

ONTARIO ENERGY BOARD &
INDEPENDENT ELECTRICITY SYSTEM OPERATOR

JOINT TARGETED CALL INTERIM REPORT

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Ontario
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Board

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1 EXECUTIVE SUMMARY

Ontario is undergoing an energy transition as emerging resources and technologies offer communities and customers more control over how their energy needs are met. The Ontario Energy Board (OEB) and the Independent Electricity System Operator (IESO) are preparing for a shift to greater decentralization as distributed energy resources (DERs) begin to play a more important role in supporting reliability.

Opportunities are opening up for DERs to not only support local energy needs in the communities where they are located, but also contribute to broader regional and provincial needs.

In June 2021, both organizations teamed up to deliver unique pilot project opportunities that explore this potential. As a first-of-its-kind collaboration, the OEB's Innovation Sandbox (Sandbox) and the IESO's Grid Innovation Fund (GIF) held a joint targeted call for innovative proposals on DER integration, focusing on projects that test the capabilities of DERs in providing grid services at both the local and provincial levels.

This important partnership explores the opportunities and challenges presented by DERs while facilitating demonstrations and furthering discussions about the role of Local Distribution Companies (LDCs) in the sector, strategies for coordinating activities between distribution and transmission levels and how DERs can provide effective non-wires alternatives (NWAs) to avoid infrastructure upgrades.

The purpose of this report is to:

- Present an overview of the projects;
- Provide an update on their statuses, and;
- Highlight how they are contributing to ongoing IESO/OEB work and broader industry discussions.

Seven projects were awarded funding from the GIF in March of 2022, with five of those projects requiring regulatory guidance from the Sandbox. These projects, described in further detail below, will demonstrate a variety of concepts spanning from Distribution System Operators (DSOs) to the integration of energy storage and public transportation.

From the IESO's perspective, the projects will provide insights into the potential for DERs to provide reliable, cost-effective services to the

electricity system while unlocking savings for ratepayers. The outcomes of the projects are expected to inform the IESO's [Enabling Resources](#) work, including the [DER Market Vision and Design Project](#) and the [Transmission-Distribution Working Group](#) (TDWG), which will enable DERs to more fully participate in IESO markets.

From the OEB's perspective, these projects demonstrate its commitment to achieving its strategic goals of becoming a top quartile regulator, driving energy sector performance, protecting the public and facilitating innovation. The outcomes of the projects will be used to inform future policy work, particularly as it relates to the recommendations that emerge from the Electrification and Energy Transition Panel. The OEB also has several initiatives underway related to DER integration, such as the [Electric Vehicle Integration initiative](#), [DER Connections Review](#) and the [Benefit-Cost Analysis Framework](#). Joint Targeted Call project outcomes have the potential to inform this work.

Notably, some of the projects will be testing how LDCs can act as DSOs, drawing upon DERs and other local forms of supply to meet community energy needs in real-time. As part of this effort, Transmission-Distribution (T-D) Coordination protocols have been developed through the IESO's [TDWG](#) and will be tested over the coming months. While different DSO models have emerged around the world, there are many factors that would impact the type of model(s) that could work best in Ontario. Both the OEB and the IESO are committed to working with LDCs, DER owners and aggregators, and others to explore DSO models, and are supporting pilot projects that explore the same.

As of September 2023, projects have started or completed critical foundational activities such as program rules and design, development of draft T-D coordination protocols, development of measurement and verification methodologies, participant recruitment, software development and asset installation. Two projects have started testing DERs for their ability to provide grid services, and the remainder of the projects will begin testing in the coming months. One project is no longer participating in the program due to project-specific circumstances that made the project no longer feasible.

2 INTRODUCTION

2.1 Background: Regulator – System Operator Partnership Leads the Way with Joint Targeted Call

The electricity sector is undergoing rapid change in response to climate change targets, evolving customer choice and technological innovation. DERs play an important role in this landscape and can provide opportunities for DER owners, aggregators, distributors, the provincial system operator and ratepayers.

DERs are resources that are directly connected to the distribution system, or indirectly connected to the distribution system behind a customer's meter; and generate energy, store energy or control load. This can include individual resources and aggregations of resources such as rooftop solar, wind generation, building/facility backup generators, storage solutions, aggregations of smaller controllable loads such as heating, ventilation and cooling, and electric vehicle (EV) charging.

With Ontario electricity demand forecasted to rise by 2% per year for the next 20 years, DERs have the potential to increase grid reliability, affordability and competition, as well as enhance value for consumers. The challenge lies in effectively harnessing these resources to support both the local and provincial electricity grids.

2.2 IESO Grid Innovation Fund

The IESO's GIF was established in 2005 to evaluate novel solutions that have the potential to reduce customer costs, enhance competition and support the reliable operation of the grid. The GIF produces Ontario-specific data that informs decisions about policy, regulation and investments by individual businesses and homeowners. Through competitive calls for pilot proposals, the GIF invests in projects that validate the performance and business case of promising new technologies, practices and services.

2.3 OEB Innovation Sandbox

The OEB's Innovation Sandbox was launched in 2019 as a first-of-its-kind initiative in Canada's energy sector. Since then, the Sandbox has provided guidance and support to over 80 energy sector innovators on a wide range of topics that include DERs, net metering arrangements and hydrogen. This

work has been conducted through two streams of support offered through the Sandbox: an “Information Service” and “Project-specific Support.”

The Information Service is intended to be an easy and accessible way for innovators to reach out to OEB staff with questions about the regulatory framework as it relates to innovative ideas, products, services or business models, or ideas about a specific pilot project.

Project-specific support is available for innovators wishing to move forward with a specific innovative project and allows innovators to request specific forms of support from OEB staff, including customized guidance related to a regulatory requirement and/or assistance in requesting temporary relief from a regulatory requirement.

Both of these services are provided to innovators by the Sandbox team which is composed of subject matter experts from across the OEB.

2.4 Joint Targeted Call (JTC) for Proposals

Leveraging the benefits of the GIF and the Sandbox, energy sector innovators were given the opportunity to bring forward projects that would simultaneously receive GIF funding and Sandbox regulatory guidance, providing valuable insights for the sector, the IESO and the OEB. This call for proposals was a result of stakeholder feedback that identified the benefits to innovators and the sector more broadly if they could work in tandem with the IESO and the OEB to advance innovative projects that support grid reliability, have the potential to reduce costs for ratepayers and are seeking electricity market and regulatory guidance with respect to innovation.

High-level objectives of the JTC include:

1. Demonstrate the potential for cost-effective services that DERs can provide to consumers, distribution systems and the IESO-controlled grid to unlock ratepayer cost savings.
2. Test and demonstrate the effectiveness of technologies, programs or other innovative strategies to further the understanding of the IESO, the OEB and the sector of the dependability of DERs to improve electricity system reliability. Specific areas of interest include real-time dispatch and compliance of various DER aggregation types, telemetry aggregation services for system visibility and forecasting, and solutions that address barriers in wholesale and distribution settlement and metering.

3. Test the effectiveness of DERs to defer or eliminate the need for traditional electricity infrastructure (e.g., poles and wires) while maintaining or improving reliability.
4. Support the development of innovative arrangements that test new activities or business models where regulatory requirements may prevent or impede those arrangements from proceeding.

Specifically, innovators were able to request bespoke regulatory guidance that would allow them to test novel solutions and business arrangements. They were also provided with funding to enable these solutions to be developed, built and tested.

This unique opportunity paved the way for Ontario's energy sector to undertake practical demonstrations that would:

- Support market evolution through informing the viability of potential new distribution activities, verifying the performance characteristics of DERs and DER aggregations, demonstrating new technologies and testing T-D coordination approaches.
- Explore potential ratepayer savings by investigating and quantifying the use of DERs as NWA's to defer costly system upgrades while maintaining reliability and resiliency.
- Drive novel partnerships and collaborations across new and existing sector players.

The projects are demonstrating themes such as EV charging management, the value stacking potential for DERs and the potential of the DSO and its implementation in Ontario. For each of the projects where the OEB has provided regulatory guidance, the regulatory lessons will be related to cost/revenue allocation and to what extent increasing the capabilities of DERs can provide potential savings to ratepayers.

3 SUCCESSFUL PROJECTS

BluWave-ai



Partners: Hydro Ottawa, Moment Energy and Invest Ottawa
Project Title: EV Everywhere
Total Project Value: \$4,830,735
IESO GIF Contribution Amount: \$2,350,268

Project Overview

The goal of this project is to demonstrate how an LDC, and a software provider/aggregator can support capacity limitations at the distribution level via managing residential EV charging and leveraging two strategically located battery energy storage systems (BESS).

The project expects to reduce peak demand and will inform the potential deferral of future infrastructure upgrades.

The provision of wholesale services such as operating reserve, energy and capacity will be tested outside of IESO-administered markets, with Hydro Ottawa acting as a Total Distribution System Operator aggregating DER resources (EVs and BESSs).

The software solution will optimize EV charging management and energy injection/consumption from the BESS and incorporate load prediction, power flow optimizations, Internet of Things connectivity and fast artificial intelligence inference to autonomously smooth local system peaks.

This project will also demonstrate the willingness of drivers to accept third-party control of their vehicle charging, consumer EV charging behaviour/patterns and the success of the system at providing near real-time grid relief.

Project Accomplishments to Date

BluWave-ai has successfully analyzed the impact of different levels of EV penetration on various areas of the Hydro Ottawa grid, recruited participants and developed a T-D coordination protocol to use during the testing phase. Activities that are underway include integrating the software platform with

EVs, confirming BESS site locations, and installing and connecting the BESSs. Testing is expected to begin in late 2024/2025.

Enel X Canada Ltd. (Enel X Canada)



Partners: Ardian Infrastructure and Powerconsumer
Project Title: Unlocking DER Participation Across Ontario
Total Project Value: \$20,455,556
IESO GIF Contribution Amount: \$3,267,304

Project Overview

This project will demonstrate the ability to measure and verify performance from heterogeneous DER aggregations participating in simulated IESO capacity and operating reserve markets. Resources participating in the pilot include a mix of behind-the-meter battery storage (up to 48.2 MW across 12 sites) and manual load curtailment (up to 17 MW across three sites) across Ontario. Alternative measurement approaches will be tested to explore how DER aggregations that are not fully utilized could provide additional value to the grid.

The project will test the provision of wholesale grid services in coordination with addressing local system needs using a third-party market and dispatching platform, where the third party (Powerconsumer) will play the role of the Wholesale-Distribution Dispatch and Compliance Operator (WDDCO). Enel X Canada will submit dispatch data in accordance with the IESO's energy market timelines for each program day to indicate the availability of the DER aggregations to the WDDCO for potential dispatch. The WDDCO will use the dispatch data submitted for the resource to determine the MW quantity that the resource will be asked to provide if dispatched for a simulated demand response or operating reserve event.

For demand response events, the WDDCO will issue standby and activation notices to Enel X Canada adhering to the IESO capacity auction timelines. For operating reserve events, Enel X Canada will receive activation notices either 10 or 30 minutes ahead of the activation, depending on the class of OR being provided, per the IESO's operating reserve requirements.

Resource performance will be measured and verified according to an alternative measurement and verification plan not used in the IESO-administered markets today. The effectiveness of the alternative measurement and verification approach will be assessed with respect to the existing approaches in the IESO's market rules.

Project Accomplishments to Date

Enel X Canada has developed a measurement and verification plan that explores different methodologies to measure and verify performance of DERs and DER aggregations during capacity and operating reserve events, in addition to a set of program rules that outline the participation protocols. The project will also explore protocols for managing bid submissions for resources that are able to provide both operating reserve and capacity services. Participating sites and their respective metering configurations have been confirmed, and testing is well underway. Further demonstrations and analyses, including local test events, will be conducted in Q3/Q4 2023.

Essex Powerlines Corp. (Essex Powerlines)



Partners: NODES AS, Essex Energy Corp., Utilismart Corp.
Project Title: Distribution System Operator (DSO) Pilot Project (PowerShare)
Total Project Value: \$8,088,778
IESO GIF Contribution Amount: \$3,882,389

Project Overview

In this project, Essex Powerlines will act as a DSO for a distribution-level electricity market for activation of DER flexibility in near real-time.

The Leamington area is constrained from a bulk system and local perspective. Through this pilot, DER owners in Essex Powerlines' service territory will be able to participate in a local flexibility market, via the NODES market platform, to sell energy or demand response services to support grid reliability and resiliency. NODES, a project partner, will be providing an electricity trading platform to enable DER owners and aggregators (the sellers) to provide their bids and offers for Essex Powerlines (the buyer) to

purchase, when and where needed. NODES will perform performance validation and settlement functions.

In addition to providing distribution-level services, the project will test how DERs can also provide bulk level services such as operating reserve, energy and capacity, outside of the IESO-administered markets environment. Elements of the Total DSO and Dual Participation DSO Transmission-Distribution coordination models will be tested during the two Trading Phases.

Expected benefits of the project include demonstrating the ability of a local utility to act as a DSO, demonstrating ratepayer value, testing the effectiveness of DERs to provide flexibility services to both distribution and bulk systems, and testing distribution level/IESO coordination.

Project Accomplishments to Date

Essex Powerlines and NODES have already established the DSO market design and T-D coordination protocols, developed program requirements and market rules, begun recruitment of program participants (DER owners and aggregators) and integrated participants into the NODES platform. The local flexibility electricity market is live as of November 2023, with Phase 1 testing underway.

Phase 2, which explores the Dual-Participation DSO model, is expected to go live in late 2024.

PowerON Energy Solutions LP (PowerON)



Partners: Toronto Transit Commission (TTC), City of Toronto
Project Title: Battery Storage for Electric Bus Charging, Demand Reduction and Grid Services
Total Project Value: \$12,099,944
IESO GIF Contribution Amount: \$3,050,000

Project Overview

The objective of this project is to explore how BESS coupled with smart management can optimize electric bus charging while also providing grid services.

This project will deploy two 1 MW BESSs and smart charging management systems at each of the TTC’s McNicoll and Wilson bus yards to provide load shifting – avoiding strain on the grid during peak times from bus charging – and other grid services while supporting the operations of the TTC’s growing electric bus fleet.

PowerON will explore the use of hybrid resources (site load plus batteries) as a means of providing capacity services, in addition to the capabilities of aggregating services from the two sites. The batteries will also demonstrate how they can provide grid services such as energy, operating reserve and capacity to the provincial electricity market.

Project Accomplishments to Date

PowerON has nearly completed the initial engineering and planning phase of the project and engaged Toronto Hydro Electric Systems Ltd. (Toronto Hydro) to conduct connection impact assessments. In the coming months, procurement and construction activities will take place at the two bus yards. Testing is expected to begin in late 2024/early 2025.

Toronto Hydro



Partners: Power Advisory and Toronto Metropolitan University
Project Title: Benefit Stacking Transmission and Distribution System Non-Wires Alternatives (NWA) Pilot Project
Total Project Value: \$3,690,000
IESO GIF Contribution Amount: \$1,892,500

Project Overview

Toronto Hydro is demonstrating how a distributor can coordinate with the IESO to dispatch local demand response (LDR) resources to meet targeted distribution system needs and simulated bulk-system needs, with the goal of driving down ratepayer and total system costs.

LDR is a Toronto Hydro NWA program, aimed at leveraging behind-the-meter DERs to address short-term station capacity constraints. Through Toronto Hydro’s LDR Program, the distributor will procure demand response

capacity to defer or avoid distribution system upgrades at two stations in the Richview south area. This area is constrained from a local and bulk-system perspective.

The pilot will run for a three-year term, including running discrete LDR Auctions in Year 1 (2023), Year 2 (2024) and Year 3 (2025).

Committed capacity from DERs in the LDR auction will be utilized to alleviate local capacity constraints and respond to simulated wholesale system needs following existing IESO market rules for hourly demand response resources in the IESO's Capacity Auction.

Project Accomplishments to Date

Toronto Hydro developed program rules defining eligibility, processes, timelines, settlement and verification for DERs participating in the LDR auction and providing wholesale-level services (outside the IESO-administered market environment). The timelines streamlined the process for the DER owner/aggregator to participate in both opportunities, while complying with existing IESO market rules and Toronto Hydro timelines.

One of the goals of the pilot was to explore how DERs that are procured for the purposes of addressing distribution system challenges can also be used to provide bulk-system services. To support this, Toronto Hydro developed a T-D Coordination Protocol that adheres to the existing IESO market rules, frameworks and tools. The protocol defines how Toronto Hydro, aggregators and the IESO would communicate to indicate when resources were available to meet a local need, a wholesale need, an overlapping need or an undeliverable need (e.g., due to a distribution-level outage). Protocols were defined for day-ahead and real-time processes, in accordance with the existing process in place for the IESO-administered markets. This Protocol will be tested in the upcoming phases of this project, and insights will inform the IESO's T-D Coordination Working Group.

Toronto Hydro launched Year 1 of the LDR in May 2023, with four activations as of September 20th during the 2023 obligation period.

Registration for Year 2 (2024) of the LDR Auction opened in August 2023. In Year 2, the pilot is expected to place additional focus on enhanced visibility of DERs.

(<https://torontohydroldr.pilot2023.com/>)

TTC



Partners: PowerON, City of Toronto
Project Title: TTC Wayside Renewable Energy Storage for Subway
Total Project Value: \$2,500,000
IESO GIF Contribution Amount: \$1,250,000

Project Overview

Led by the TTC, this project is implementing a pilot project to capture, store and distribute electricity generated through an existing onboard regenerative braking system on subway trains. A feasibility study is being conducted and will be followed by a proof-of-concept implementation and testing of the energy management system at the TTC's Greenwood Yard location.

TTC trains use a regenerative braking system to capture a portion of the kinetic energy generated from braking and transfer that energy to other trains that use it to accelerate. Currently, the portion of the electricity that is not used by vehicles accelerating within the same circuit is burned off as heat. The TTC would like to capture, store and distribute this untapped source of energy.

A Wayside Energy Storage System (WESS) will be installed at the pilot location to capture and store excess electricity. The energy storage system will allow the TTC to use energy that would otherwise be burned off as heat to help reduce their own electricity demand and potentially support the grid. The project will demonstrate that WESS has the potential to reduce existing demand on the grid in a dense urban environment where existing resiliency issues exist.

Project Accomplishments to Date

The project is in the feasibility study stage.

Following completion of the feasibility study, the project will explore the design and implementation of this proof of concept including developing technical specifications, construction, commissioning and testing of the system to reduce site electricity consumption and potentially support the grid.

Peak Power Inc. (Peak Power)



Partners: Oshawa PUC, Ontario Tech University, eCamion
Project Title: Demonstration of a Distributed Energy Resource Aggregation (“DERA”) Platform at Ontario Tech University
Total Project Value: \$4,472,248
IESO GIF Contribution Amount: \$1,548,744

This project sought to demonstrate the capabilities of a DER aggregation software platform that manages DER operations by optimizing multiple DER benefits, including greenhouse gas reductions, resiliency, power factor correction, demand response and other needs of the local distributor, Oshawa PUC. The project aimed to leverage behind-the-meter DERs, including a combined heat and power generator, EV chargers, battery energy storage and solar energy located at Ontario Tech University.

Peak Power is no longer participating in the program due to a project partner withdrawing their participation in the project. Their withdrawal impacted project scope and budget, making the project no longer feasible.

3.1 OEB Regulatory Guidance

As part of the Joint Targeted Call process, OEB staff provided regulatory guidance to project proponents. In several cases, proponents had questions about whether the proposed project was permissible under section 71 of the *Ontario Energy Board Act, 1998*, which generally prohibits an electricity distributor from carrying out a business activity other than distributing electricity, except through an affiliate; one proponent also asked whether an OEB licence would be required. Guidance provided to each of the proponents can be found on the dashboard of the OEB Innovation Sandbox (www.oeb.ca/innovation).

4 PROJECT INSIGHTS SHAPING OEB/IESO INITIATIVES

4.1 OEB DER Integration

The JTC initiative reinforces the OEB's commitment to its strategic goals of becoming a top quartile regulator, driving energy sector performance, protecting the public and facilitating innovation. The outcomes of the JTC projects will continue to advance the OEB's strategic priorities and legislative mandate of facilitating innovation through initiatives aimed at facilitating the cost-effective adoption of innovation and new technologies and enhancing value for consumers. They will also support current and future policy work, including the following initiatives underway related to DER integration:

- The EV Integration initiative is working to ensure the efficient integration of EVs with the electricity system;
- The DER Connections Review is focused on streamlining the process of connecting DERs;
- The Benefit-Cost Analysis Framework to identify the full energy system benefits and costs of DER solutions.

The OEB is actively monitoring the JTC projects and exploring how their insights can be integrated into these and other OEB initiatives related to DER integration, as appropriate.

4.2 IESO DER Integration

The funded projects are providing valuable insights into some of the larger initiatives underway at the IESO, namely the DER Market Vision and Design Project (MVDP) and the TDWG, as part of the IESO's Enabling Resources Program.

The MVDP is seeking to establish new participation models for DER/A (DERs and DER aggregations) integration into wholesale markets and the TDWG is seeking to develop implementation-ready operational protocol(s) that detail the coordination and communications among the IESO, LDC and DER participants in the wholesale market and distribution NWA services.

Key focus areas for these JTC projects in support of the IESO's DER integration work include:

1. DER/A capabilities and performance validation, such as the ability to:
 - Reflect true availability

- Follow 5-minute energy dispatches, and
 - Respond to 10/30-minute operating reserve activations or capacity calls
2. T-D Coordination:
 - Coordination of DER/A availability and utilization between the IESO and LDCs from day-ahead through to real-time
 - Exploring different DSO models (Total DSO and Dual Participation/Hybrid DSO)
 3. Metering, Monitoring and Control Solutions
 - Assessing different types of metering, data aggregation, accuracy, etc.

Lessons learned in the above areas will inform future DER integration work within the Enabling Resources Program at the IESO.

5 CONCLUSION

The collaborative effort between the OEB and the IESO marks a significant milestone in advancing the province's energy sector. This unique partnership, initiated in June 2021, has laid the groundwork for pioneering pilot projects with the potential to shape the future of Ontario's grid.

The purpose of this report has been to provide an overview of these projects, their current statuses and their contributions to ongoing IESO/OEB initiatives and broader industry discussions. In Q1 2022, seven projects were awarded funding, five of which received regulatory support. They showcase a diverse range of concepts, from DSOs to energy storage integration to public transportation electrification. The projects underway have made progress; for some this has meant program design and participant recruitment, while others have moved onto testing of resources.

The OEB and IESO will continue to be actively involved in supporting these projects as they work towards their milestones. A final report with results and lessons learned will be published once the projects conclude and results become available.

The joint efforts of the OEB and IESO underscore each organization's dedication to driving positive change in Ontario's energy landscape, with the

ultimate aim of enhancing grid efficiency, resiliency and sustainability while enabling customer choice in the face of evolving energy needs and technologies. The success of these pilot projects has the potential to influence the broader industry and contribute to the evolution of Ontario's energy sector, and an affordable, reliable and sustainable energy transition for all Ontarians.