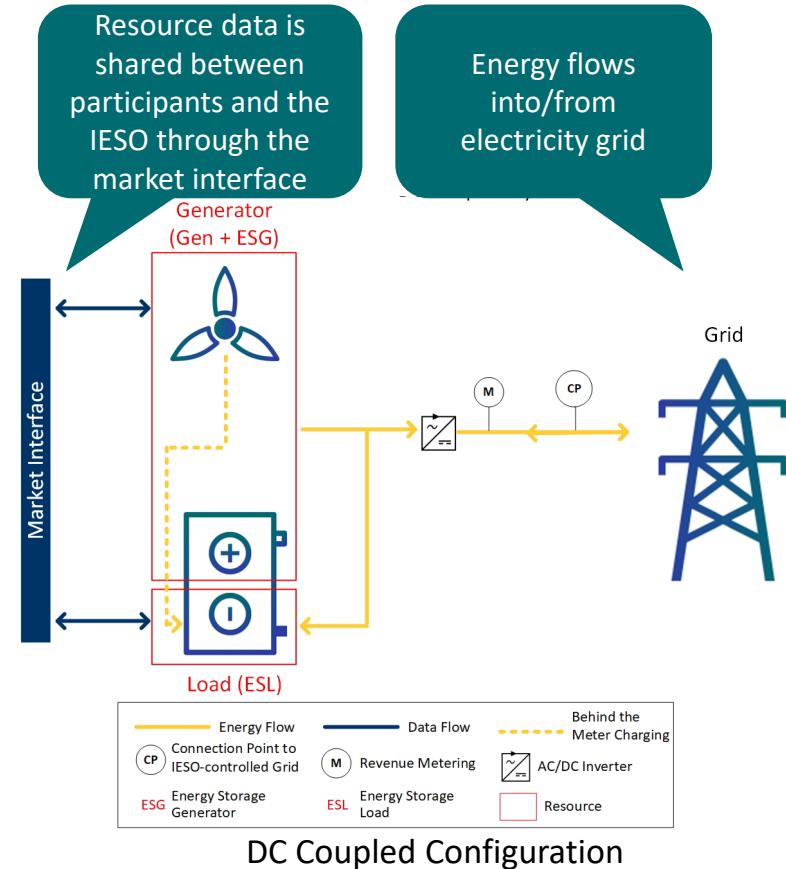
Co-Located Hybrid Model

- Consists of generation and electricity storage facilities, including at least three (3) dispatchable resources:
 1. a generation resource;
 2. a storage injecting/generation resource for discharging storage; and
 3. a storage withdrawing/load resource for charging storage from the grid.
- The facilities and associated resources will be located behind a single connection point to the grid, but the resources will participate separately in capacity, energy and operating reserve (OR) markets, as allowed for the technology type.



Integrated Hybrid Model

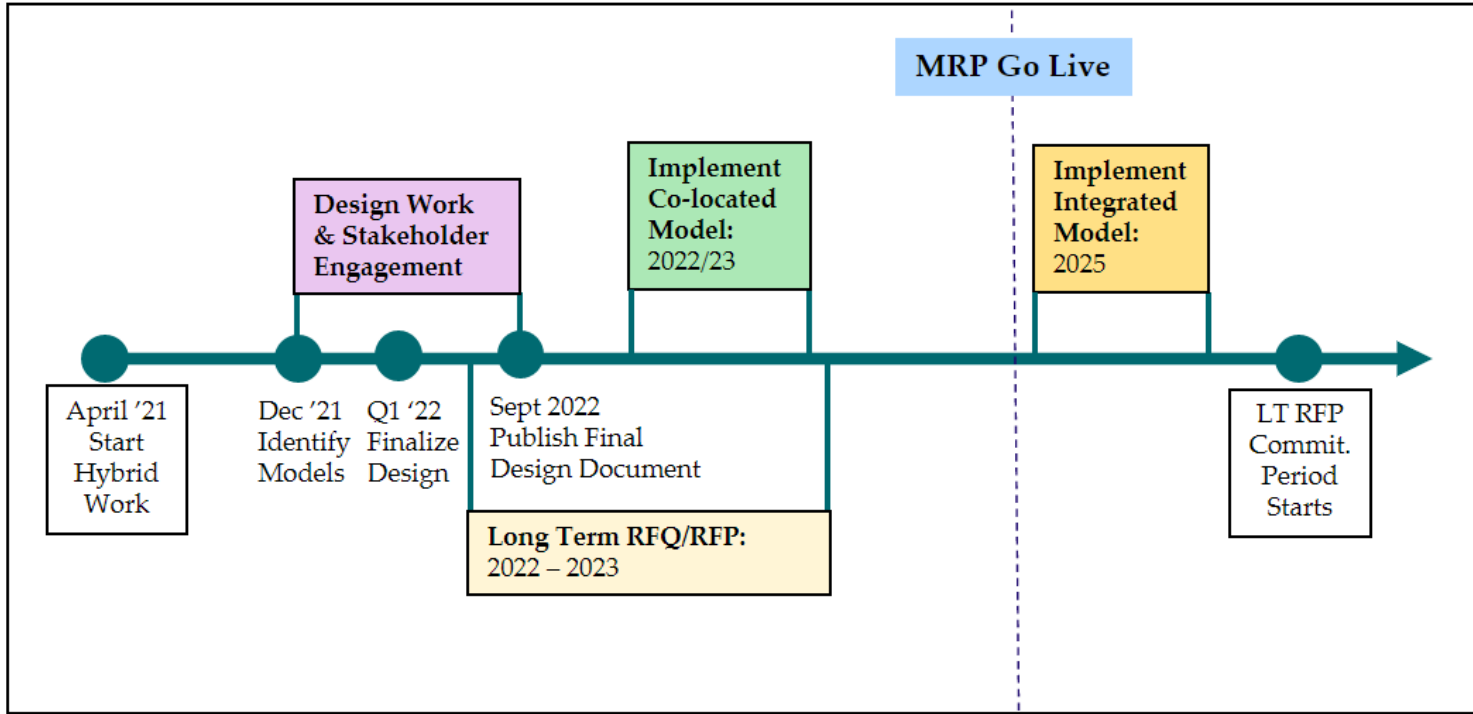
- Consists of generation and electricity storage facilities, including at least two (2) dispatchable resources:
 1. a combined quick-start generation resource (generation and storage injections), and
 2. a storage withdrawing/load resource for charging storage from the grid.
- The facilities and associated resources will be located behind a single connection point to the grid, but the resources will participate separately in capacity, energy and operating reserve (OR) markets, as allowed for the technology type.



Implementation Planning

- Stakeholders have requested that the IESO implement the hybrid models as soon as possible
 - Co-located model has limited impacts on governing documents and no tool impacts, so the IESO is able to implement by mid-2023, prior to MRP go-live
 - Integrated model has greater complexity/impacts due to the combined generation resource; due to resourcing constraints, this model will be implemented as soon as possible following MRP implementation to meet procurement timelines
- Uplift allocation changes for storage will also be implemented asap post MRP go-live, deferred due to resourcing constraints; until then, uplift exemptions may apply for storage under contracts, outside of the IESO-administered markets

Timeline for Hybrid Integration Project - UPDATED





Co-located Model: Design for Current Market

Capacity

Design Element	Highlights
Capacity Qualification	<ul style="list-style-type: none">• For procurements or capacity auctions (CA) that use unforced capacity (UCAP) methodologies for qualifying capacity, the IESO foresees using UCAP for each resource of the hybrid (storage and generation)• Until UCAP methodologies are used for qualifying capacity for procurements or CA, the prevailing methodology used in the CA will apply, subject to procurement terms:<ul style="list-style-type: none">• Participant submits the maximum quantity of capacity that they can reliably provide; this quantity establishes the enrolled capacity for the CA• An availability de-rating factor is not applied• Note: Variable generation is not eligible for participation in CA currently
Performance Obligation Assessment	<ul style="list-style-type: none">• Energy must-offer and/or availability / capacity performance obligations will be specified in relevant procurement mechanism, aligning with underlying technology characteristics

Authorization and Registration (1)

Design Element

Design Decision

Registration and Class of Market Participant (MP)

- There must be only one Registered MP (RMP), one Metered MP (MMP) and one Operator across all resources
- The Owner can be the same or different across resources, except storage resources need to have the same Owner
- The RMP, MMP, Operator and Owner can be different entities from each other
- Obligation of MP to ensure compliance with all applicable OEB requirements; however, IESO expects MP will be able to participate under existing OEB generator/storage licenses

Prudential Security (PS)

- No changes required to PS framework: there will be resource-specific assessments, but total security is assessed at MP level
 - No security is expected (subject to GA treatment) for hybrids since it is likely to have net injections

Facility Registration

- All resources will be dispatchable

Authorization and Registration (2)

Design Element Design Decision

Connection Assessment & Approval (CAA) including System Impact Assessment (SIA)

- No change to CAA process; facilities under a hybrid model will require an SIA as per the existing process
 - CAA is required when a new resource is added at connection point
 - Complexity of assessments depends on various factors such as type of new equipment, size of potential load, combined output of the facility
 - Additional technical & performance requirements will be identified during SIA
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Resource Size

- Maintain status quo minimum capacity of 1 MW for generation resource and 1 MW for storage resources (for both storage injecting/generation resource and storage withdrawing/load resource); therefore, the hybrid model must have at least 2 MW of injecting/generation capability.
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Revenue Meter Registration

- No change to revenue meter registration process, rules or manuals
 - Separate meters for storage and generator, no change
-

Grid and Market Operations

Design Element

Design Decision

Dispatch Data and Other Data Inputs

- No changes to dispatch data, dispatch data revision rules, data inputs or outage process
 - All resources that wish to participate in real-time must bid/offer into the day-ahead commitment process (DACP), setting the availability declaration envelope (ADE)
 - Storage charging must be dispatched through the market
 - IESO requires resources to accurately reflect their capability in their bid/offer, noting:
 - all resources are allowed to make changes in mandatory window for forced outage;
 - reduction in bid/offer quantity in mandatory window is allowed for storage state-of-charge; and
 - variable generation (VG) allowed to operate based on ambient conditions in real-time, while also following mandatory dispatch instructions to reduce output when required
- Where none of the facilities is providing contracted ancillary services or OR, total net injections & withdrawals for all facilities under an RMP at a connection point must be within the MAQ
- Where one or more of the facilities is providing contracted ancillary services or OR, the sum of all energy offer or bid quantities for all facilities under an RMP at a connection point must be within the MAQ

Market Settlement

Design Element

Design Decision

Settlement

- No changes are required; each resource is subject to separate settlement

Uplift Charges

- No change; uplifts are applicable to energy withdrawn from IESO controlled grid

Global Adjustment (GA)

- No impacts or changes
 - As per the Ontario Regulation 429/04, GA is applicable to all load facilities including the storage charging from the grid
 - Load may be Class A, where GA charge is based on a “peak demand factor”, or Class B, based on a \$/MWh rate for all withdrawals
 - Storage is treated as Class B; however, a facility may be treated as Class A once eligibility is determined during the first base period
 - Class B Storage may be reimbursed for injections into the grid, as per the regulation



Co-located Model: Implementation in Current Market

Current Market Rule: Chapter 7, Section 3.5.6

- Chapter 7, Section 3.5.6 ensures that an individual facility bids or offers energy considering registration data, participant estimates and the maximum allowed quantity (*MAQ) in section 3.5.6.3.

* The "MAQ" in subsequent slides refers to the maximum allowed injection (for an energy offer) or withdrawal (for an energy bid) through the relevant connection point.

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|---------|--|
| 3.5.6 | The largest quantity in any <i>energy offer</i> or <i>energy bid</i> for any <i>dispatch hour</i> must be at least 1.0 MWh but shall not exceed the lesser of: |
| 3.5.6.1 | the maximum output of <i>energy</i> in an hour indicated in the registration information for the relevant <i>registered facility</i> ; |
| 3.5.6.2 | the maximum quantity of <i>energy</i> that can be supplied (for an <i>energy offer</i>) or taken (for an <i>energy bid</i>) in that <i>dispatch hour</i> by the <i>registered facility</i> , as estimated by the <i>registered market participant</i> for that <i>registered facility</i> ; or |
| 3.5.6.3 | the maximum allowed injection (for an <i>energy offer</i>) or withdrawal (for an <i>energy bid</i>) in that <i>dispatch hour</i> through the relevant <i>connection point</i> , as limited by the lesser of (i) the capacity of any radial line connecting the <i>registered facility</i> to the <i>connection point</i> ; (ii) the maximum injection or withdrawal as specified in the <i>connection agreement</i> applicable to the <i>registered facility</i> ; or (iii) the maximum injection or withdrawal otherwise permitted by the relevant <i>transmitter</i> . |

Market Rule Amendments (MRA)

- Chapter 7, Section 3.5.6 does not address multiple facilities under an RMP at the same connection point, where total capability may exceed the MAQ
- New market rule Section 3.5.6A will allow an RMP to offer or bid a quantity greater than MAQ for one facility along with an offsetting quantity for another facility so that the total net injections and withdrawals remain within MAQ, as long as no facility provides contracted ancillary services or OR (known together as “ancillary services”)
 - Netting to remain within MAQ is not allowed when ancillary services are provided to ensure the IESO can continue to depend on reliability services
- New market rule Section 3.5.6B will specify that when ancillary services are provided, the sum of all energy offers or the sum of all energy bids must be within MAQ

MRA – Draft Red-lined Changes, New Section 3.5.6A

- The IESO is seeking stakeholder feedback on the proposed market rule amendment; there are no associated market manual (MM) changes required

3.5.6A Where one or more *electricity storage facilities* and one or more other *generation facilities* are all:

3.5.6A.1 connected to the same *connection point*;

3.5.6A.2 registered to the same *registered market participant*, and

3.4.5A.3 none of the *facilities* are providing *contracted ancillary services* or participating in the *operating reserve market*;

section 3.5.6 shall not apply. Instead, the largest quantity in any *energy offer* or *energy bid* for any *dispatch hour* for each *facility* must be at least 1.0 MWh but shall not exceed the lesser of:

3.5.6A.4 the maximum output of *energy* in an hour indicated in the registration information for the relevant *registered facility*;

3.5.6A.5 the maximum quantity of *energy* that can be supplied (for an *energy offer*) or taken (for an *energy bid*) in that *dispatch hour* by the *registered facility*, as estimated by the *registered market participant* for that *registered facility*; or

3.5.6A.6 the maximum allowed injection (for an *energy offer*) or withdrawal (for an *energy bid*) in that *dispatch hour* through the relevant *connection point*, as limited by the lesser of:

3.5.6A.6.1 the capacity of any radial line connecting the *registered facility* to the *connection point*; or

3.5.6A.6.2 the maximum injection or withdrawal as specified in the *connection agreements* applicable to the *registered facilities* or to the maximum injection or withdrawal otherwise permitted by the relevant *transmitter*, calculated as the total net injections and withdrawals for all *generation facilities* and *electricity storage facility* registered to the same *registered market participant* at the same *connection point*.

Design Decision and Scenario (Ch. 7 Section 3.5.6A)

Where none of the facilities are providing contracted ancillary services or OR:

The total net injections & withdrawals for all facilities under an RMP at a connection point must be within the MAQ

Scenario: Generator capability is equal to or greater than the MAQ; storage is added without increasing MAQ.

Therefore, the total injection capability is greater than the MAQ.

e.g., Generator capability of 60 MW, storage capability of 10 MW;

Total injecting capability = 70 MW; MAQ for injections is 50 MW and MAQ for withdrawals is 10 MW

The following bid/offer is allowed:

- Generator offers to inject 40 MW; storage offers to inject 10 MW
- Generator offers to inject 50 MW; storage bids to withdraw 10 MW
- Generator offers to inject 60 MW; storage bids to withdraw 10 MW; in this case, the MP must manage bid/offer such that both resources get scheduled, comply with dispatch instructions, and result in total net injection ≤ 50 MW

The amendment disallows the following:

- Generator offers to inject 50 MW and storage offers to inject 10 MW
 - Generator offers to inject 60 MW and storage offers to inject 10 MW
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MRA – Draft Red-lined Changes, New Section 3.5.6B

- The IESO is seeking stakeholder feedback on the proposed market rule amendment; there are no associated market manual (MM) changes required

3.5.6B Where one or more *electricity storage facilities* and one or more other *generation facilities* are all:

3.5.6B.1 connected at the same *connection point*;

3.5.6B.2 registered to the same *registered market participant*, and

3.5.6B.3 any of the *facilities* are providing *contracted ancillary services* or participating in the *operating reserve market*;

sections 3.5.6 and 3.5.6A shall not apply. Instead, the largest quantity in any *energy offer* or *energy bid* for any *dispatch hour* for each *facility* must be at least 1.0 MWh but shall not exceed the lesser of:

3.5.6B.4 the maximum output of *energy* in an hour indicated in the registration information for the relevant *registered facility*;

3.5.6B.5 the maximum quantity of *energy* that can be supplied (for an *energy offer*) or taken (for an *energy bid*) in that *dispatch hour* by the *registered facility*, as estimated by the *registered market participant* for that *registered facility*; or

3.5.6B.6 the maximum allowed injection (for an *energy offer*) or withdrawal (for an *energy bid*) in that *dispatch hour* through the relevant *connection point*, as limited by the lesser of:

3.5.6B.6.1 the capacity of any radial line connecting the *registered facility* to the *connection point*; or

3.5.6B.6.2 the maximum injection or withdrawal will be what is specified in the *connection agreement* applicable to the *registered facility* or the maximum injection or withdrawal otherwise permitted by the relevant *transmitter*, and the sum of all *energy offers* or the sum of all *energy bids* from all *facilities* shall not exceed these limits.

Design Decision and Scenario 1 (Ch. 7 Section 3.5.6B)

Where one or more of the facilities is providing contracted ancillary services or OR:

The sum of all energy offer or bid quantities for all facilities under an RMP at a connection point must be within the MAQ

Scenario 1: VG capability is equal to or greater than the MAQ; storage is added without increasing MAQ. Therefore, the total injection capability is greater than the MAQ. Storage may provide energy and OR. VG is not eligible to provide OR.

e.g., VG capability of 60 MW, storage capability of 10 MW;

Total injecting capability = 70 MW; MAQ for injections is 50 MW and MAQ for withdrawals is 10 MW

The following bid/offer is allowed under the amendment:

- VG offers to inject 40 MW and storage offers to inject energy/provide OR 10 MW
- VG offers to inject 50 MW and storage bids to withdraw energy & offers to provide OR 10 MW

The amendment disallows the following:

- VG offers to inject 50 MW and storage offers to inject energy/provide OR 10 MW
- VG offers to inject 60 MW; storage bids to withdraw energy/provide OR 10 MW
 - If the storage withdrawing resource is allowed to offer OR and there is an OR activation, storage would need to stop withdrawing and the VG schedule would be over the MAQ at 60 MW

Design Decision and Scenario 2 (Ch. 7 Section 3.5.6B)

Where one or more of the facilities is providing contracted ancillary services or OR:

The sum of all energy offer or bid quantities for all facilities under an RMP at a connection point must be within the MAQ

Scenario 2: Generator (non-VG) capability is equal to or greater than the MAQ; storage is added without increasing MAQ. Therefore, the total injection capability is greater than the MAQ. Both generator and storage may provide energy and OR.

e.g., Generator capability of 60 MW, storage capability of 10 MW;

Total injecting capability = 70 MW; MAQ for injections is 50 MW and MAQ for withdrawals is 10 MW

The following bid/offer is allowed:

- Generator offers to inject energy/provide OR 40 MW; storage bids to inject energy/provide OR 10 MW
- Generator offers to inject energy/provide OR 50 MW; storage bids to withdraw energy/provide OR 10 MW

The amendment disallows the following:

- Generator offers to inject energy/provide OR 60 MW; storage bids to withdraw energy/provide OR 10 MW
 - If both resources are scheduled for OR and there is an OR activation, storage would need to stop withdrawing and the generator would need to start injecting, and the schedule would be over the MAQ at 60 MW.
- Generator offers to inject energy/provide OR 60 MW and storage bids to withdraw 10 MW (no storage OR offer)
 - If generator is scheduled for OR, the storage withdrawal is still within MAQ; however, it is possible/likely that storage withdrawals will be cut when OR is activated, and then the gas generator energy schedule will not be within MAQ.

Additional MM Changes – MM 1.5, Section 2.2.3

- A change to MM 1.5, Market Registration Procedures is required to reflect the design; however, no MRA is needed in this case
- MM 1.5, Section 2.2.3 will be amended to specify:
 - There must be only one RMP, one MMP and one Operator across all resources under a hybrid model (storage and generation facilities under the same connection point)
 - The Owner could be different for the generation resource and the storage resources, noting that the storage injecting/generation resource and storage withdrawing/load resource must have the same Owner
 - The RMP, MMP, Operator and Owner could also be the same entity for all resources or could be different from each other

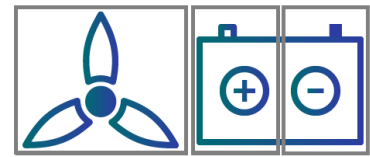
Additional MM Changes – MM 1.5, Section 3.11.1

- Another change to MM 1.5, Market Registration Procedures is required to reflect the design; again, no MRA is needed in this case
- MM 1.5, Section 3.11.1 will be amended to specify:
 - When the electricity storage facility is under a hybrid model, all resources (generator resource, storage injecting/generation resource, and storage withdrawing/load resource) will be dispatchable



Co-located Model: Energy and Operating Reserve Market Participation in Current Market

Timeline – Co-located: Day-ahead



Generation

Participant submits energy and OR offers (if generator is eligible for OR)*

- Bid/offer into the DACP, establishing the ADE for real-time market and fulfilling any contractual or capacity obligations
- DACP considers the IESO centralized forecasted value and the VG energy offer

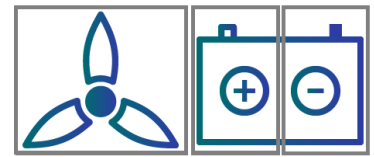
Storage

Participant submits energy offers, energy bids for charging from the grid, and/or OR offers*

- Bid/offer into the DACP, establishing the ADE for real-time market and fulfilling any contractual or capacity obligations
- Schedules for charging are managed by the participant through IESO market interface with their bids (not behind the meter)

*As allowed under Chapter 7, Section 3.5.6A market rule amendment

Timeline – Co-located: Pre-dispatch



Generation

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

- Generator is scheduled throughout pre-dispatch
- Pre-dispatch considers the IESO centralized forecasted value and the VG energy offer

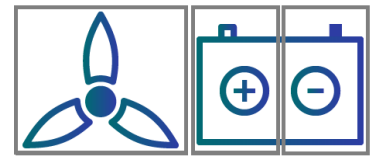
Storage

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

- Considering energy limitations and managing state-of-charge (SoC), storage can reduce their bid and offer quantities in mandatory window (within two hours of the start of the dispatch hour) due to SoC limitations that arise during that period

*As allowed under Chapter 7, Section 3.5.6A market rule amendment

Timeline – Co-located: Real-time



Generation

Participant delivers upon their IESO dispatch schedule

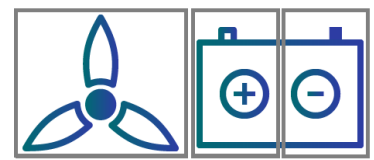
- Generation resource must comply with 5-minute dispatch instructions by injecting
- VG operate based on ambient conditions, but are also required to follow mandatory dispatch instructions (reduce output) either due to reliability or economics

Storage

Participant delivers upon their IESO dispatch schedules

- Storage resources must comply with 5-minute dispatch instructions, by injecting or withdrawing/charging

Timeline – Co-located: Settlement



Generation

Participant settled based on RT injection

- Generation is subject to market settlement and, if applicable, they should consider the implications of their power purchase agreement

Storage

Participant settled based on RT injection or withdrawal

- Storage is subject to market settlement
- Settled separately for the injecting resource and withdrawing/load resource
- Uplifts and global adjustment (GA) are applicable to a storage resource when withdrawing/charging from the grid as a load



Next Steps

Next Steps for Co-located Model Implementation

Month		Key Activity and Description
September 2022	✓	Published final design document to enable foundational hybrid models
October	✓	Present design & implementation details for the co-located model <ul style="list-style-type: none">• Draft market rule amendments• Draft market manual content
November		Stakeholder feedback due November 16
December		Respond to stakeholder feedback Technical Panel education on co-located hybrid model
January 2023		Market rule amendment proposal to Technical Panel
February		Target date for Technical Panel vote
Early April		Target effective date for implementation in IESO-administered Markets

Stakeholder Feedback



- IESO questions:
 - Do the design decisions to implement the co-located hybrid model in the current market provide adequate clarity for implementation?
 - Do you have any feedback on the proposed market rule amendment and associated market manual changes?
- Please use the feedback form found under the October 24, 2022 entry on the [Hybrid Integration Project webpage](#) to provide feedback and send to engagement@ieso.ca by November 16, 2022
- The IESO is able to meet with stakeholders to clarify information presented today, as well as discuss any further questions

Thank You

ieso.ca

1.888.448.7777

customer.relations@ieso.ca

engagement@ieso.ca



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