Feedback Form

Repowering Existing Facilities – October 20, 2025

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To promote transparency, feedback submitted will be posted on the Long Lead-Time engagement page unless otherwise requested by the sender.

- ☐ **Yes – there is confidential information, do not post**
- ☐ **No – comfortable to publish to the IESO web page**

Following the Repowering Existing Facilities engagement webinar, the Independent Electricity System Operator (IESO) is seeking feedback from stakeholders on the items discussed. The presentation and recording can be accessed from the LLT RFP Stakeholder Engagement Webpage.

Note: The IESO will accept additional materials where it may be required to support your rationale provided below. When sending additional materials please indicate if they are confidential.

Please submit feedback to engagement@ieso.ca by November 21, 2025 .

Technology-Specific Considerations

- **What types of repowering are technically and economically feasible for each generation technology (e.g., hydro, wind, solar, gas)?**

The ability to repower a site hinge on a few key considerations, such as the health of the foundations and other components on the site, the economics of the power being generated at the site, and the new technology available.

One great thing about lithium-ion energy-storage systems is that they are long-lived. As a modular system, individual cells can easily be replaced if they become damaged, faulty or degraded. If the core infrastructure (power cables, foundations, heating/cooling systems) remains in good shape, the whole system can carry on with minimal maintenance.

The batteries themselves are generally expected to exceed ten years of operation, depending on the number of charges and discharges they experience, as well as the speed and frequency of these events. In this respect, each site will have a unique life expectancy, accounted for by the project developer.

Approximately 95 percent of a lithium-ion battery can be recycled into new batteries. In fact, the metals used in lithium-ion applications, such as lithium, nickel, and cobalt, hold their value beyond the life of the battery, allowing recycling facilities to reclaim these materials. Recycled metals command prices that are beginning to compete with metal from mining operations.

Below ESC has prepared some technology specific requirements to answer the IESO's questions

Technically Feasible Repowering Pathways

1. Battery Energy Storage Systems (BESS)

Battery repowering is the most prevalent and commercially mature form of repowering. Approaches include:

Module or Cell Replacement. This involves Replacing aging or degraded modules with newer versions of the same chemistry (e.g., LFP → improved LFP). Generally, this requires minimal re-engineering beyond BMS and EMS recalibration.

- Benefits: higher usable energy, improved round-trip efficiency, and extended lifecycle.

Major Repowering (Chemistry Swaps). This involves changing the full container or rack replacement with newer chemistry (e.g., NMC → LFP). While it is technically feasible, it is more complex than cell replace and requires, new safety approvals and thermal assessments, EMS/BMS re-integration and a re-evaluation of inverter and protection system compatibility. Essentially this would be considered as a full repower rather than a simple augmentation.

Balance-of-Plant Upgrades

Many mid-life BESS repowers include replacement or modernization of Inverters / Power Conversion Systems, HVAC and thermal management, Battery Management Systems / Energy Management Systems and Fire detection and suppression systems

These upgrades ensure the system remains compliant with evolving standards, improving performance and safety.

2. Pumped Hydroelectric Storage (PHS)

PHS repowering is well established and often highly cost-effective. This often includes installation of more efficient turbines and pump-turbines, generator rewinds and control system modernization and adding pumped-storage capability to conventional hydro plants.

These improvements increase flexibility, cycling capability, and overall facility efficiency while extending operational life by decades.

3. Compressed Air Energy Storage (CAES)

Repowering CAES is less common globally but technically feasible. Like pumped hydro repowering this often includes modernization of compressors and turbines, integration of waste-heat recovery systems and/or a transition to adiabatic CAES (A-CAES) configurations, improving round-trip efficiency

Due to the small global fleet, repowering efforts remain limited but prove advantageous where geological assets already exist. Repowering can extend a facility's operational life to 20–30+ years, improving long-term revenue certainty and reducing lifecycle emissions.

Repowering energy storage systems is a technically feasible and economically compelling strategy across multiple technologies. BESS repowering is the most advanced and widely adopted, while PHS repowering is proven and high impact. TES and CAES repowering remain more site-specific but offer meaningful opportunities where infrastructure already exists.

Eligibility & Contract Design

- **Should there be a minimum equipment replacement percentage requirement for repowered facilities (or some other similar criteria)?**
- **Should there be a minimum facility age to be eligible for "full" repowering (new 20-year term)? How can the IESO best incentivize getting maximum value for ratepayers out of existing facilities?**
- **Are there any unique contractual provisions that may be required for repowered facilities relative to the current LT2 contracts?**
- **Should performance security or milestones differ for repowered facilities? If so, how?**
- **Are there technologies that could conduct phased repowering by repowering a portion of their facility while the rest of the facility continued to operate?**

ESC supports a practical, principle-based approach that distinguishes full repowers (eligible for long-term 20-year contracts) from incremental or partial upgrades. Any design elements need to capture the system and ratepayer benefits of repowering while protecting against inappropriate reclassification of legacy assets as "new builds."

Competition & Fairness

- **Should repowered facilities seeking 20-year contracts compete directly with new builds under the LT2 RFP? Why or why not?**

Repowered facilities seeking 20-year contracts should not compete directly with new builds under the LT2 RFP; instead, they should participate through a parallel but coordinated procurement stream. Repowering and new builds have fundamentally different cost structures and risk profiles.

For one repowered asset leverage existing interconnections, permits, and civil works, enabling them to deliver capacity faster, with lower cost and lower risk, while new builds require full greenfield development. Direct, head-to-head competition would distort pricing, undervalue repowering's system benefits, and risk crowding out new builds needed for system expansion.

ESC believes that a separate repowering stream allows the IESO to properly evaluate the incremental value provided by existing assets including but not limited to avoided interconnection upgrades, reduced land and community impacts, and faster deployment timelines.

ESC believes that the above approach is consistent with leading practices in other jurisdictions: CAISO, ERCOT, and PJM all evaluate repowering through modernization or extension pathways rather than forcing direct competition with new builds, ensuring fair evaluation and clear price signals. Adopting a similar model in Ontario improves cost transparency, maintains competitive discipline within each category, and ensures the province secures the optimal mix of repowered and new-build resources to meet growing system needs in a cost-effective and reliable manner**.**

Alternatives to Repowering

- **How likely is it that suppliers will seek to decommission facilities rather than repower for each respective technology?**
- **What does decommissioning look like for your technology?**

End-of-life management is a critical component of responsible energy storage deployment and a topic that remains top of mind for Energy Storage Canada and our members. ESC recognizes that energy storage is not only about enabling clean energy but also about ensuring sustainability across the full lifecycle of projects. The industry is actively planning for responsible decommissioning, reuse, and recycling of batteries, with most components being recyclable or repurposable.

Advances in recycling technologies, including hydrometallurgical and direct recycling processes, are improving recovery rates while reducing environmental impacts, and second-life applications further extend the value of batteries. ESC supports clear and practical policy frameworks, including extended producer responsibility and circular economy approaches, and is committed to collaborating with manufacturers, recyclers, policymakers, and our members to ensure a coordinated, safe, and efficient circular approach. We see this as an ongoing priority and look forward to engaging further with stakeholders to strengthen sustainability, enhance critical mineral security, and integrate decommissioning planning into project design from the outset. Below are some common findings when it comes to BESS recycling and decommissioning.

Most battery components are recyclable or reusable.

- A significant amount of the materials in lithium-ion batteries (lithium, nickel, cobalt, copper, aluminum) can be recovered with current technologies.

Second-life applications extend battery value.

- Before recycling, many batteries are repurposed for second life uses (e.g., stationary storage for commercial buildings or grid balancing), maximizing the energy and materials invested in their production.

Industry collaboration is key.

- Energy Storage Canada is supportive of working with manufacturers, recyclers, and policymakers to ensure a **coordinated, circular approach** where batteries are tracked, reused, and recycled efficiently.

LT2 Window 2 Timing Considerations

- **What is the minimum viable period between revised deliverability guidance and LT2 Window 2 proposal submission?**
- **Is there a general concern with the timing of municipal elections with respect to the Window 2 Proposal Submission Deadline?**

ESC recommends that IESO provide a sufficient period between the release of revised deliverability guidance and the LT2 Window 2 proposal submission deadline to allow proponents to fully assess updated interconnection information, adjust project designs, and ensure accurate and complete proposals. A rushed window could lead to incomplete or lower-quality submissions, reduce competition, and ultimately limit value for ratepayers.

This concern is heightened given the timing of municipal elections, which can slow local approvals, limit staff availability, and create uncertainty regarding council support for MSR's. Requiring proposals to be finalized during election periods risks creating energy projects as a wedge issue in local campaigns and could inadvertently disadvantage certain proponents. ESC therefore supports adjusting the submission deadline to avoid municipal election periods, ensuring developers have sufficient time to navigate municipal processes and maintain a fair, competitive, and politically neutral procurement process.

General Comments/Feedback

ESC notes that requiring Municipal Support Requirements (MSRs) for repowered facilities would significantly increase project risk, particularly for Battery Energy Storage Systems (BESS) and other storage-integrated projects. With this said ESC also understands the value of MSR's and the critical important of municipal alignment with energy projects. We raise this point to simply highlight that risk is heightened by ongoing permitting and zoning challenges in certain municipalities, which have already created delays and uncertainties under both the ELT and LT1 processes.

For repowered facilities overall, ESC strongly emphasizes that the integration of BESS and other energy storage technologies should be a central design and policy consideration. Adding storage to existing facilities delivers tremendous benefits that extend far beyond simply increasing capacity. First, storage maximizes the value of existing infrastructure, including interconnections, land use, and civil works, reducing the need for costly greenfield development. Second, it significantly enhances grid flexibility and reliability, providing rapid response services, frequency regulation, load shifting, and peak shaving capabilities that support the integration of variable renewable generation. Third, storage enables better utilization of renewable energy resources by storing excess solar and wind generation for use during periods of high demand or low generation, effectively reducing curtailment and improving system efficiency. Finally, integrating storage contributes to lower lifecycle emissions, avoiding the need for additional fossil-based peaking resources and leveraging existing generation more efficiently.

ESC encourages IESO to adopt a flexible, outcome-focused approach for repowered facilities that emphasizes system value. By recognizing the unique advantages of storage integration, this approach would unlock faster deployment, reduce project risk, and ensure that repowering initiatives deliver tangible benefits to ratepayers, municipalities, and the broader electricity system. Prioritizing storage integration in repowering projects is therefore essential to achieving Ontario's clean energy and reliability objectives.