IESO Engagement Session

Enabling Resources Program

November 20, 2024

IESO Enabling Resources Program

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Engagement Process

- The engagement process for the Enabling Resources Program ('ERP' or 'Program') will be conducted according to the **IESO Engagement Principles**
- Today's session will be **recorded** and available for viewing online
- All **meeting materials** associated with this engagement can be found on the IESO's ERP and related engagement webpages

Participation

- For questions and comments click on the "**raise hand**" icon (hand symbol) at the top of the application window. This will indicate to the host you would like to speak
- To **unmute** audio, click on the microphone icon at the top of the application window
- Audio should be **muted** when not asking a question
- **Connection issues** contact engagement@ieso.ca or Microsoft Office Support directly

Purpose

The purpose of today's session is to provide an overview of the ERP initiative, with a specific focus on:

- ERP visioning work and progress made to date
- Update on the current direction of ERP and scope of the Program
- Design considerations for the Storage and Hybrids Project to obtain sector feedback

Meeting Agenda

Retrospective: Review previous ERP-related projects and visioning work

ERP Today: Overview of where we are going, structure and scope

Storage & Hybrid Integration Project: Design and Engagement

Next Steps: Wrap-up and Feedback

Enabling Resources Program

The Enabling Resources Program is a set of projects that will enable key emerging resources, specifically electricity storage (“storage”), hybrid generation-storage pairings (“hybrids”) and further enable Distributed Energy Resources ("DERs") into the IESO-administered markets, tools, and processes to provide required system services and contribute to the safe and reliable operation of the bulk power system in Ontario.

Enabling Resources Program - Overview

Stream A Project (Transmission and distribution resources)

- **Storage** – a foundational model was implemented in 2018, ERP will be implementing an enhanced model
- **Co-located Hybrids** – introducing a method for participants to pair *energy storage resources* with a generator resource behind a single connection point; foundational co-located model was introduced in June 2023. ERP will be looking to implement an enhanced co-located model which applies the enhanced storage model to the storage resource in a hybrid participation model

Stream B Project (Distribution only resources)

- **Distributed Energy Resources** – supporting greater participation of DERs by introducing a new market participation model(s) (beyond existing DER participation). Supporting an incremental step for DERs by considering set(s) of smaller individual and/or aggregated DERs

Retrospective

1. Retrospective

Storage Design Project (SDP) in 2021: addressed electricity storage barriers identified in collaboration with the Electricity Storage Advisory Group (ESAG) in the 2018 IESO Report "Removing Obstacles for Storage Resources in Ontario"

- Market Rules and Market Manual amendments approved and implemented to include storage resource participation in the IESO-Administered Markets
- Developed long-term vision for enhanced storage participation post-MRP, including single resource model, modelling state of charge, regulation service

2. Retrospective

Foundational Hybrid Model: design of hybrid storage-generation resource models in the Hybrid Integration Project

- Project published potential foundational design for:
  - Co-located model: 3 dispatchable resources (generation resource, a storage injecting resource for discharging storage, and a storage withdrawing resource for charging storage) participating behind a single connection point
  - Integrated model: 2 resources; quick-start generation (storage & generator injecting technology) resource and load resource, behind a single connection point, providing a combined offer into the market
- The IESO Implemented the foundational Co-located Model in Q2 2023

3. Retrospective

Distributed Energy Resources - Market Vision Project (MVP/D) in 2023: desire to determine cost-effective methods to enhance DER participation in the wholesale markets

- Project focused on the development of potential DER participation models, considering participation requirements, aggregation compositions, service eligibility, IESO-LDC-aggregator data sharing and coordination, and options to address barriers for telemetry and metering
- DER potential study (new DERs emerging) and existing DER's coming off contract are some of the drivers to consider for enhanced DER participation

ERP Today

ERP and Project - Webpages

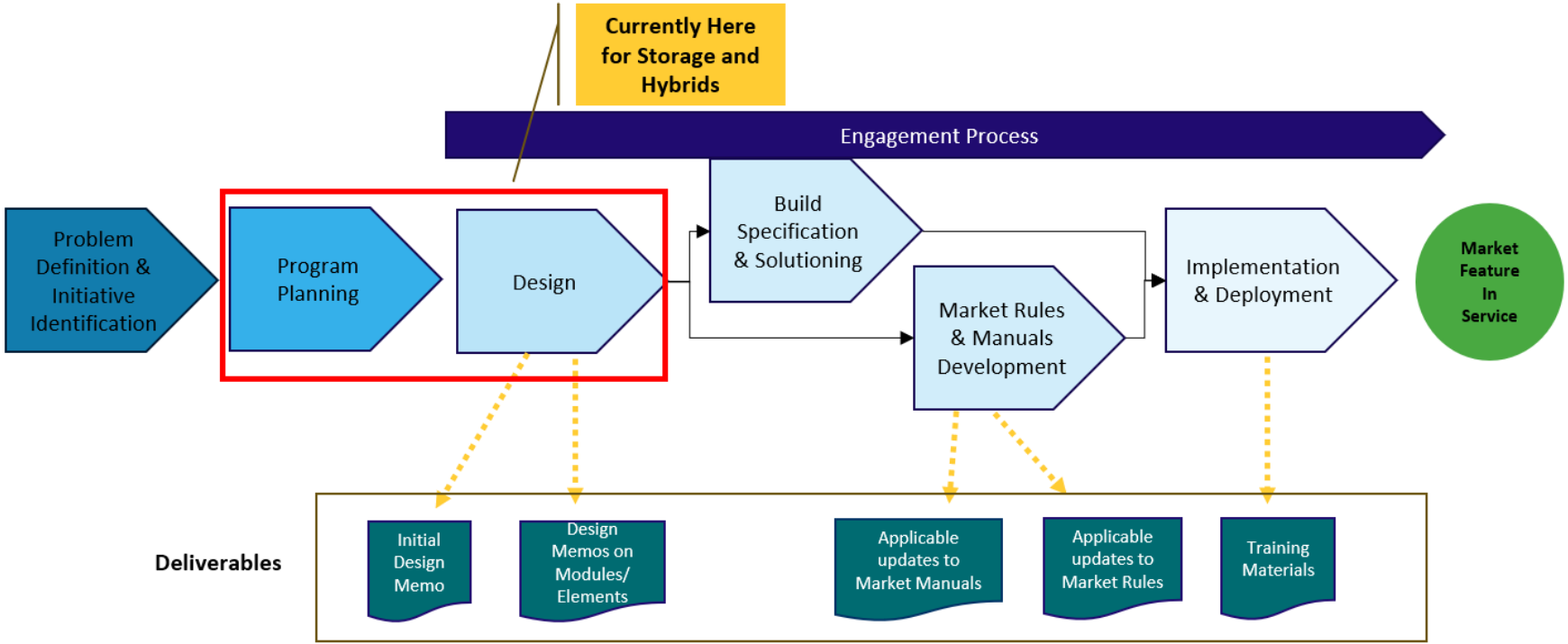
ERP main engagement webpage: ERP webpage

To serve as a landing page for Program-level updates, information and documents

ERP project webpages: Storage and Hybrid Integration Project

Each ERP Project (e.g. Storage/Hybrids and DERs) will have their own respective engagement webpage to communicate the meeting schedule, meeting materials and related information

Storage & Hybrid Integration Project - Process



Engagement Approach: Design Memos

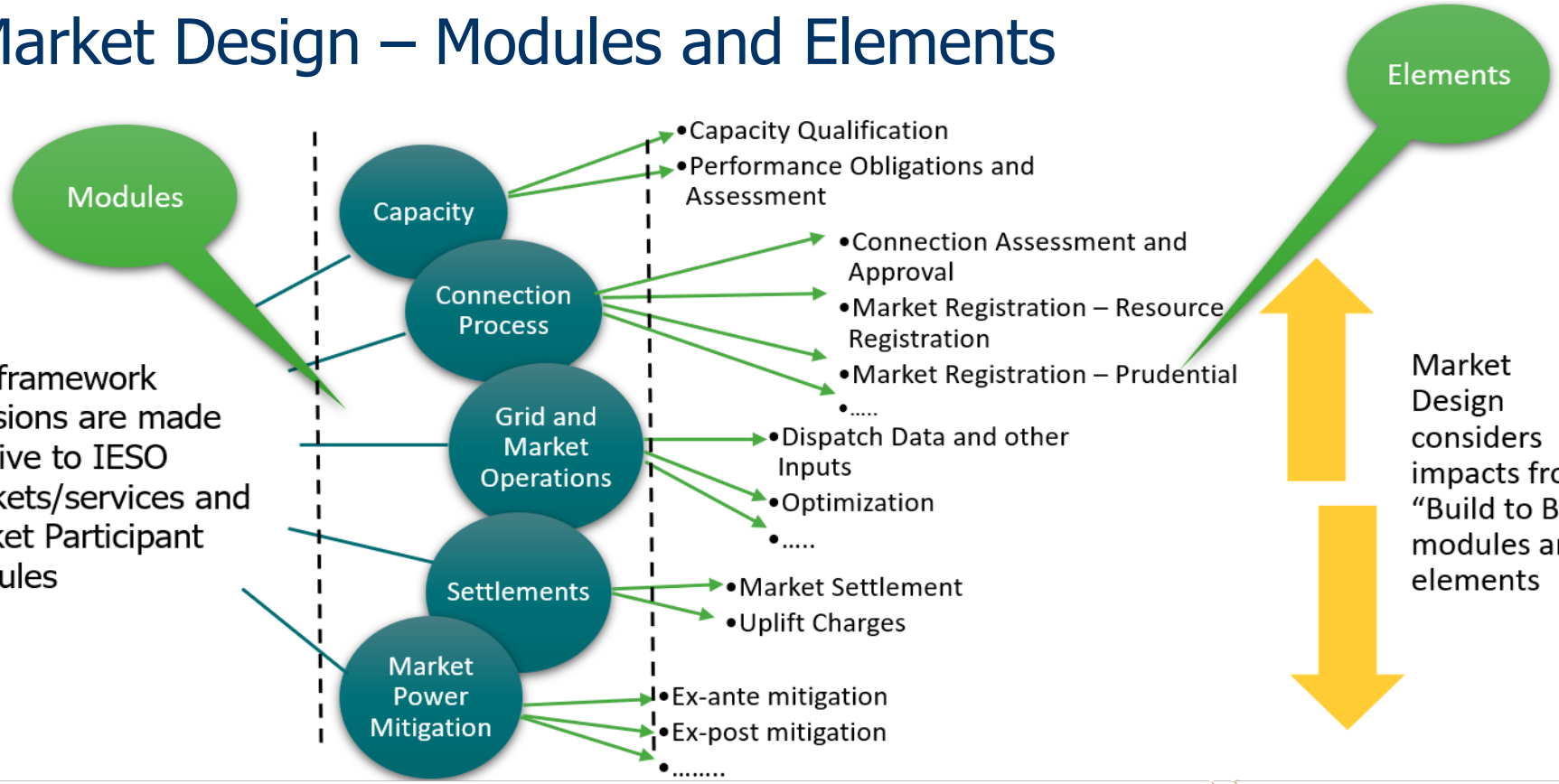
- IESO will utilize **Design Memos** in addition to engagement presentations, to capture a greater level of detail required to communicate IESO design intent, inform participant feedback, and prepare the IESO to implement additional project steps, such as but not limited to business design, solution design, Market Rules and Manuals
- The November 2024 engagement session memo provides an overview of the upcoming modules that will be presented in greater granularity at future engagements
- Feedback will be requested on each Design Memo, with updates made as required based on that feedback prior to them being finalized

Storage and Hybrid Design Overview

Market Design Approach

- Key framework decisions based on prior visioning work and need to be considered across various IESO/market systems and processes
- The design and integration of storage will be organized in a "build-to-bill" format; called "modules" (representing larger functions) and "elements" (more specific functions within a module)
  - The build-to-bill are specific to the market participant and IESO process to bring new resources onto the grid and facilitate their participation in markets and services
  - Design modules and elements will not be engaged on in a chronological format regarding a typical build-to-bill decision-making process; but rather, based on project dependencies and priorities
- Market design will be built on the foundation of MRP: locational marginal pricing, day-ahead market, enhanced real-time unit commitment, market power mitigation, etc.

Market Design – Modules and Elements



Scope – Storage and Hybrid

Storage	Hybrids
Technology: • Battery storage • Will consider applicability of other types such as pumped generation storage	**Technology:** • Co-located Hybrid Participation Model – generator and storage • Battery Storage with consideration for other types of storage (as per enhanced storage), if applicable; generator is agnostic
Resource Considerations: • Sole purpose of withdrawing electricity from the electricity system, storing that electricity, and re-injecting it, or a portion thereof, into the electricity system • Single-site; greater than 1 MW; self-scheduling less than 10 MW • Transmission or distribution (embedded) connected (Not including aggregated DER participation) • Dispatchable or self-scheduling	**Resource Considerations:** • Generator resource is expected to not be impacted • Sole purpose of withdrawing electricity from the electricity system, storing that electricity, and re-injecting it, or a portion thereof, into the electricity system • Single site; each resource greater than 1 MW • Transmission or distribution (embedded) connected (Not including aggregated DER participation) • Dispatchable

Storage – Framework Decisions

Feature	Description
Resource Modelling	• Storage will be modelled in IESO's tools as a single bi-directional resource that can both inject (offer) or withdraw (bid) across a continuous offer curve.
State-of-Charge (SOC)	• State-of-charge will be modelled and calculated in IESO tools to support efficient/reliable use of storage (will ensure tools have view or forecasted state-of-charge so only feasible dispatch or scheduling instructions issued) • *Note:* Scheduling and dispatch also considers participant bid/offer curve or out of market action needed to support reliability. E.g. the participant will need to have an economic offer and adequate SOC to be dispatched.
Regulation Service	• Storage will be integrated into regulation service tools and systems, as well as determining ability and impacts to providing other grid services. • *Note:* This is ONLY to support storage in IESO tool sets if eventually contracted. Necessary procurements/contracting is still required to facilitate participation in regulation service. This contracting will NOT be done as part of ERP. This also doesn't consider introducing further co-optimization.
Uplifts	• Storage to be exempt from uplifts on energy withdrawn as "fuel" for the sole purpose of being able to provide services back to the grid at a future point in time. E.g. energy for station service is not exempt.

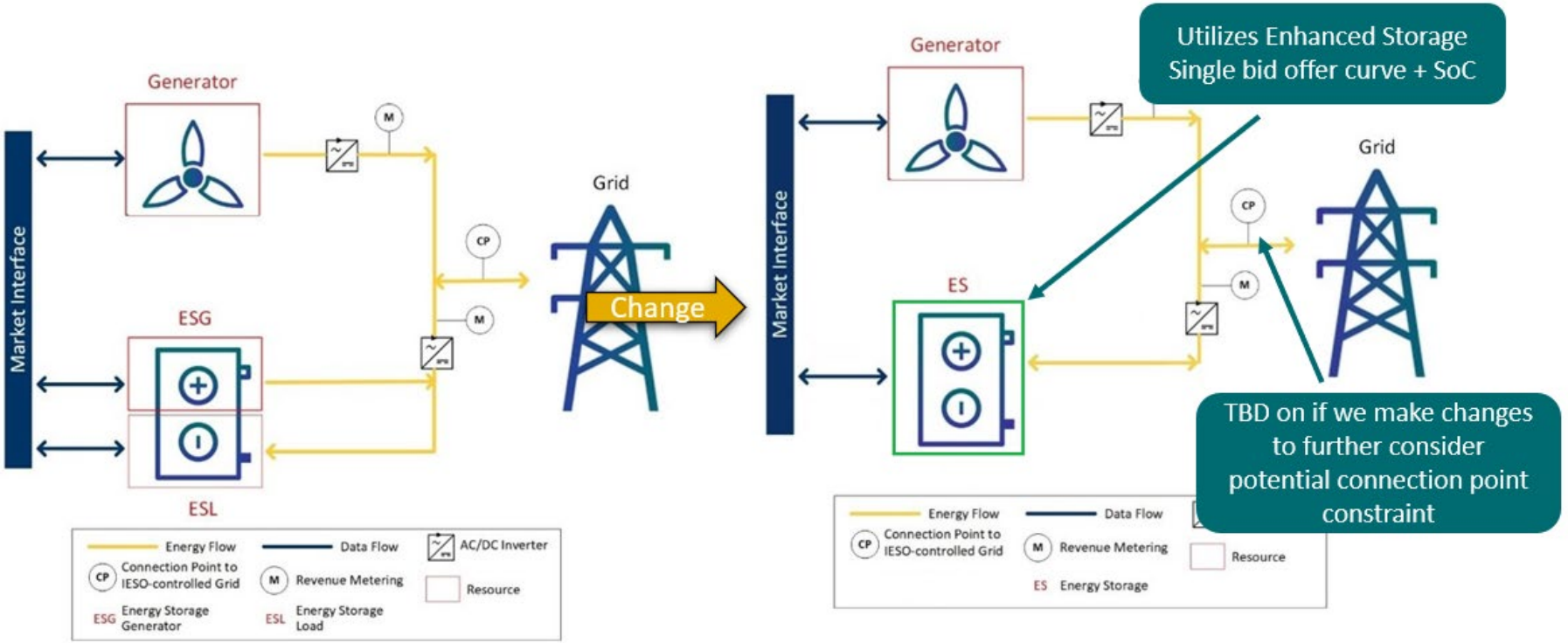
Co-located Hybrid – Framework Decisions

Feature	Description

Following Enhanced Storage Design for Storage Resource – Resource Modelling, SoC, etc.	• Co-located resources under the hybrid model will be modelled as two distinct resources:
	  ○ Storage resource with a single continuous offer curve (i.e., based on the enhanced storage model above.
	  ○ Generator resource leveraging the appropriate existing resource model (e.g., the variable generator model for a solar or a wind facility.)
	• State-of-charge of the storage resource will be modelled in the IESO tools.
	• Storage to be exempt from uplifts on energy withdrawn as "fuel" for the sole purpose of being able to provide services back to the grid at a future point in time.
	• The generation resource will continue to leverage the appropriate existing resource model (e.g. the variable generation model for a solar or wind facility).
	• **(TBD)** If regulation service is enabled when utilizing a hybrid participation model, it will be through either storage resource or other generator type that has already been enabled in IESO tool sets. This will also consider connection point limitations that are relevant to the hybrid participation model.

(TBD) Constraint Modeling/Consideration	• The ability to model or consider a constraint on net injection/withdrawal from the generator and storage resource that is overbuilt to the connection point will be further explored.

Co-located Hybrid Changes



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Storage and Hybrid Design Memo #1

- Topic is the “Design Framework and Modules”.
- The first memo highlights the framework decisions and how they are integrated into each of the modules.
  - This memo is more general than future memos, where we will get into more specific information related to that module or element as we work through them in greater detail.
- Memo includes design decision/intentions that the IESO is considering including rationale, as well as considerations that the IESO will consider as part of our design work.

Feedback Requested From Memo #1

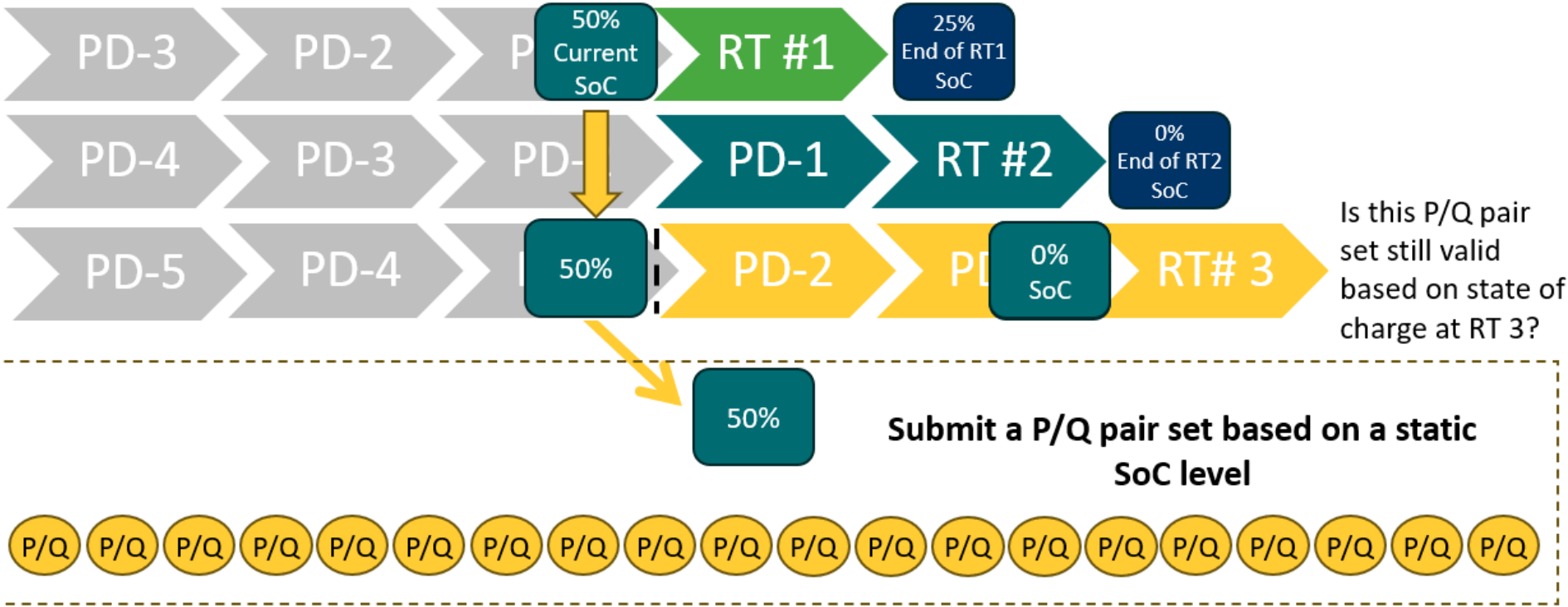
- Please identify missing information relevant to design work, i.e. additional modules, design considerations for the modules or elements being explored
- Should the IESO explore bid/offer tied to SoC in some form?
  - NOTE: As a reminder, the IESO needs to ensure proposed design solution can be implemented. Optimization software changes may have limitations that have yet to be considered by the IESO.
  - What considerations should the IESO have for day-ahead market (DAM) in relation to SoC estimation? How can the IESO support an estimate that will accurately reflect the full SoC value that could be present at the start of the next day?
- Are there other resource operating characteristics needed to properly automate operation of the resource to avoid changes in the mandatory window? Any other reasons why changes could be needed in the mandatory window?

Feedback Requested in Detail – Bid/Offer tied to SoC

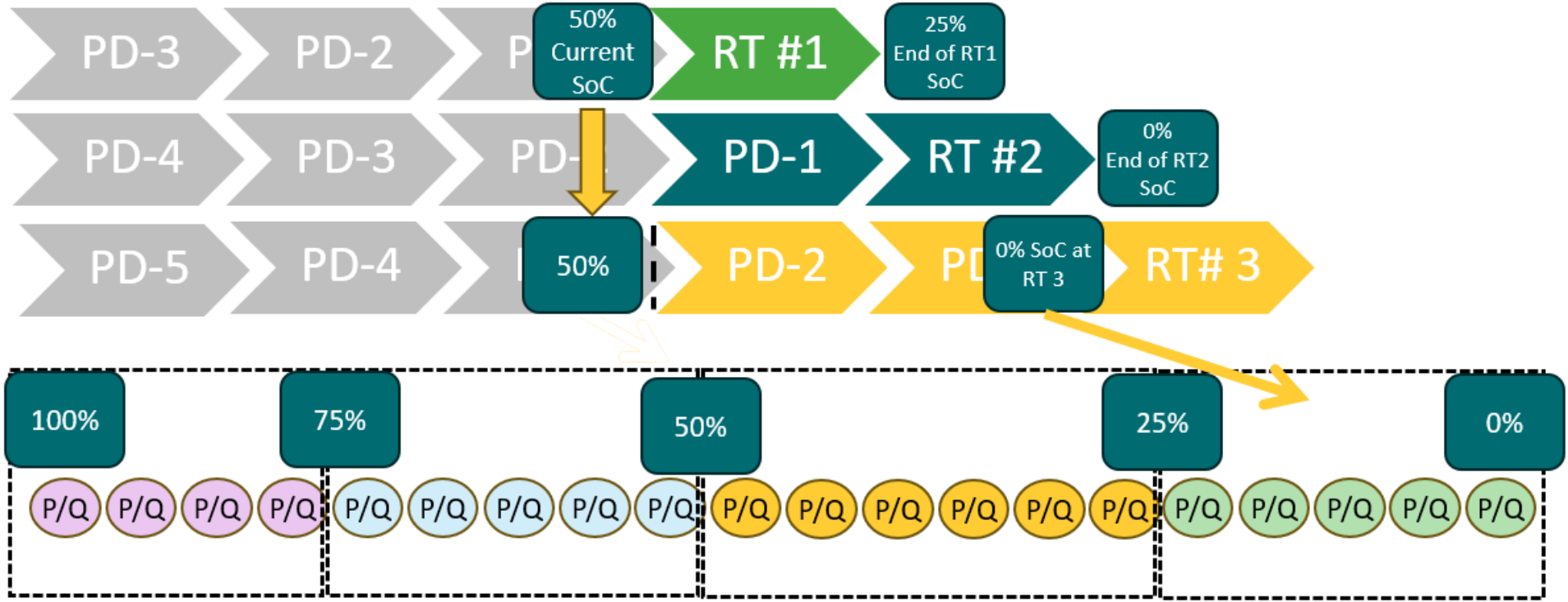
Bid/Offer and SoC – Issue

- How a storage resource operates its battery can impact degradation of the battery system. Allowing resources to consider the cost of operations under different circumstances can help support economic utilization of battery resources and provide adequate return on investment
    - Some operation concerns that can impact the lifecycle of the battery are its depth of discharge/charge, operation to specific extremes of charging/discharging, etc.
- *Submission issue* - Storage is energy limited. The IESO has a two-hour mandatory window which limits storage participants bid/offer changes as the SoC changes to reflect real time operating costs if dispatched to charge or discharge within those two hours.

Bid/Offer and SoC – Example not tied to SoC



Bid/Offer and SoC – Example tied to SoC



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Bid/Offer and SoC - Considerations

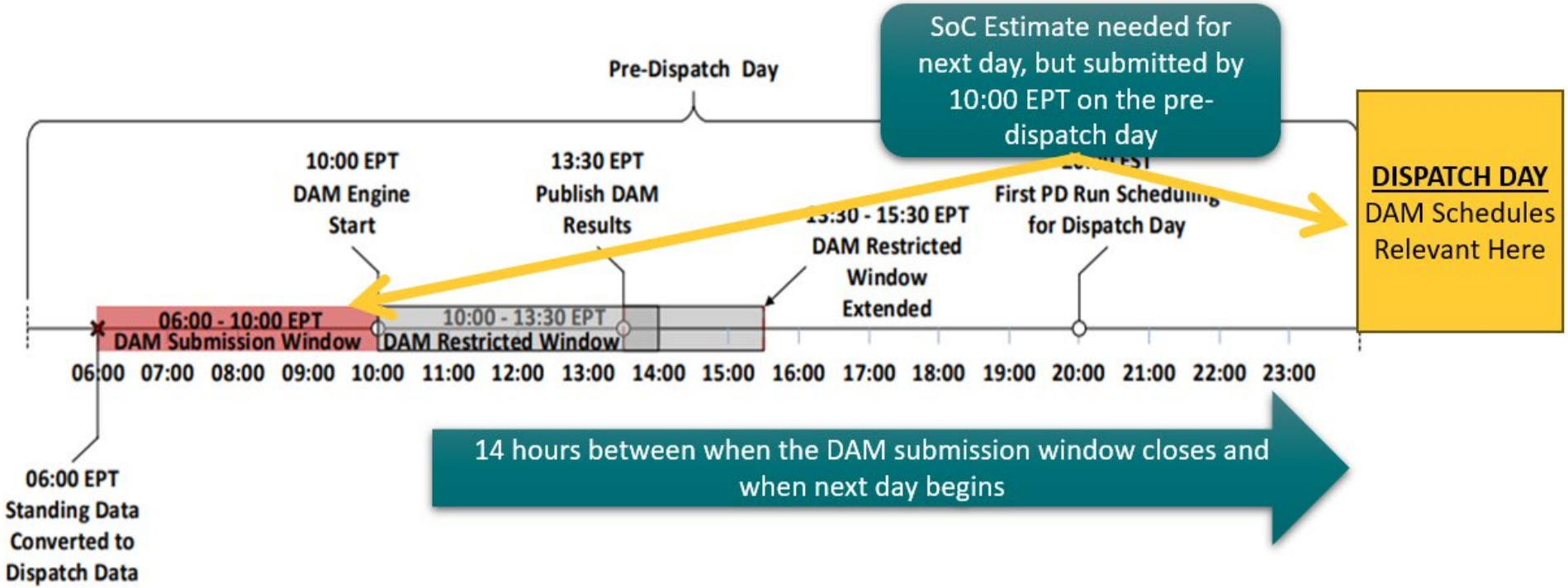
- This could also be helpful for DAM allowing expression of different operational scenarios
- 20 P/Q pair max will likely need to be maintained
- Participant can produce different ranges they want to be applicable with specific P/Q pair sets (max of 20 across all ranges) and update throughout bid submission window
- Other options could also be considered, such as an adder for certain operation conditions of the resource
- Would be a more complex implementation and could present challenges that elongate project timelines. Are participants willing to have a longer implementation for the enhanced model to consider this design?

Feedback Requested in Detail – DAM and SoC

DAM Participation and SoC - Issue

- Storage participants and the IESO will need a starting SoC value to allow the DAM optimization; need foresight to estimate value as DAM submission window occurs prior to end of previous operation day.
- Conservative/low SoC estimates could create differences between DAM and RT pricing, and storage to bypass DAM scheduling.
- The IESO needs to determine a reasonable method to ensure estimation is fair and reasonable to support DAM participation

DAM Participation and SoC – Issue Illustration



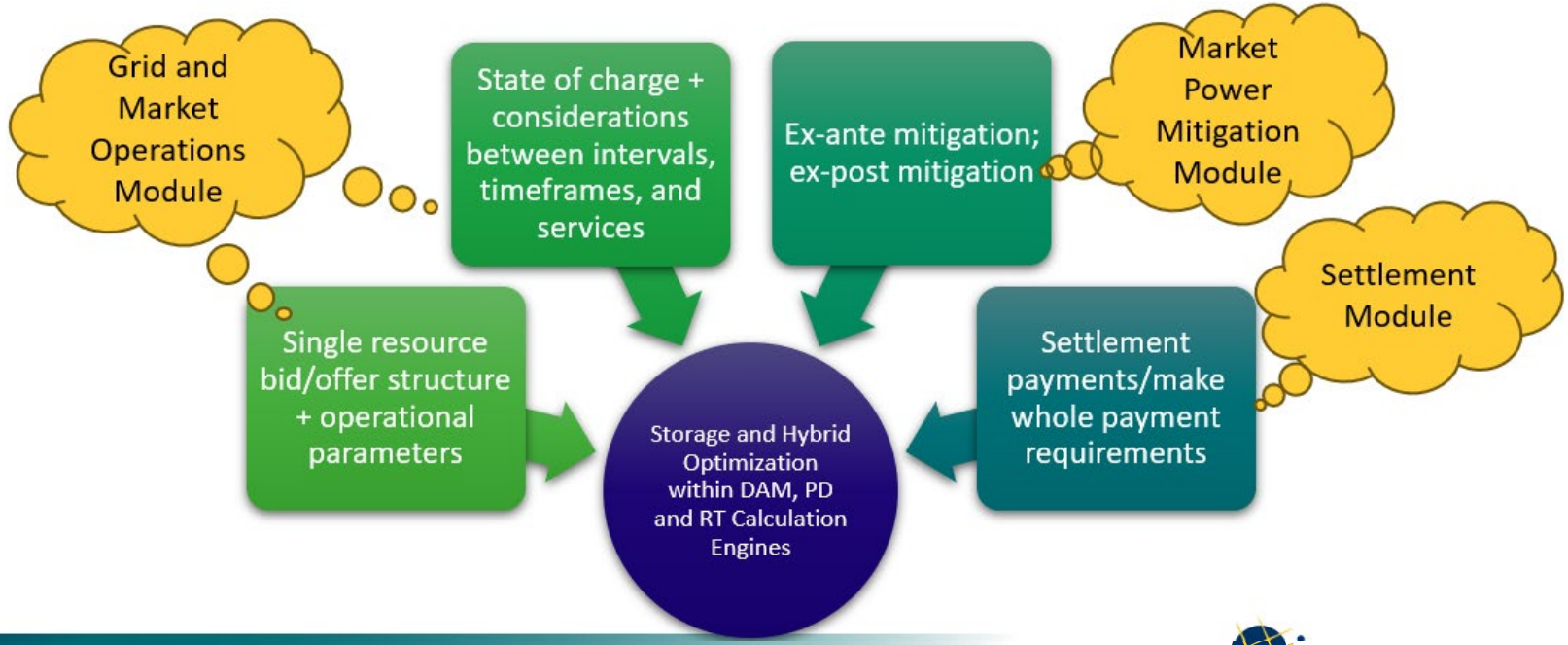
DAM Participation and SoC – Considerations

- The participant sets their SoC
  - Potential need for ex-post mitigation or other compliance requirements for deviating too far from DAM estimates continuously.
  - Can this initial estimation occur purely by the participant, or will IESO estimation based on PD schedules be useful to establish the starting DAM SoC value?
- The IESO can estimate the starting SoC based on PD schedules and set that as the minimum requirement; participant can adjust it up.
- Other methods can be explored

Next Design Module – Initial Considerations

Next Design Module – Grid and Market Operations

The next design focus is the "Optimization" element. The "Optimization" element impacts multiple modules and elements throughout the market design and is necessary to support decision-making in those modules.



Feedback, Discussion and Next Steps

Focus Areas of Feedback

General ERP Feedback Questions:

- Engagement approach to use Design Memos for each Project along with Presentations to inform feedback and ensure information on design elements and concepts is clearly communicated

Storage/Hybrid Project Feedback Questions:

- Additional design considerations for future modules or elements?
- Should the IESO explore bid/offer tied to State of Charge or other options?
- What considerations should the IESO have for day-ahead market (DAM) in relation to SoC estimation? How can the IESO support a SoC that will accurately reflect an accurate SoC value that could be present at the start of the next day?
- Are there other resource operating characteristics needed to properly automate the operation of the resource to avoid changes in the mandatory window? Any other reasons why changes could be needed in the mandatory window?

Submitting Feedback

- Feedback from participants is an important engagement principal of the IESO's refreshed external engagement framework to ensure your input and perspectives are considered
- The IESO is requesting input via the **IESO's Feedback Form** available on the ERP Storage and Hybrid webpage (Project Webpage)
  - Feedback is being requested by **December 9, 2024**
- Please submit to IESO Engagement engagement@ieso.ca or contact to contact the IESO with any questions following today's session

Next Steps

Timing	Engagement Activity
November 20, 2024	**ERP Introduction - Public Engagement Session**
December 9, 2024	Feedback Deadline, Nov 20 session
January 2025	IESO Response to Feedback, Nov 20 session
Date TBD: Q1-2025	**Public Session – Storage and Hybrid Project (Meeting #1)**
Date TBD: Q1-2025	Deadline for Feedback & IESO Response to Feedback
Date TBD: Q2-2025	**Public Session – Storage and Hybrid Project (Meeting #2)**
Date TBD: Q2-2025	Deadline for Feedback & IESO Response to Feedback
TBD: 2025	**Public Session – DER Integration Project**

Questions?

Please submit feedback forms to IESO Engagement@ieso.ca

or contact us with any questions/concerns

Thank You

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