IESO Response to Feedback

March 19, 2025

IESO's Enabling Resources Program (ERP)

Following the IESO's Enabling Resources Program (ERP) public engagement session on November 20, 2024, sector participants were invited to provide written feedback on the materials presented at the session and responses to questions included in the feedback form. Meeting materials included a presentation outlining the direction and approach of ERP, along with a design memo on the Storage and Co-located Hybrids Integration Project.

Following the session, the IESO received written feedback submissions from the following sector participants:

- **Atura**
- **Boralex**
- **Energy Storage Canada** (ESC)
- **Neoen**
- **Workbench Energy** (Workbench)

The IESO would like to thank the participants who have responded with feedback to the IESO's meeting materials and questions. The meeting materials and feedback submissions are posted on the Enabling Resources Program main page as well as on the ERP Storage and Co-located Hybrids Integration Project webpage. As a reminder, when ERP sessions are specific to the Program, the ERP webpage above will be utilized. If the focus of the session is specific to one of the noted Projects (i.e. Storage & Hybrid project), the corresponding project webpage will be used for updates and meeting materials. Since the session in November included topics on both the ERP program and Storage & Hybrid project, both webpages contain the meeting information from that session.

The full feedback submissions are available at the sector participant links above. The following tables below provide a summary of participant's response to each topic area along with the IESO's response to that feedback.

If you have any questions, please contact IESO Engagement at engagement@ieso.ca.

Feedback Summary and IESO Responses: ERP Engagement Session

Topic: Feedback requested around the general engagement approach and use of design memos to support engagement and feedback in addition to slides/presentations on design elements to ensure concepts are clearly communicated.

Summary of Feedback	**IESO Responses**
Workbench: Would like target implementation timeline. Could be challenges with model due to storage not being operational until post MRP. Lessons learned from Ontario assets in MRP should be considered and storage should be considered beyond battery storage.	The IESO will be sharing project implementation timelines in upcoming engagements once determined. A key input to our timelines is the feedback on the proposed design modules and elements from stakeholders. Understanding the extent of the changes will be needed before we can commit to a completion timeline. The Storage and Co-located Hybrid Integration Project will coordinate across various groups within the IESO, including departments who interact with market participants and MRP to understand upcoming market changes. The IESO will also be considering challenges and lessons learned from existing storage assets. The scope of this project will focus on battery storage resources, as this resource type will be the primary storage technology type. It will also consider other types of storage where this model will be applicable towards and may make additional changes in the future to support other types of storage technologies if not covered under this project.

ESC: Sufficient time for participants to provide adequate feedback. Need time for review and for internal teams to coordinate resources. ERP should engage with various Market Participants (MP) before moving ahead. Supportive of the engagement approach of memos and presentations.	The IESO will continue to post materials two weeks before each engagement session, to allow participants to proactively review details prior to the public engagement session. In addition, feedback is only requested in the weeks following the session, so we believe this will also help participants to collaborate before submitting feedback.
Neoen: Support the use of design memos to more easily convey information	The IESO will continue the approach of supporting engagement session presentations with design memos to ensure design details are provided in a clear and informative manner.

Topic: Additional design considerations for future modules or elements?

Summary of Feedback	**IESO Responses**
Atura: Additional considerations included: provide Operating Reserve (OR) from both generator and loads with multiple offer sets, cycling of storage limited by warranties for original equipment manufacturer (OEM), market power mitigation (MPM) conduct and impact tests, consideration of contracts within MPM.	The IESO is considering a single offer curve for energy and OR for storage. The aim is to support energy and OR from full withdrawal and injection capability from the storage resource. In relation to offer sets, the IESO is exploring how many offer sets will be required for a storage resource compared to other resource types. Regarding the parameters, the IESO will be considering daily cycling parameters of storage and other parameters to allow market participants to control usage (supported by multiple sector participants).

	Within design development and further engagement, the IESO is considering MPM and has committed to MPM having its own dedicated module at a future engagement session. Contracted facilities will be considered throughout the entire design.
Workbench: Module for consideration of storage design with procurement contracts. Consider the following: 1) dispatch data changes with must offer obligations; 2) Stage of Charge (SoC) declaration with must offer obligations; 3) manage degradation and cycling without impacting costs of bid in procurement and that may trigger MPM. Reregistering under the new model may result in incremental costs to assets owners and should be made whole or allow them to maintain participation under a two resource model.	The IESO will be working closely with its Procurement and Contract Management teams in developing the ERP design to identify any design changes and requirements that may potentially impact contracts, as well as the transition to a new storage model.
ESC: The IESO should have a design module that properly integrates the scheduling of regulation capacity in coordination with the Day Ahead Market (DAM) process and allows energy storage resources visibility into future multiple service offerings Energy storage resources are energy limited resources and therefore schedule and dispatch instructions must be coordinated not only for energy charge and discharge but also for reserve products (i.e. OR). Given the reliability benefits of energy storage resource capacity, the IESO may want to consider optimization that schedules energy storage for OR even if offering a lower real-time energy price earlier in the day if the IESO scheduling algorithm sees short reserves/resources later in the day. Doing so would require appropriate compensation for opportunity costs in OR prices which	Currently, Operating Reserve is not permitted for resources when providing regulation service simultaneously. The IESO is not intending to change the restriction on providing OR when providing regulation service and will not be co-optimizing all services (energy, OR, and regulation service) at this time. The IESO will consider the impacts of regulation service or operating reserve schedules on DAM, Pre-Dispatch, and Real Time energy schedules or dispatch for storage and energy limitations. This includes resources that have appropriate duration of service to be scheduled or dispatched for services. The IESO will consider the feasibility of these considerations against established design principles outlined in the ERP presentation materials.

should be the basis for a design module in the ERP. Long duration storage may require different optimization objectives compared to short duration and a design module is needed for coordinated MPM design changes in coordination with the ERP changes being proposed. A design module is required for integration of market rule changes and changes to energy storage contract designs. Energy storage attributes can change over the life of the asset that may require adjustments to static information submitted to the IESO at market registration (e.g., cycling efficiency). ERP module must come with a commitment from the IESO to include a process for publishing energy offers and bids for every hour for all resources historically to provide appropriate insight for energy storage market participants and to achieve market efficiencies.	
Neoen: Within grid and market operations, provide services concurrently without restrictions, from both the generators and loads. SoC that accurately reflects operation capability in Real Time (RT) and impact of SoC modelling on Locational Marginal Pricing (LMP).	The IESO will review and consider methods from both the generation and withdrawal ranges of a storage resource. In addition, RT and PD scheduling and dispatch is expected to be based on real time telemetry of SoC (in addition to forecasting required to extrapolate the PD schedules). It should be a reliable operational parameter to complete those processes.

Topic: Should the IESO explore bid/offer tied to State of Charge or other options?

Summary of Feedback	IESO Responses
Boralex: SoC should only be in RT; inclusion of SoC in DAM could limit MPs ability to fully cycle over the day and expose them to DA/RT settlement risk.	Different jurisdictions do consider the SoC in the DAM from various perspectives. DAM is a financial market, and the requirement to fully include operational capability differs from jurisdiction to jurisdiction. The IESO typically includes operational parameters for resources in the DAM to ensure feasible scheduling. SoC in DAM can potentially support less DA/RT risk as it considers the operational capability to avoid excessive scheduling of the resources.
Workbench: Conceptually this makes sense but will need to be considered in MPM reference levels. Considerations include: 1) DSO calc results timelines 2) Ex-ante mitigation in calc times 3) DSO solving for next interval and not balance of day. Will this be the most efficient and economic decision for both energy and OR 4) MPM reference level redesign required with opportunity cost consideration for SoC bands.	The RT DSO will consider multi-interval optimization, and RT needs generally take precedent over future hours. Although, control room operators can make decisions to address needs for the balance of the day. As a result of the multi-interval optimization and future multi-hour considerations of other engines, it should be making the most economic and efficient decision for impending needs in RT hours and giving the control room adequate information to make informed decisions about future hours. The IESO agrees that MPM "implementibility" and considerations will need to be considered when developing the optimization module and any other design modules. A separate MPM module will be developed as part of this design.

ESC: Yes, but consider market power mitigation. The IESO should also explore an option for energy storage resources to continue to self-schedule in case a market participant has a different approach to participation or objectives.	The IESO is considering MPM in the optimization design and will be dedicating a separate module on MPM. The IESO is intending to adopt a "SoC-lite" approach that balances both system operator and market participant needs whereby market participants manage the SoC through competitive offers, and the system operator ensures that all dispatch instructions respect SoC. The IESO is also exploring the self-scheduling storage model as part of its design.
Neoen: Current mandatory window restrictions likely caused increased buffers in offers and higher costs to consumers. Yes, the IESO should explore bid/offer tied to SoC. Including: self-managed ranges to reflect participant specific operational costs and more than 20 p/q pairs to provide greater flexibility.	The IESO is considering self-managed ranges for SoC for bid/offer submission. Also, as noted in feedback from sector participants, the IESO must be cognizant of changes to the DSO which could impact engine run times. Increasing p/q pairs to more than 20 could impose challenges to implementation and engine run times.

Topic: 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?

Summary of Feedback	**IESO Responses**
Atura: MPs provides SoC or use IESO PD schedule to end of day	The IESO has noted this suggestion.
Boralex: DAM SoC is a forecast affected by real time events leading to the dispatch day and could result in margins of error in forecast. How	The IESO agrees with challenges in estimating SoC for the next dispatch day; however, not including SoC could result in a larger margin of error (multiple infeasible schedules i.e. 5+ hours of continuous injection or charging). The IESO is weighing many

can it be used? SoC in DAM could hinder the ability of storage to schedule three full charge/discharge cycles over a 24-hour period. Market Participants can use the MaxDEL.	options, one of which is to give the market participant the ability to set its own SoC for scheduling purposes in the DAM, so they can determine expected operational capability for the next dispatch day based on their best estimates. The IESO also agrees that the MaxDEL could still be a relevant parameter for storage resources, where the addition of a SoC value and a max starts-per-day could allow a market participant to have better control over scheduling to maintain operational efficiency of the storage resource. The IESO is exploring these parameters in its design.
Workbench: Not specific of which method is preferred; however, the following principles must apply: 1) Starting SoC should not have an impact on the storage unit. The participant should not be left with the risk of the IESO needing/not needing the storage in the current day due to system conditions and having a DA commitment they are unable to meet. 2) Make-whole payments related to inaccurate starting SoC estimates depending on cause. Causes can include inaccurate IESO forecast, changing supply conditions, and reliability requirement that changes facility dispatch ahead of DAM. No make whole payment if the inaccurate value is a result of the MP changing offer profile to avoid discharge after DAM offer window and dispatch day. 3) Consider the contracts from the procurements.	With the SoC parameter in DAM, the IESO would support feasible schedules based on a SoC parameter input into the DAM optimization. The IESO is considering methods for how this SoC value will be derived (either market participant entered or estimated from PD schedules). The IESO is considering make-whole payments (MWP) to ensure fairness with other resources and that they are derived when it is required to schedule outside of economically clearing the market. MWP treatment for storage will be similar to other resources that participate in the market. As mentioned during the November engagement session, the IESO will be following certain principles when developing the design which were also principles consistent with those developed for MRP.
ESC:	The IESO will make its best efforts in the SoC estimation and methods to extract the most accurate value. The IESO will also be sharing these considerations and working closely with the sector

The IESO should consider options or processes to allow a market participant to include an estimation of their SoC at submission to calibrate real-time energy and scheduling calculations. In addition, it is not clear that SoC estimations will be accurate based on energy bids and offers and dispatch instructions. Cycling losses and other factors that influence SoC at an energy storage facility can change due to external factors like external temperature, operational challenges, and degradation.	participants to understand their needs and vendors who have experience implementing SoC estimation in other jurisdictions.
Neon: SoC estimation will likely come with significant uncertainty. Suggestion to use last PD run prior to DAM (perhaps the best estimate) or allow the participant to submit. In either case, expect uncertainty with the estimate.	The IESO will consider this feedback as it explores SoC estimation.

Topic: Are there other resource operating characteristics needed to properly automate the operation of the resource to avoid changes in the mandatory window?

Summary of Feedback:	**IESO Responses:**
Atura: Automatic revision to OR capability based on SoC and cycling limitation that restricts annual/cumulative number of start/stop cycling per year.	The intention is to consider SoC in relation to OR capability in the design. An adequate duration of service, including appropriate SoC, will be required to provide the service. The IESO will consider start/stop requirement as a daily dispatch parameter (not annual).
ESC:	The IESO will take this feedback into consideration.

Consideration should be given to ramping rate, external temperature, cycle count, and depth of cycle.	
Neoen: One further element to consider is the ability for participants to over-ride static values from their registration.	The IESO will take this feedback into consideration.

Topic: Any other reasons why changes could be needed in the mandatory window?

Summary of Feedback	**IESO Responses**
ESC: Other reasons could include typical resource challenges.	The IESO will take this feedback into consideration.
Neoen: Consider changing the amount of time of the mandatory window and allowing increases in quantity. Specifically, the ability to go online earlier than expected from an outage to reflect the physical capabilities of the resource, not necessarily economic reasons.	The IESO will take this feedback into consideration.

General/ Other Feedback:

Summary of Feedback:	**IESO Responses:**
Boralex:	The IESO appreciates the support for the proposed approach.

Supportive of the exemption of Uplifts for Energy withdrawals "fuel" as well as the ability of the system to support Regulation service from Storage facilities.	
ESC: Supportive of the project and uplift exemption, noting the need for no additional metering requirements in determining station service. The feedback also noted that the IESO should coordinate with peer agencies to address transmission and distribution rates. Also, consider how changes may have impacts on contracts.	The transmission distribution rate is not within the scope for ERP; although, the impacts of the proposed design on those rates could be helpful to understand throughout the engagement discussion. The uplifts exemption will be explored in greater detail during the Settlements module and any design changes will consider impacts on contracts.
Neoen: Proposal to exempt uplift charges from storage has significant benefits for the BESS.	The IESO will take this feedback into consideration.