

Innovation Roadmap Update: Energy Storage Design Project

Stakeholder Advisory Committee

February 11, 2020

SAC Input

Input from SAC is requested to inform:

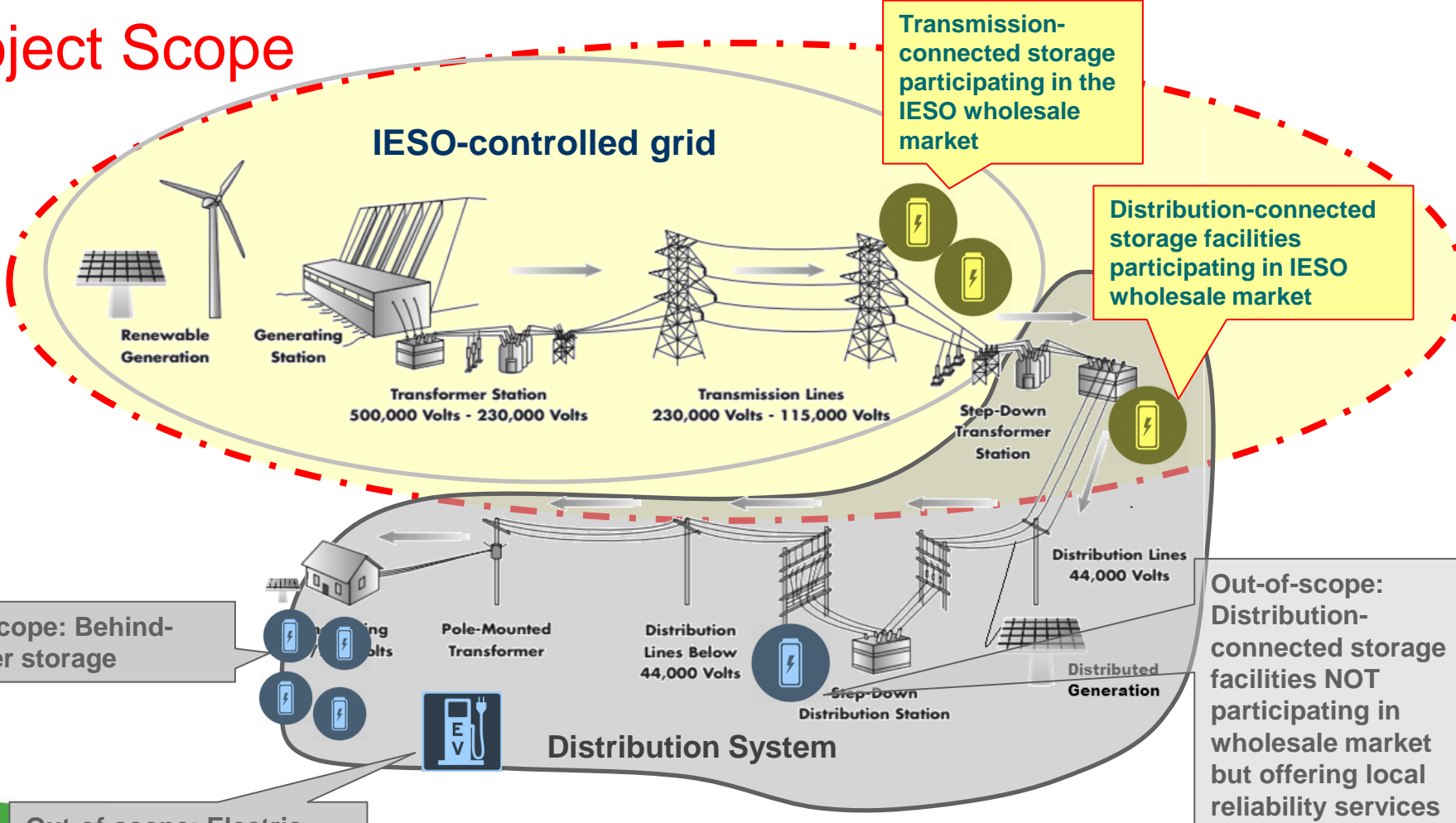
1. What areas of the project are likely to be of greatest interest to the stakeholder community? Why?
2. What advice or guidance do you have for the IESO as we progress through the Energy Storage Design Project?

Recap: Storage Design Project Scope

- The Storage Design Project will:
 1. Clarify how energy storage resources can participate in today's IESO Administered Markets (the **interim period**), and
 2. Provide a vision for how storage resources will participate on an enduring basis in markets resulting from the Market Renewal Program (the **long-term period** - once investment in IESO tool upgrades to fully integrate storage resources are made)
- The Storage Design Project is an important step towards ensuring energy storage can fully compete to reliably and efficiently provide needed system services

Recap: Scope – Transmission and Distribution Connected Storage in Wholesale Markets

Project Scope



Recap: Project Inputs and Phasing

Previous IESO efforts:

- Energy storage obstacles – identification and prioritization
- Examination of U.S. system operator responses to FERC order 841
- Research, pilot projects and stakeholder input

Guidance

Learnings

Energy Storage Design Project

Design

Two Key Phases:

- Interim measures to clarify how energy storage resources can participate in today's IESO Administered Markets
- Long-term vision for how energy storage resources will participate on an enduring basis in the IESO Administered Market (*once investment in IESO tool upgrades to fully integrate energy storage resources are made*)

Recap: Project Deliverables

The project includes four key deliverables:

1. Design Document

- Answer key questions about how the IESO will treat storage in IESO-Administered Markets
- Reflect different timeframes (e.g. greater detail for interim measures and higher-level design discussion for long-term solutions)

2. Market Rules and Manuals

- Draft and invite stakeholder feedback on market rule/manual language required to implement interim measures
- Produce inventory and description of future market rules/manual changes required to implement long-term design questions addressed in the project

3. Inventory of IESO Tool/Process Changes

- Develop a list of tools/processes that will require updating to enable design questions addressed in the project

4. Schedule for Market Updates

- Develop an integrated schedule to roll out changes that reflects dependencies on/timing of other initiatives

Stakeholder Feedback on Project Scope

Key Themes from October 28 Engagement Meeting

| Theme | Stakeholder Feedback | IESO Response |
|--|---|---|
| Timing of storage integration into markets | Ensure storage is fully enabled in first iteration of new energy markets resulting from Market Renewal | Schedule for implementation of design decisions is a project deliverable (will be provided prior to project completion in Summer 2020) |
| Scope of Storage Design Project | Expand project scope to include behind-the-meter storage and hybrid (e.g. storage/ generation) facilities | Integration of behind-the-meter resources (distributed energy resources more generally) and hybrid facilities are being looked at in other IESO forums |
| Distribution System Coordination | Suggestion that Storage Design Project should address issues related to coordination of transmission and distribution operations related to storage | Transmission/Distribution (T-D) coordination is an issue larger than the scope of storage design project IESO is exploring enhanced T-D coordination via multiple forums and projects (e.g. IESO York Region Non-Wires Alternative Demonstration Project) |

SDP Progress to Date

- Oct. 2019 – introduced project to Stakeholder Advisory Committee
- Oct. 2019 – initial meeting with Energy Storage Advisory Group to introduce project and invite feedback on scope
- Nov. 2019 – Energy Storage Advisory Group feedback on scope of project due
- Dec. 2019 – IESO team meets with New York Independent System Operator to learn about their approach to storage integration
- Oct. 2019 to Jan. 2020 - IESO developed draft design proposals for interim period (existing markets) for Energy Storage Advisory Group input at February 18th meeting

Interim Design Proposals

High level overview

| Design Element | Current Barrier/Issue | Proposed Interim Design Solution | Rationale for Proposed Solution |
|----------------------------------|--|---|---|
| Market and Facility Registration | <p>Current IESO tools model each storage facility as a combination of a generator and load which means that the facility could receive conflicting dispatch signals AND tools can't see State of Charge</p> <p>Acceptable participation models for storage not clearly defined in the Market Rules and Manuals</p> | <p>Proposing to enable storage to register in 1 of 3 ways:</p> <ol style="list-style-type: none"> 1. Self-scheduling facility providing regulation service only (registered as self-scheduling generator) 2. Self-scheduling facility in the energy market only (registered as self-scheduling generator and non-dispatchable load) 3. Dispatchable facility, capable of participating in energy and operating reserve markets* (registered as dispatchable generator and dispatchable load) | <ul style="list-style-type: none"> - Provides clarity on acceptable participation models for energy storage resources - Respects current IESO tool limitations - Builds on IESO experience with storage pilot projects |

*Existing, off-contract dispatchable facilities will also be able to participate in June 2020 Capacity Auction

Interim Design Proposals

High level overview

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|----------------------------|---|--|--|
| State of Charge Management | <ul style="list-style-type: none"> Because IESO tools can't model storage facilities as a single entity capable of injection and withdraw, there is a risk of conflicting dispatch instructions for the two sides of a dispatchable facility As a storage facility approaches a dispatch hour its ability to inject or withdraw energy may change (due to state-of-charge limitations); currently no rules for storage bid/offer change | <ul style="list-style-type: none"> Restriction against overlapping or equal bid/offer prices (i.e., offer prices must be greater than bid prices) Allow storage facilities to signal state-of-charge limitations during the two-hour mandatory window that precedes each dispatch hour | <ul style="list-style-type: none"> Minimizes risk of conflicting dispatch instructions for the two sides of the facility Limits potential for infeasible dispatch instructions |

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Interim Design Proposals

High level overview

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|-------------------------|--|--|--|
| Operating Reserve | Unclear requirements for storage resources | <ul style="list-style-type: none">• No simultaneous offers from load and generation resources• Minimum state-of-charge requirements to ensure facility can meet 1 hour activation requirement | <ul style="list-style-type: none">• Avoids conflicting/infeasible operating reserve activations• Ensures storage resources can meet reliability requirement for operating reserve |
| Day-ahead Participation | Unclear requirements for storage resources | <ul style="list-style-type: none">• Storage facilities will bid/offer in day-ahead commitment process like any other facility | <ul style="list-style-type: none">• Consistent with treatment of other resources; results in Availability Declaration Envelope that will allow storage to participate in real-time market |

Interim Design Proposals

High level overview

| Design Element | Current Barrier/Issue | Proposed Interim Design Solution | Rationale for proposed solution |
|-------------------------------------|----------------------------------|---|---|
| Prudential Requirements for ESRs | Unclear requirements for storage | Set collateral based on net energy withdrawals (based upon cycle efficiency and projected number of cycles per assessment period) | Provides sufficient collateral to cover risk of default without being overly onerous |
| Self-Scheduling Thresholds for ESRs | Unclear requirements for storage | <ul style="list-style-type: none"> • 10 MW threshold for self-scheduling facilities in the energy market • Allow regulation-only facilities greater than 10 MW until IESO tools are upgraded to allow dispatchable storage facilities to provide regulation service | <ul style="list-style-type: none"> • Consistent with threshold for generators • Increases potential for storage facilities to compete to provide regulation service while respecting current tool limitations |

Next Steps

- February 18 Energy Storage Advisory Group meeting to walk through design proposals for the interim period
- Q2 2020 Energy Storage Advisory Group to introduce long-term design proposals and draft rule/manual language for interim measures in Q2 2020
 - Technical Panel process to follow in summer 2020 for interim measure rules
- Q2 2020 - produce high-level schedule for market updates
- Q3 2020 – target for project completion in early Q3
 - Continued work on implementation of design decisions
 - Decisions have been made re: timing of long-term solution

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