

Feedback Form

Enabling Resources Program (ERP) - Storage and Co-located Hybrid Integration Project

Meeting Date: October 16, 2025

Feedback Provided by:

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Title: Director, Power Systems

Organization: Power Advisory

Email: [REDACTED]

Date: October 30, 2025

Following the **October 16, 2025**, engagement webinar, the Independent Electricity System Operator (IESO) is seeking feedback on the items discussed during the webinar. The presentation and recording can be accessed from the engagement web page.

Please submit feedback to engagement@ieso.ca by October 30, 2025. If you wish to provide confidential feedback, please submit it as a separate document, marked "**Confidential**." Otherwise, to promote transparency, feedback that is not marked "Confidential" will be posted on the engagement webpage.

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October 30, 2025

Maral Kassabian
Senior Manager, Enabling Resources Program Implementation
Independent Electricity System Operator (IESO)
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ATTN: Enabling Resource Program Engagement Team

Dear Maral,

This submission responds to the Independent Electricity System Operator's (IESO's) invitation for feedback in relation to the October 16, 2025, webinar (the "webinar") on the Enabling Resource Program (ERP) and the associated Optimization Design Memo.¹

Power Advisory has coordinated this submission on behalf of a consortium of energy storage providers under contract with the IESO through multiple procurement initiatives (the "Consortium")².

We would like to thank the IESO for its continued outreach to stakeholders during the ERP engagement process. The Consortium generally supports the direction and objectives of the ERP for storage resources participation in the IESO-Administered Market (IAM). Establishing a single resource model for energy storage will enhance the capabilities of energy storage resources in the Ontario electricity market.

The Consortium continues to request that the IESO establish a voluntary opt-out mechanism for the energy storage resource participation in the IAM including specifically the State-Of-Charge (SoC) management. Unforeseen challenges or outcomes may require storage resources to manage their own SoC to maintain warranty and facility economics.

Based on the information presented in the webinar we have the following comments on the Optimization Design Element for Storage Resources memo and accompanying presentation.

¹ See <https://ieso.ca/-/media/Files/IESO/Document-Library/engage/erp/erp-20251016-presentation.pdf> and <https://ieso.ca/-/media/Files/IESO/Document-Library/engage/erp/erp-20251016-optimization-design-memo.pdf>

² The members of the Consortium are Alectra Energy Solutions, Atura Power, Compass Energy, Capital Power, Convergent Energy+Power, EDP Renewables, AYPa, Brookfield Renewables, Neoen, Northland Power, Boralex, and Potentia.

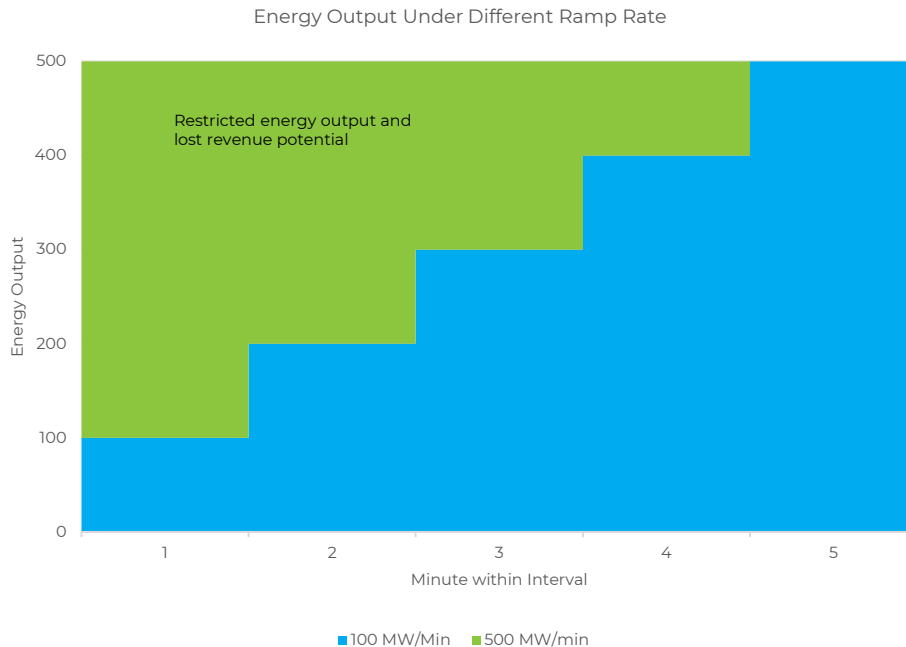
100MW/min Ramp Rate Restriction

The IESO's response to feedback on the Ramp Rates for energy dispatch instructions being limited to 100 MW/min is severely lacking. Proponents, including the ESR Consortium, stated that restricting Ramp Rates would cause economic harm to proponents and requested that the IESO provide detailed analysis of how the 100 MW/min limit was determined including the potential challenges stated by the IESO to Area Control Error (ACE). The IESO provided no analysis and simply repeated that it was needed for challenges to ACE linked to qualitative factors.

The IESO stated in the ERP webinar that the 100 MW/min ramp rate is already applied to energy storage dispatchable generators. The Consortium requests the IESO provide citations for where ramp rate restrictions specifically applied to energy storage are identified in the market rules and/or market manuals including the authority for the IESO to implement those restrictions (e.g., market rule amendment process).

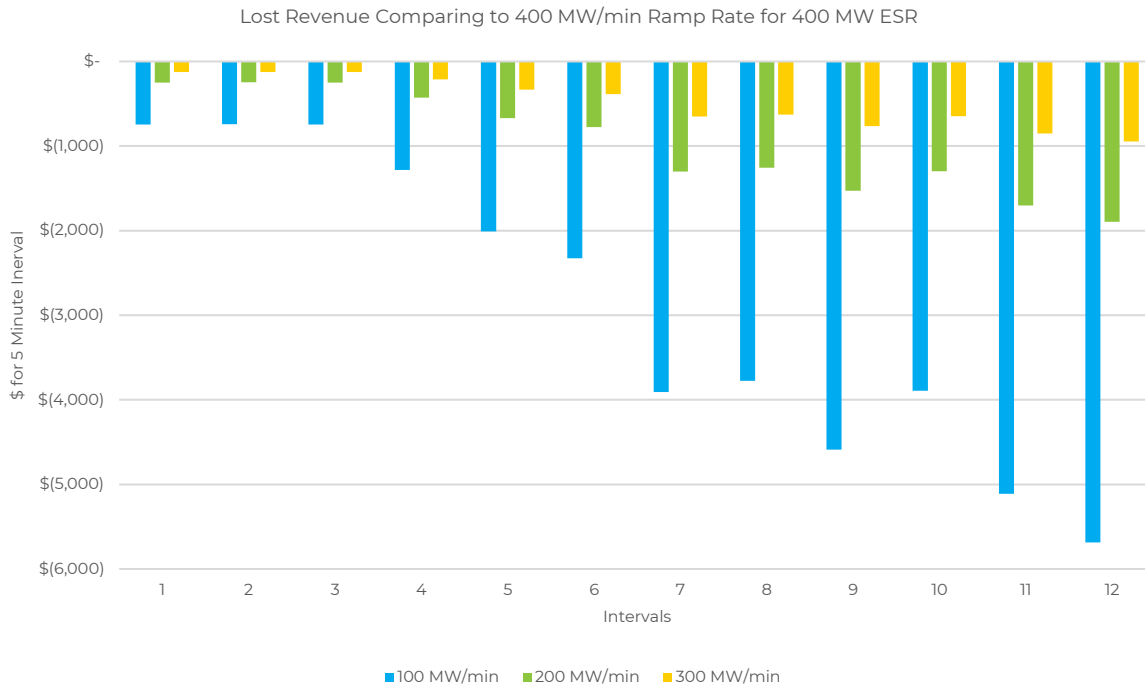
The IESO has stated that the ramping limitation is required to manage challenges with ACE. The IESO has provided no information or analysis to demonstrate that ACE challenges are due solely to BESS MP. Specifically, at this time there is very small amounts of BESS connected and operating in the IAM. For the IESO to conclude that BESS and energy storage resources will be the sole cause of ACE challenges and therefore are the only resource to be artificially restricted through ramp rate limitations is inappropriate and unjustified. Challenges for ACE are primary due to resources that deviate from their dispatch instructions and the IESO's error bounds for estimating non-dispatchable demand. First, as an inverter-based resource with firm energy availability (i.e., energy is stored and not available intermittently) BESS can meet their dispatch instruction with significantly higher precision than almost all other resources and MPs. Second, roughly 90% of demand is non-dispatchable and estimated by the IESO. Over the past decade the IESO ability to accurately estimate interval demand levels across the Ontario power system has decreased materially due changing load shape, more flexible demand, greater electrification and limited market participation by load customers. There is a much higher likelihood that ACE challenges are due to load variation and errors compared to MP output variation let alone BESS fast ramp issues. If the IESO has concluded that BESS is the primary cause of ACE challenges and has analysis that supports the conclusion they must publish the information. At this time, the Consortium is unconvinced and believes the unique and punitive ramping limitation applied only to BESS resources should be eliminated.

The impact of restricted ramp rate on storage Market Participants (MPs) is lost revenue from delayed response to dispatch instructions. The diagram below shows the ramp function of an ESR under a 500 MW/min ramp rate restriction compared to the 100 MW/min ramp rate restriction the IESO is proposing. The diagram below shows ramping of an ESR during a dispatch interval under the different ramp rates.



The green area is energy injection that is being forgone by a MP due to the ramp restriction over the dispatch interval. This foregone energy translates into lost revenue from reduced energy delivered during a dispatch interval. Since storage resources are a quick start resource that targets not only high priced intervals but intervals that experience a spike in price, the lost revenue can be significant.

For example, consider an hour that experienced a price spike on October 6th, 2025 hour ending 17 (HE17). The analysis has assumed an ESR of 400 MW and four different ramp rates (i.e., 100 MW/min, 200 MW/min, 300 MW/min, and 400 MW/min). The lost revenue for the 400 MW ESR ranges can be as much as 30% for that dispatch interval. Depending which interval the ESR is initially activated, the lost revenue from different ramp rates can range from ~\$744 to as much as \$5,686.



Stepping further back, since the launch of the Renewed Market the Consortium has calculated the potential lost revenue during instances where ramping requirements have exceed 100 MW. Depending what interval a storage facility was dispatched in, the range of lost revenue is estimated to be between \$215,000 to \$940,000. These values can significantly impact project economics and demonstrates the negative outcome of the unjustified and unfair 100MW/min ramping limit imposed arbitrarily only on storage resources.



The IESO has stated the potential for additional costs from regulation capacity to manage ACE; however, the IESO has not provided what the incremental cost of regulation capacity is or if there are technical challenges in securing additional regulation capacity in the immediate future. The IESO has stated a need for at least 30 MW of additional regulation capacity by 2026 growing to 110 MW by 2035.³ It is unclear to the Consortium if this additional regulation capacity will address the ACE challenges from higher ramp rates or if they are separate. The Consortium requests the IESO provide guidance if the additional regulation capacity will resolve the ramp rate restriction or if additional regulation capacity is needed.

As the IESO is aware, energy storage resources can provide regulation capacity and are critical resources in maintaining system frequency throughout North America. Future phases of the ERP are expected to explore Frequency Regulation from storage resources. The Consortium requests the IESO consider moving regulation capacity from storage resources into Phase 1 to help address the ramp rate restrictions and consider how energy storage resources could offer the service. The timing is critical as storage resources under development can make design and service agreement adjustments to support the IESO if guidance is provided early enough. As stated previously, the Consortium does not believe that energy storage resources are the cause of the ACE challenges, but they can be the solution.

The IESO has stated that no ramp rate restriction will be applied for storage resources dispatched for Operating Reserve activations (ORA). The Consortium's understanding is that ORA information is not made public so it is impossible for MP to assess how often they will be able to use their full ramp capabilities compared to the restrictions being proposed by the IESO. Generally, the Consortium's understanding is that almost all ramping actions by resources in the IAM are through energy dispatches and therefore the ramp restriction will lead to lost revenue in almost all days of operation.

The response from the IESO on Ramp Rates are insufficient as the IESO fails to meet their own Design Principles.

- Efficiency – Limits on Ramp Rates reduces market revenue and requires higher out-of-market payments through contract payments. The ESR consortium would have expected the IESO to analyze the cost of increased regulation capacity to manage challenges to ACE compared to the potential market revenue for BESS resources. This analysis has not been completed by the IESO.
- Competition – The advantage of BESS resources is their extreme fast response time to capture shifts in energy prices quickly before other slower resources can react. This is particularly important as part of the scheduling and dispatch instruction outcomes from the IESO algorithm. By restricting the Ramp Rate to an arbitrary value, the IESO is decreasing competition within the IAM.
- Certainty – BESS resources will be the largest expansion of capacity in the Ontario system this decade. Their operation and involvement in the market should be established with consistency and certainty for investment and operational actions. Waiting for the IESO to potentially make further changes in the future reduces certainty for BESS operators. In addition, the entire ERP scope is already delayed based on the IESO decision as part of MRP to exclude Energy Storage

³ See IESO Annual Planning Outlook 2025, Section 6.1.2 Regulation Needs Assessment, pg 59

Resources within the network model, a decision most ESR Consortium opposed at the time. The delay in appropriate Ramp Rate levels is a continuation of lack of certainty in previous IESO market design changes.

- Transparency – Appropriate transparency on this design decision would include analysis that quantifies the challenges posed to ACE (e.g., the cost of additional regulation capacity to manage ACE due to various degrees of higher Ramp Rates) compared to the lost revenue from restricted Ramp Rates for ESRs operating in the IAM. The IESO has not presented any analysis to justify their conclusions. Instead, the IESO has repeated a statement without any support that severely damages the transparency of the process.

To assist stakeholders in understanding the challenges and options for Ramp Rates; the following information and data sets would be required

- The IESO publish their analysis that demonstrates that BESS resources alone are the cause of ACE challenges in Ontario based on current experience in the IAM. The analysis should include analysis of error bands for non-dispatchable load estimates at an interval level.
- The IESO states that ramping restrictions are aligned with other jurisdictions like CAISO and SPP. The IESO should publish the ramping restrictions deployed in both of those jurisdictions.
- The proposed ERP ramping restriction are stated for energy only and does not include operating reserve dispatches. The IESO does not publish operating reserve dispatch data which makes it difficult to understand the full economic impact. To provide transparency and efficiency, the IESO must publish operating reserve dispatch statistics for the past 5 years on an hourly basis to understand how the limit on energy only dispatch impacts the future economics of ESRs. The ESR Consortium is concerned that there are very limited operating reserve dispatches and often the IESO dispatches under energy dispatch even through it is the OR resource that is being called upon short notice (i.e., that the IESO does not appropriately distinguish between the two dispatch types currently and may not do so in the future).
- Publish individual unit costs for regulation capacity to assist in understanding the cost of managing challenges with ACE from faster ramp rates. The ESR consortium is also interested in the ability of ESRs to provide regulation capacity through contract amendments and/or additional market products to support the IAM. Furthermore, the IESO should clarify what the additional regulation capacity is required for and if it will resolve the ACE challenges from higher ramp rates.
- Many of the challenges to ACE are related to the Net Intertie Scheduling Limit (NISL) of 700 MW. The Consortium recommends that the IESO consider exploring changes to the NISL now that more fast response resources exist.

Internal Service Load (ISL) and Round-Trip-Efficiency (RTE)

Both ISL and RTE can be heavily influenced by environmental and external factors. The Consortium understands that the IESO is seeking MPs to submit a maximum ISP value at registration to support data submission validation on a daily basis. In addition, the IESO is seeking MPs to submit daily values that can be adjusted throughout the day. The Consortium is seeking confirmation that the ISL value will

be submitted for each hour and can be adjusted up until the submission closing period (i.e., two-hours before real-time).

RTE is an estimated value and typically recorded after cycling is complete. The value can be influenced by the number of cycles (e.g., through degradation of the storage facility) and speed of cycling (e.g., how fast discharge or charge happens) among other factors. The Consortium is concerned that the IESO SoC management may overemphasize the RTE value when assessing availability of the storage resource. A better understanding how the RTE value is used and how MPs can update is required. Specifically, is the expectation that MPs will be able to update on an hourly basis daily.

Voluntary SoC Management

The Consortium has consistently requested that the IESO as part of the ERP include an ability for a MP to opt-out of the SoC Management and manage their SoC through bids and offers including a MP's strategy for participation in the DAM and RTM. This is offered in other markets such as NYISO and provides better flexibility, transparency and certainty for MPs participating in the IAM.

At this time, the IESO does not appear to have offered voluntary participation and has provided no explanation or reasoning why this option is not available. The SoC management involves significant monitoring and market participation requirements that may not be cost-effective or logical for MPs. Further, concerns with SoC management outcomes compared to MP optimization and market revenue objectives requires ability for opt out to maintain competition and certainty of investment. Finally, the SoC management estimates will be used to apply financially binding schedules in the DAM which may not be practical or economic for the MP if the SoC management system lacks the required accuracy. For this reason alone the IESO must offer a voluntary opt-out

The Consortium requests the IESO establish an opt-out of SoC management as part of the ERP. The Consortium reminds the IESO that voluntary opt-out was a key component of discussions during the long-term standard energy storage market participation discussions in 2020 as part of the SoC Lite decision-making process.

Contracts Management Involve

The Consortium supports the integration of IESO contract management as part of the market design and rule drafting phase of Batch 1 of the ERP. In previous market design changes, there has been challenges for stakeholders engaging both the IESO market design change team and the IESO contract management team together to address gaps and risks appropriately. The Consortium strongly recommends that the IESO plan to host joint sessions for IESO contract management and IESO ERP team with stakeholders to discuss any changes that might be needed in market design and/or contract obligations.

During the October 16, 2025, engagement session, the IESO suggested that discussion between the ERP market design team and IESO contract management will only occur within the IESO and that the IESO alone will determine what joint actions may be required. This approach is not appropriate and does not reflect the reality for MPs that are both participants in the market and contract counterparties to the IESO. The IESO must accept the fact they are both market designers and contract holders and engage stakeholders on a common ground. Furthermore, the IESO cannot understand what challenges MPs will have with design changes and contract obligations therefore must engage with MPs early to ensure

all parties understand the impact of changes and design options will have on changes and contract amendments all together. The Consortium strongly recommends IESO contract management attend ERP sessions in the future to understand the nuance of discussion and challenges early to support fruitful and productive discussions on potential contract amendments or clarifications in the future.

Multiple Market Participation Units

Certain BESS facilities have been structured by the IESO to have multiple generation/load resources (i.e., 2 generators and 2 loads) and thus, are required to submit bids/offers for each generation/load resource. The resources are related and share the same connection and metering installation. Most importantly, the BESS facility and resources are controlled by a single site-controller and as such, maneuvering the BESS facility to follow “resource specific” dispatch instructions will be challenging or nearly impossible. The IESO has proposed “Compliance Aggregation” as a means to mitigate this concern however, the compliance deadband of +/- 15 MW may be insufficient to avoid dispatch non-compliance and potential settlement impact if measurement and verification do not accurately compile output appropriately. The Consortium believes this challenge should be included in the ERP process and specifically within the Optimization Design Memo scope. The Consortium requests that the IESO amended the Optimization Design Memo to state how the IESO intends to structure BESS facilities at common connection points if there is a requirement for multiple units to submit bids/offers. Further, the Consortium requests a explanation and reasoning on when the IESO decides multiple units at a common connection point is required.

Market Power Mitigation Physical Withholding Obligation

The Consortium is seeking clarity on the obligations under Market Power Mitigation for energy offers to meet physical withholding obligations. Can the IESO clarify if the current IESO market rules expect energy storage resources to offer their full capacity in every hour to meet their physical withholding requirements? If so, what path does an energy storage resource have to ensure an hour is only charging and not potentially scheduled to withdrawal. Finally, under the ERP design how will SoC limitations be considered within physical withholding calculations?

Transparent and Accessible Market Data Publication

The Consortium wishes to restate its comments related to transparent and accessible market data publication by the IESO from the July 24, 2025, feedback. The comments are critical and the IESO has not responded to the request as part of the ERP process.

There are a number of areas where further information and action is required from the IESO. First, the changes being considered as part of the ERP will influence scheduling, dispatch, pricing and settlement for energy storage resources in addition to all market participants. The complexity of energy storage resource operations will result in different market outcomes and changing dynamics in the power system. For the benefit of Ontario consumers and market participants, addressing market inefficiencies and determining future market design changes (including potential power system planning and procurement actions) will require broader stakeholder participation and analysis. This cannot happen if market data and information are restricted and withheld by the IESO. The launch of the renewed market should have occurred with a revamping of IESO market data publication standards. In particular, the IESO has failed to adhere to best practices of sharing detailed information on scheduling and dispatch

outcomes including the inputs on a nodal basis for i) energy offers, ii) energy bids, iii) non-dispatchable load assumed by IESO, and iv) load assigned and observed at each node. This information is critical to understanding the market outcomes and determining if they align with what was expected from the IESO's scheduling and dispatch tool (e.g., are the changes for the ERP playing out as expected). Further, the market data discloser is required for Market Participants to learn how the market is operating and determine optimal energy bid and offer strategy by back-testing against actual market data. In the ESR Consortium's opinion, this component must be included as part of the ERP or as a parallel process. The IESO's own jurisdictional review (<https://www.ieso.ca/-/media/Files/IESO/Document-Library/corporate/applications/PA-IESO-Markets-and-Planning-Data-JR-Report-20230623.pdf>) demonstrates that the IESO is a laggard compared to other RTOs/ISOs.⁴

We will be pleased to meet with IESO about this submission at a mutually convenient time.

Sincerely,



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cc:

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Simon Laroche (Boralex)
Talmadge Farnes (Potentia)

⁴ ESR Consortium Submission - <https://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/erp/erp-20250821-feedback-form-ESR-Consortium.pdf>