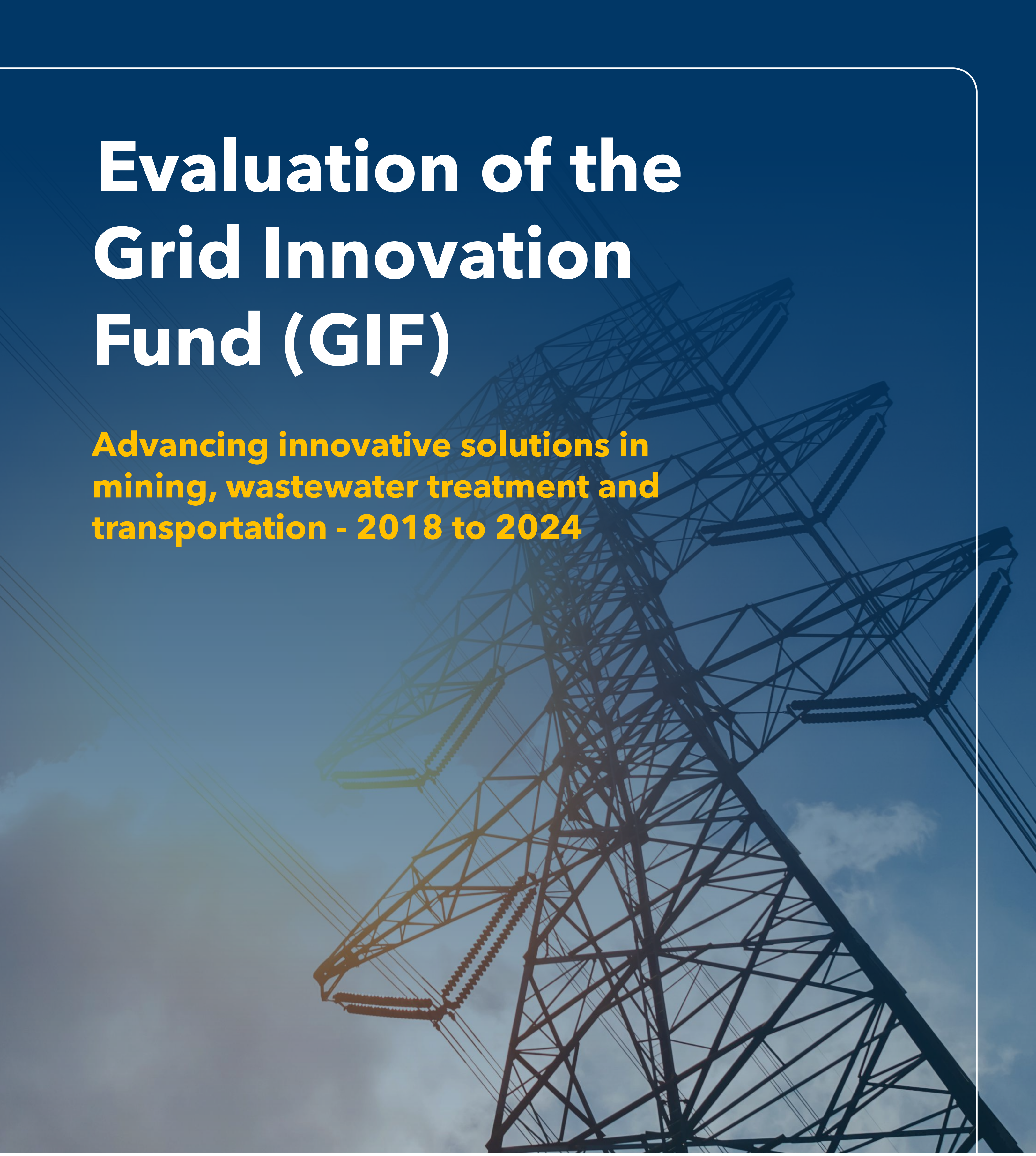
Evaluation of the Grid Innovation Fund (GIF)

Advancing innovative solutions in mining, wastewater treatment and transportation - 2018 to 2024



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Executive Summary

The Independent Electricity System Operator (IESO) Grid Innovation Fund (GIF) supports demonstration and deployment of innovative technologies that enhance Ontario's electricity system. Following the OEB directive, the IESO undertakes a third-party evaluation of the GIF and supported pilot projects every two years. This evaluation assesses five GIF-funded pilot projects completed between 2018 and 2024. Three projects focused on industrial energy efficiency and two on electric vehicle (EV) demand flexibility.

Table 1: Summary of GIF-supported projects

Project	Focus	Verified Energy Savings (kWh)	Verified Demand Savings (kW)	Project Costs	Estimated Cost Savings
Borden Mine	Mining Energy Efficiency	5,900,000	~675	$1,971,805	$413,165
Hespeler Membrane Aerated Biofilm Reactor	Wastewater Treatment Energy Efficiency	102,000	~23	$8,012,240	$7,145
Aisla Craig & Watford Double Vortex Aerator	Wastewater Treatment Energy Efficiency	Watford: 43,235 Ailsa Craig: 14,305	~6	$146,400	$3,025 (Watford) & $1,000 (Aisla Craig)
Alectra Drive@Home	EV Demand Flexibility	N/A	Time-based pricing: avg 0.08 kW/EVSE DR events: avg 0.92 kW/EVSE (MURB); -0.65 kW/EVSE (SFH) Peak Demand Mgnt: <0.15% of building demand	$3,400,000	$115 lifetime avoided costs per EVSE
Elocity	EV Demand Flexibility	Not reported	Not reported	$1,005,275	Could not calculate[1]

The evaluation examined project outcomes across three key dimensions:

1. **Demand-Side Impact**
2. **Ontario Energy Sector Impact**
3. **Value for Money**

[1] Elocity did not report savings. The pilot project was focused on changing EV owner charging behaviour, testing infrastructure integration and customer experience.

Key Findings

GIF-supported projects have delivered valuable technical, operational, and strategic insights across industrial and transportation initiatives. While the program has played an important role in de-risking early-stage innovation, and in several cases, supporting progress toward further development or commercialization. At the same time, translation of pilot-level results into broader Ontario electricity sector impacts have varied across projects, reflecting differences in technology/solution maturity, pilot scale, data availability, evaluation timing, and evolving market conditions.

GIF projects advanced understanding of emerging technologies. Industrial pilots achieved measurable energy and cost savings, while EV projects provided lessons on flexibility potential, grid integration, and regulatory challenges around utility direction and compensation. The decentralized compressed air (CA) system at Borden Mine showed cost-effective savings, strong scalability, flexibility, and non-energy benefits such as noise reduction and safety improvements. The MABR pilot demonstrated that site design and vendor choice significantly affect performance and cost, with potential for broader application. Modular systems like IPEX's DVA show strong replication potential. Alectra Drive@Home, Elocity demonstrated future potential for managed charging, contingent on strong coordination among utilities, vendors, and customers.

Future pilots should balance innovation with targeted objectives to manage complexity and improve measurability. Developing clear pilot logic and theory and planning evaluation at the pilot design stage with defined baselines, seasonal adjustments, and robust measurement and verification will strengthen pilot design and execution, improve data quality, reduce uncertainty, and enhance comparability across projects. The pilots, conducted between 2018–2024, were evaluated retrospectively, reducing data access, staff availability and recall. Conducting evaluations closer to project completion will improve data integrity, ensure alignment with GIF objectives, and deliver timely lessons for replication and broader impacts.

GIF successfully de-risked innovation; however, several structural and design factors help explain variation in post-pilot scaling and sector-wide impact. Many GIF-supported projects focused on early commercial demonstrations, where technologies at TRL 7 inherently face greater uncertainty than more mature TRL 9 solutions. In addition, pilots were often implemented at a limited scale, and project reporting requirements did not consistently emphasize the measurement or articulation of broader Ontario electricity system impacts, particularly beyond the pilot period. The GIF portfolio underscores the vital role of public funding in de-risking innovation but highlights the need to bridge the gap between demonstration and adoption. Strengthening alignment with emerging grid priorities (i.e., decarbonization, electricity load growth, load flexibility and grid modernization) and refining innovation metrics will enhance program impact.

To strengthen GIF's strategic value:

- **Initiate evaluations closer to pilot completion** to reduce potential data loss and provide timely insights to participants and the broader market.

- **Strengthen alignment at the application stage by asking targeted, GIF objective-linked questions that clarify each project's intended contribution** whether addressing market barriers, advancing technology adoption, validating technical performance, or building organizational capacity. And GIF expectations should reflect what pilots can reasonably achieve. For example, applicants should be asked to explicitely describe how their project will support GIF objectives (i.e., develop and deploy grid-enhancing technologies, encourage the adoption of innovative solutions, identify barriers and mitigation strategies, test grid resilience and reliability and disseminate findings to the broader Ontario market). Asking applicants targeted questions aligned with GIF objectives helps ensure proposed projects are designed to directly advance those goals, while also prompting proponents to think more clearly about how they will design, deliver, and evaluate their approach. We note that as of 2024, IESO has implemented specific key performance indicators for each funding round so that results can be measured.
- **Provide early and additional support to GIF recipients to strengthen evaluation plans, improve data collection and tracking to directly measure impacts**. While evaluation plans are required as part of the application package, these can be strengthened. Evaluation plans should include a clear pilot description, including a program theory logic model that clearly links pilot activities to expected outcomes. Additionally, plans should articulate evaluation objectives and key research questions (linked to GIF objectives), data sources and collection methods, evaluation approach, schedule, contingency plans/risk mitigation strategies and how they intend to report results. Involving IESO staff at the beginning versus only at the end could also provide valuable technical expertise that can help facilitate better evaluation plans and approaches. We note that the IESO has already taken several important steps. In 2024, the IESO team began closely monitoring project progress through bi-monthly meetings and is offering more support at project execution.
- **Consider offering mechanisms (additional incentives and/or support) to enhance learning dissemination and project replication**. GIF results help demonstrate how to mitigate risks, identify barriers, and assess the replicability of solutions across Ontario. Project findings are shared publicly by recipients and on the IESO website and are often used by the IESO's DSM team to inform future programming. However, there is an opportunity for GIF to further elevate projects by strengthening post-program support, ensuring initiatives continue to receive visibility, guidance, and partnership opportunities. This could include financial support (e.g., funding for knowledge-transfer activities, publication grants, or follow-on commercialization funding) and technical support (e.g., dissemination through funder channels, events to showcase results, assistance in packaging insights, partnership brokering, regulatory engagement support, and ongoing advisory guidance).

Glossary

APO	Annual Planning Outlook
BEV	Battery Electric Vehicle
CA	Compressed Air
CAS	Conventional Activated Sludge[2]
DER	Distributed Energy Resources
DERMS	Distributed energy management system
DO	Dissolved oxygen
DR	Demand Response
DSM	Demand Side Management
DVA	Double Vortex Aerator[3]
DWTP	Drinking Water Treatment Plant
ECCC	Environment Climate Change Canada
eDSM	Electricity Demand Side Management
ESG	Environmental, Social, and Governance
EV	Electric Vehicle
EVCCP	EV Charging Connection Procedures
EVSE	Electric Vehicle Supply Equipment
FCM	Federation of Canadian Municipalities
GHG	Greenhouse gas
GIF	Grid Innovation Fund
GWh	Gigawatt-hour
HIEV	Hyper Integrated EV[4]
IESO	Independent Electricity System Operator
kW	Kilowatt

[2] Widely used biological process for treating wastewater by using a mix of air and microorganisms to break down organic matter and nutrients
[3] Device that uses a "double vortex" flow to inject and mix air into liquid, primarily used in sewage systems and stormwater treatment to control odors and corrosion
[4] End-to-end AI-powered EV management charging device.

kWh	Kilowatt-hour
LDC	Local Distribution Company
MABR	Membrane Aerated Biofilm Reactor[5]
MAC	Mining Association of Canada
MECP	Ministry of Environment, Conservation and Parks
MURB	Multi-Unit Residential Building
MW	Megawatt
MWh	Megawatt-hour
OCPP	Open Charge Point Protocol
OCWA	Ontario Clean Water Agency
OEB	Ontario Energy Board
OMA	Ontario Mining Association
PDM	Peak Demand Management
PUC	Public Utility Company
SCBA	Self-Contained Breathing Apparatuses
SFH	Single Family Home
TOU	Time-of-Use
TRL	Technology Readiness Level
TWh	Terawatt-hour
ULO	Ultra-Low Overnight
VFD	Variable Frequency Drive[6]
VOD	Ventilation On Demand[7]
WWTP	Wastewater Treatment Plant

[5] Wastewater treatment technology that uses hollow, gas-permeable membranes to deliver oxygen directly to a biofilm that grows on the membrane's surface.
[6] Motor controller that adjusts the speed of an AC electric motor by varying the frequency and voltage of the power supplied to it.
[7] Method applied to underground mine ventilation systems to maintain safety while reducing fan energy consumption.

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Introduction

Grid Innovation Fund Overview

The $9.5M Grid Innovation Fund (GIF) supports new and innovative conservation and demand management initiatives. The GIF was preceded by the IESO Technology Development Fund and Conservation Fund. While the older funds offered grants for energy conservation and demand management, the current GIF provides financial support for projects addressing provincial electricity system challenges and opportunities, including clean technologies and system upgrades.[8] Since 2005, the GIF (and its predecessor funds) has provided financial support for more than 200 innovative energy projects across the province. GIF issues targeted calls for projects addressing IESO identified challenges or opportunities and open calls to capture broader promising ideas.[9]

GIF Program Goals and Objectives

The GIF aims to advance innovative solutions that have potential to enhance the efficiency, reliability, and affordability of Ontario's electricity system. The GIF invests in projects that have the potential to enable Ontario customers to better manage their energy and power consumption and/or reduce overall system costs and enhance reliable operations of Ontario's electricity grid.

The fund aims to support projects that are aligned with GIF objectives and focuses on validating new technologies at technology readiness level (TRL) 7 or greater[10], as well as new practices and services that address market barriers and have potential to accelerate the adoption of cost-effective energy solutions. By supporting the demonstration and validation of emerging energy technologies, practices, and services, the GIF aims to facilitate their transition from pilot stages to broader market adoption.

GIF has five main objectives:

1. Support the development and deployment of grid-enhancing technologies ready to be demonstrated in an operational environment.
2. Encourage the adoption of cutting-edge cost-effective, competitive energy solutions
3. Identify barriers to innovation in the electricity sector and opportunities to mitigate.
4. Explore how solutions may impact grid resilience and reliability while reducing ratepayer costs.
5. Inform Ontario's industries of developments in these grid-enhancing technologies.

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[8] https://ieso.ca/en/Get-Involved/Innovation/Grid-Innovation-Fund/Overview#:~:text=Since%202005%2C%20the%20GIF%20(and%20its%20predecessor,a%20specific%20challenge%20or%20opportunity%20identified%20by

[9] The 2018-2019 calls focused on conservation and electricity savings, while 2020 included an open call and targeted agricultural applications.

[10] TRL 7 indicates a prototype is ready for demonstration in an appropriate operational environment; TRL 8 is defined as a technology that has proven to work under expected conditions; and TRL 9 involves application of a technology proven through successful deployment in an operational setting.

The program is designed to help overcome barriers that new technologies may face in achieving widespread adoption, including:

- **High Initial Costs**: Innovative projects often require significant upfront investment. GIF provides financial support to reduce upfront capital and increase their economic viability.
- **Risk Perception**: Innovative projects often carry technical or financial risks. Financial support serves to de-risk projects and attract private investment.
- **Integration Challenges**: Deploying new technologies may require changes to grid distribution operations, infrastructure, and market structures. The GIF supports projects that aim to understand and address these integration issues, ensuring that solutions can be effectively implemented within the existing system at scale.

> **Note:** Throughout this document we refer to the Grid Innovation Fund as "***GIF or program***", whereas the funded initiatives are referred to as "***projects or pilots***".

Evaluation Purpose

The IESO is required to procure a third-party evaluator on a biennial basis to evaluate GIF and funded projects.[11] The purpose is to ensure effective governance, demonstrate responsible use of public funds and investment impacts, and contribution to IESO's core strategy to drive and guide the sector's future.

The IESO engaged Dunsky Energy + Climate Advisors (Dunsky) to conduct the evaluation. The evaluation focuses on understanding the projects' demand-side impacts (e.g., energy and demand savings and process improvements), Ontario energy sector impacts and value for money.

GIF Supported Projects Evaluated

In this GIF evaluation cycle, five projects were evaluated. One focused on energy efficiency in the mining sector, two in the wastewater treatment plant (WWTP) sector and two leveraged electric vehicles (EV) for demand management and flexibility. Projects were completed between 2018-2024.

The table below summarizes the GIF supported projects evaluated this evaluation cycle followed by a description of each and how they intended to contribute to the IESO goals.

[11] The GIF program will undergo an internal evaluation separately in 2026.

Table 2: GIF supported projects

Project	Lead GIF Recipient	Focus	Timeline	Savings	Scope	Planned Cost	GIF Funding
Borden Mine Distributed Air Compression	Goldcorp Inc. (Mine)[12]	Energy Efficiency	2018 - 2024	Yes	1 mine	$1,517,462	$500,000
Hespeler MABR	Region of Waterloo (Municipal)	Energy Efficiency	2018 - 2024	Yes	1 WWTP	$4,696,400	$495,000
Ailsa Craig/Watford Double Vortex Aerator	IPEX Technologies (WWTP Equipment Company)	Energy Efficiency	2018 – 2024	Yes	2 WWTP	$146,400	$73,000
Alectra Drive@Home	Alectra (Utility)	EV Demand Response	2018 - 2023	Yes	30 customers	$1,724,431	$499,160
Elocity HIEV	Elocity (EV Platform Provider)	EV Demand Response	2021 - 2023	No	Target: 80-150 customers Actual: 58	$1,005,275	$499,427

PROJECT 1
Borden Mine Distributed Compressed Air System

This project aimed to assess the feasibility and impact of replacing centralized compressed air systems in underground mines with distributed equipment. Eliminating inefficient air distribution networks could significantly reduce energy losses while maintaining essential emergency oxygen delivery capabilities. Alternative safety practices were evaluated in parallel to ensure operational reliability. As a fully electric underground mine, efficiency becomes essential to limit grid impacts and maintain reliable operations.

PROJECT 2
Hespeler WWTP Membrane Aerated Biofilm Reactor (MABR)

This project evaluated the potential of a novel MABR to reduce energy consumption in wastewater treatment. By minimizing the use of blower fans in the aeration process, the technology could significantly lower the energy required per volume of treated wastewater easing demand on the grid. If successful, this approach could lead to more energy-efficient wastewater treatment solutions. The solution was implemented by the Region of Waterloo's Hespeler wastewater treatment plant (WWTP).

[12] Since the project application, Goldcorp Inc., was acquired by Newmont Corporation in 2019 and then Discovery Silver Corp. acquired the Porcupine Complex from Newmont Corporation, which includes the Borden Mine, as part of a larger transaction, in April 2025.

PROJECT 3

Ailsa Craig WWTP Double Vortex Aerator (DVA)

This project explored the use of a DVA to enhance pre-aeration in wastewater treatment, reducing reliance on energy-intensive blower fans. The technology could lower the energy required for wastewater treatment, decreasing overall grid demand and improving system efficiency. The project was spearheaded by IPEX technologies inc. and installed at the Ailsa Craig WWTP.

PROJECT 4

Alectra Drive@Home

The project involved an EV deployment model for both single-family and multi-family residential customers to address economic, technical, regulatory, and customer engagement factors required for large-scale adoption and improve overall grid efficiency. The project included a monthly subscription-based fee for access to Alectra-provided connected EV supply equipment (EVSE) and Alecta facilitated response to time-varying electricity rates and demand response events for single-family and multifamily customers to encourage off peak charging and peak demand management events for multi-family buildings.

PROJECT 5

Elocity Hyper Integrated EVs (HIEV)

Elocity aimed to demonstrate the benefits of its digital platform, HIEV, in collaboration with two local distribution companies (LDCs), Toronto Hydro & Waterloo North Hydro. The HIEV system, comprising both software and hardware, was designed to monitor and manage residential EV charging loads. By optimizing charging patterns, the project aimed to secure incentives for EV owners while enhancing grid capacity utilization, ultimately benefiting all ratepayers. Managed EV charging can enhance grid efficiency and stability while lowering overall system costs by shifting charging demand to off-peak hours, reducing peak load stress.

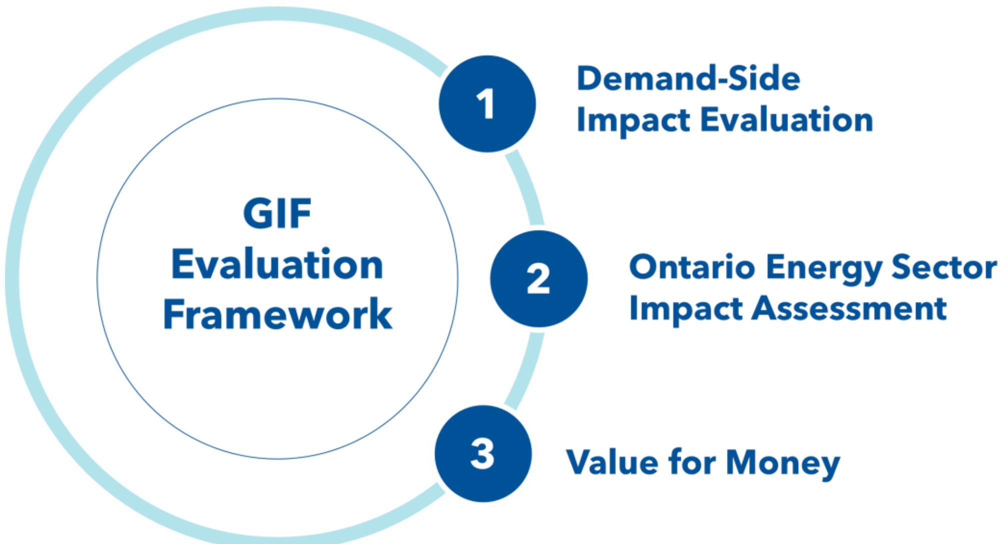
PART 1

Evaluation Approach and Methodology

Evaluation Framework

The evaluation assessed grid innovation investment impacts, contributions to the broader Ontario energy sector, IESO's core strategy and the efficacy of public spending. The evaluation framework is structured across three dimensions.

Figure 1: GIF Evaluation Framework



1. Demand-Side Impact Evaluation

The demand-side impact evaluation combined a quantitative impact analysis with qualitative process insights to provide a comprehensive assessment of project outcomes and estimate the achievable potential if projects were to scale.

- **Impact evaluation.** The impact evaluation involved verifying the energy, demand and costs savings for four projects that had available data. This included a review of all project documents, reports, and data.
- **Process evaluation.** A process evaluation was conducted on all five projects to help tell the story, explain impact results and identify improvements to achieve greater impact if projects were to scale. The process evaluation considered how users were engaged; how funding, project design and delivery impacted success; how grid integration challenges were addressed; and what changes may be required to scale the project across Ontario.
- **Achievable potential.** To determine the scalability and future potential of the projects', we used the verified savings to estimate high-level potential and system wide benefits.

2. Ontario Energy Sector Impact Assessment

The Ontario energy sector impact assessment explored the extent to which GIF projects have advanced innovative solutions to improve electricity affordability and reliability for ratepayers. The assessment identified and described key project learnings that address Ontario energy sector trends and challenges and additional market effects that projects achieved.
Through a desktop review, secondary research and interviews with IESO and GIF recipients, industry and subject matter experts the assessment addressed the following questions:

- What **key learnings** were derived from each project?
- To what extent have project learnings and outcomes **informed sector discussions**?
- Did projects achieve additional **market effects**?
- To what extent have projects impacted the organization's **growth and financial success**?

3. Value for Money

Building on the previous evaluation activities, the value-for-money analysis assessed each project's performance and the efficacy of GIF investments across **three indicators**:

- **Strength of Investment** focused on each project's financial performance (e.g., annual energy and demand savings against costs expressed as kWh or kW/$). We also considered contributions to grid modernization (e.g., visibility, control, and flexibility; strengthened reliability/resilience as electrification/extreme events grow).
- **Strategic Alignment** examined how the innovative projects/solutions align with and contribute to the range of IESO GIF objectives.
- **Risk Management** evaluated the potential uncertainties and vulnerabilities that might affect project success. This includes **technical risks** (e.g., integration challenges and performance variability); **financial risks** (e.g., cost overruns and funding uncertainties); and **operational risks** (e.g., safety concerns and potential implementation challenges).

Data Sources

- **Project data,** including relevant documentation, historical and performance data, surveys, and technical reports were reviewed to understand pilot design and delivery, validate all inputs, assumptions and calculations and verify energy, demand, and cost savings.
- **In-depth interviews with IESO, GIF recipients, industry and subject matter experts** provided qualitative insights into project design and implementation, challenges/lessons learned, successes and influence on broader Ontario energy sector impacts.
- **Secondary research** leveraged market data, studies and reports to understand Ontario electricity sector trends, challenges and opportunities, and support evaluation activities.

Limitations

This evaluation faced several constraints, including diverse project topics, scope and small sample, external factors and a rapidly evolving sector context. This limited the ability to aggregate broader insights into sector-wide or policy-level impacts.

Moreover, several projects took place during the COVID-19 pandemic, which impacted customer and supplier interactions and disrupted supply-chains and may have skewed project results. The retrospective nature of the review, covering projects implemented between 2018 and 2024 also presents challenges, as some pilots concluded almost five years ago.

Though the projects remain relevant to current conditions, staff turnover and/or diminished recall and data limitations could have been addressed if the evaluation had been conducted closer to project completion. This would ensure projects could be effectively evaluated against GIF's overarching objectives, provide timely feedback to participants and others planning similar projects, and maintain momentum across sectors for broader impact.

PART 2

Electricity Sector Trends, Challenges and Opportunities

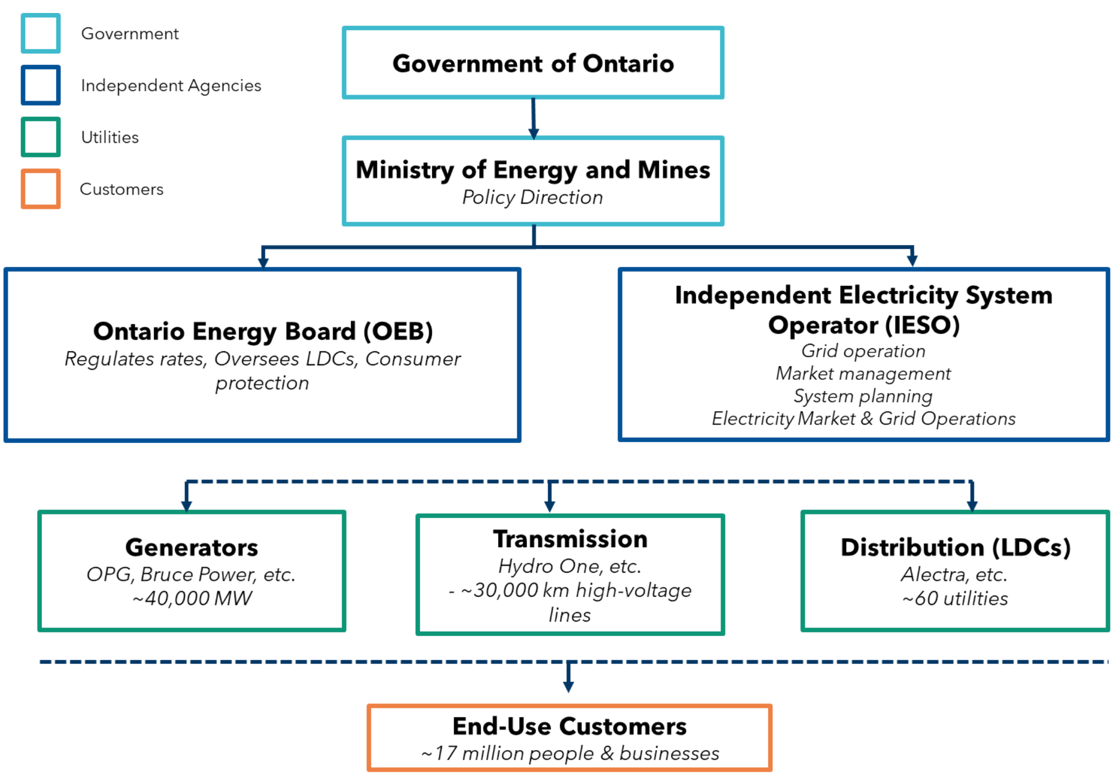
Electricity Sector Trends, Challenges and Opportunities

The GIF provides financial support for real-world demonstrations of grid-enhancing technologies, promotes adoption of cutting-edge, cost-effective solutions, and helps identify and address innovation barriers in Ontario's electricity sector. Its initiatives explore how emerging technologies can improve grid reliability and resilience while reducing ratepayer costs and keep Ontario's industries informed of key developments. The GIF priorities are shaped by broader trends and challenges across the provincial electricity system.

This section provides an overview of Ontario's electricity sector trends. Note that the trends discussed below are reflective of 2025. While the projects were initiated between 2018-2020, they remain relevant to help address challenges that persist today and present innovative ways to leverage future opportunities. **Understanding these trends helped to support the evaluation and findings further discussed in the Ontario Potential Opportunity Assessment, Ontario Energy Sector Impact and Value For Money sections.**

Ontario is one of the largest electricity systems in North America fully integrated with generation, transmission and distribution. Ontario's electricity sector operates under a hybrid market system with both regulated and market-based mechanisms.

Figure 2: Key Players in Ontario Electricity Sector



Ontario's power generation fleet is large, diverse, and clean with approximately 90% of electricity generation from non-emitting sources (55% nuclear, 25% hydro, 10% natural gas, 8% wind, and 2% solar and bioenergy). As of 2025, there is approximately 40,000 MW of installed generation capacity, nearly 60 Local Distribution Companies (LDCs) serving 17 million electricity customers. Ontario has over 700 individual generation facilities connected to the IESO-controlled grid, plus thousands more small-scale systems (mostly solar) on distribution networks. The over $20 billion/year electricity market is operated by the IESO.[13]

GIF supported projects evaluated this cycle focus on mining, wastewater treatment and transportation. These three sectors have a significant impact on Ontario's economy and energy sector.

Mining

There are 36 active mines in Ontario, of which 26 are underground mines. Gold mines represent the largest share of underground mines (50%).[14] In 2024, Ontario's mining industry generated $12B worth of minerals accounting for 24% of the country's total mineral production value.[15]

Wastewater Treatment

There are 484 wastewater treatment plants (WWTP) in Ontario.[16] Ontario's housing development goals, which include building at least 1.5 million homes by 2031[17], and upcoming effluent requirements[18] will require significant investments by existing WWTPs to expand capacity and comply with new requirements.

Transportation Sector

There are over 200,000 light duty Electric Vehicles (EVs) in Ontario today and projections estimate 11.5 million EVs on the road in Ontario by 2050.[19] EV demand will represent a major source of load growth and how EVs are charged could have a large impact on system peaks and the overall load shape.

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[13] IESO. 2024. Markets Financial Statements. Pg. 7 https://www.ieso.ca/-/media/Files/IESO/Document-Library/annual-reports/ieso-2024-market-financial-statements.pdf?utm
[14] Ontario Mining Association. 2025. Ontario Mining Operations 2025.
[15] Government of Ontario. 2025. Energy for Generations Ontario's Integrated Plan to Power the Strongest Economy in the G7
[16] Operational WWTP in Ontario reported by Environment and Climate Change Canada.
[17] Government of Ontario. 2023. Ontario Making Progress on Work to Build at Least 1.5 Million Homes.
[18] The Ontario Ministry of Environment, Conservation and Parks (MECP) sets effluent requirements for municipalities across the province. The federal government recently made amendments to Canada's Wastewater Systems Effluent Regulations, which include reductions to the concentration of un-ionized ammonia. The Ontario MECP requirements are expected to follow suit.
[19] IESO. 2025. IESO Demand & Conservation Planning Technical Paper: Electric Vehicles.

Five Key Ontario Energy Sector Trends

Ontario's electricity system is experiencing significant shifts driven by climate policy, electrification of buildings, transportation and industry, evolving supply sources, and changing demand profiles, creating both opportunities and challenges related to system decarbonization, reliability, infrastructure renewal, and distributed energy resources[20] integration. **Ontario's electricity sector is facing five key trends:**

1. **Decarbonization policies:** Canada is committed to achieving net-zero emissions by 2050 and provinces, territories, utilities and industry are aligning with the national goal. Decarbonization efforts are driving electrification and the need for innovative, grid-enhancing technologies and greater efficiency. GIF is well positioned to support projects that enable a cleaner, more reliable and cost-effective electricity system.

2. **Load growth:** Demand for Ontario's clean electricity is expected to increase by up to 75% by 2050. While increased load growth, impacts to system peaks and overall load shapes is certain, the rate of adoption of technologies like EVs and building, transportation and industry electrification is unclear. GIF plays an important role by helping to deploy grid-enhancing technologies, identify barriers to innovation and opportunities to mitigate, and explore how solutions may impact grid resilience and reliability while reducing ratepayer costs.

3. **Demand Side Management (DSM) and load flexibility**: Ontario's new Electricity Demand Side Management (eDSM) framework targets an estimated 18 TWh of electricity savings and 3,000 MW of peak demand savings by 2036 to support greater electrification and reduce grid impacts. GIF-supported initiatives can contribute to these goals by identifying ways to improve system operability, enhance flexibility, and reduce ratepayer costs through greater efficiency.

4. **Grid modernization and distribution readiness:** Ontario is modernizing its electricity grid through initiatives like the "Energy for Generations," which aims to ensure reliable, affordable, and clean supply through new generation, integrated planning and storage.[21] Ontario's grid modernization efforts align directly with GIF's mandate to demonstrate and deploy technologies that strengthen distribution system readiness, improve reliability, and understand and overcome integration barriers.

5. **Markets and industry dynamics:** The three sectors we reviewed (i.e., mining, wastewater treatment and transportation) have several competing priorities, such as managing near-term cost pressures while investing in growth and decarbonization. Competing industry priorities often slow adoption of innovative technologies and solutions. GIF's support is critical to reduce high upfront costs, de-risk projects and accelerate uptake of grid-enhancing solutions.

These trends and challenges directly impact sectors that GIF supported projects can help address.

[20] Examples of distributed energy resources include smart thermostats, solar PV, EV charging infrastructure, batteries.
[21] Government of Ontario. 2025. Energy for Generations Ontario's Integrated Plan to Power the Strongest Economy in the G7. https://www.ontario.ca/page/energy-generations

1. Decarbonization Policies

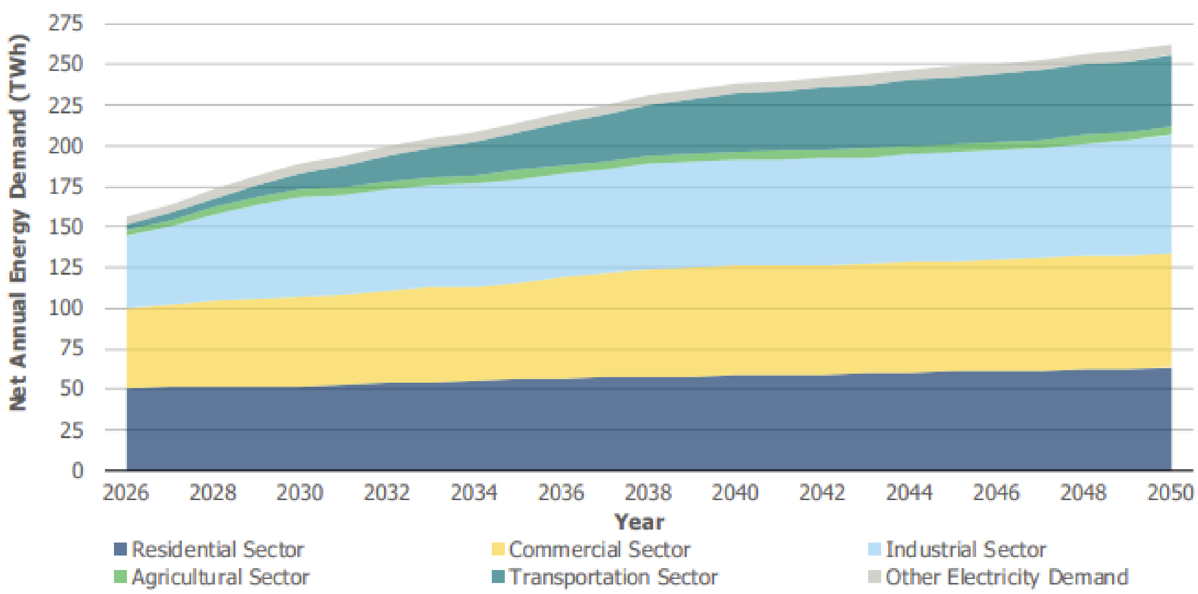
Canada has set a goal to achieve net zero emissions by 2050 and solidified that commitment under the Canadian Net-Zero Emissions Accountability Act requiring the federal government to promote transparency, accountability and action to achieve them. In addition, Ontario's Made-in-Ontario Environment Plan commits to reducing GHG emissions to 30 per cent below 2005 levels by 2030, a target that aligns with the Federal Government's short term targets – although it does not commit to the longer term target of net zero by 2050. These commitments have prompted various sectors to measure and mitigate their GHG emissions.

SECTOR	TRENDS & CHALLENGES
Mining	Mining operations in Ontario fall under the *Environmental Protection Act* and *O. Reg. 241/19: Greenhouse Gas Emissions Performance Standards*, which establish a carbon pricing system for large industrial emitters. Mining facilities must meet specific GHG limits—those exceeding limits face compliance obligations, while those below earn emission performance units. Mining critical minerals represents a major opportunity for Canada amid global decarbonization efforts, but the mining sector remains hard to abate, challenging Canada's 2050 net-zero goal. Canada's 2030 Emissions Reduction Plan projects that 39% of emission cuts will come from decarbonizing large emitters, including mining. Similarly, the *IESO 2025 Annual Planning Outlook* expects northern Ontario mines to adopt industrial process electrification to reduce GHGs that will impact the electricity distribution system. Federal and provincial governments are advancing mining decarbonization through initiatives such as Ontario's *Critical Minerals Strategy (2022–2027)* and *"One Project, One Process"* framework, the *Critical Minerals Innovation Funds* (provincial and federal), and federal programs like the *Mining Decarbonization Demonstration Call for Proposals* and the *Low Carbon Economy Fund/Challenge Fund*.
Wastewater Treatment	Municipalities are investing in projects to reduce emissions from WWTP. The Net Zero Roadmap Water Project, funded in part by Environment Climate Change Canada (ECCC), focuses on accelerating progress towards net zero emissions in municipal water, wastewater, and stormwater services in partnership with several key stakeholders, including several municipalities in Ontario.
Transportation Decarbonization	Canada's 2030 Emissions Reduction Plan focuses on decarbonizing transportation and includes a target – 100% of new light-duty vehicle sales to be zero-emission by 2035 establishing a national benchmark guiding Ontario's move to electrify new vehicle sales.

2. Load Growth

The IESO Annual Planning Outlook (APO) reports show that demand for electricity in Ontario is expected to grow significantly over the next two decades, increasing by up to 75% by 2050.[22] Key drivers include electrification of transportation, buildings, and industry, population and economic growth, and net-zero emissions policies.

Figure 3. Forecasted Annual Energy Growth 2026-2050[22]



SECTOR	TRENDS & CHALLENGES
Mining	Growth in the mining sector and development of critical minerals are expected to result in a significant increase in electricity demand as operations are energy intensive. Mining currently represents the 4th largest step load (i.e., commercial and industrial projects that are more than 20 MW and connect to the grid in large blocks at a time) over the next 10-15 years. The IESO APO forecasts significant electricity growth in industrial mineral extraction and processing, primary metals (from steel production and electrification), and chemical production sub-sectors in the next 1-5 years. Growth is expected to pick up again in the longer term (11+ years). Recent federal announcements highlight the importance of critical minerals for national security and climate competitiveness underscore the growing demand in this area.[23,24] This will further support mining industry growth.

[22] IESO. April 2025. "Annual Planning Outlook Ontario's electricity system needs: 2026–2050"
[23] Government of Canada News Release. 2025.
[24] The federal government recently designated certain critical minerals as a national security priority under the Defence Production Act. Government of Canada News Release. October 31, 2025. https://www.canada.ca/en/natural-resources-canada/news/2025/10/canada-unlocks-25-new-investments-and-partnerships-with-9-allied-countries-to-secure-critical-minerals-supply-chains.html

Wastewater Treatment	Electricity use is expected to grow in the wastewater treatment sector in lock step with housing development. Ontario is investing $1.7B through the Housing Enabling Systems Fund to ensure water infrastructure is in place to keep pace with housing.
Transportation Decarbonization	In general, transportation electrification is expected to increase electricity in all years of IESO APO 2026-2050 period. Ontario's transportation energy demand is projected to rise from 3 TWh in 2026 to 44 TWh by 2050, driven by EV adoption reshaping electricity load profiles.[25] As more EVs charge (often at home during evening hours), Ultra-Low Overnight (ULO) and time-of-use rates are key to managing charging behavior and peak demand. Utilities are increasingly testing innovative rate designs and managed charging to reduce peaks, defer infrastructure upgrades, and reduce pressures on ratepayers. In 2024, Ontario had over 200,000 registered EVs (about 2% of all vehicles), with charging demand of ~700 GWh per year (~0.5% of total electricity use). Although current demand is small, EV adoption is accelerating. By 2050, EV charging is expected to account for almost 17% of total electricity consumption.[25]

3. DSM and Load Flexibility

Ontario's electricity system is expected to grow at an unprecedented pace. Over the next 25 years, the IESO anticipates electricity demand to ramp up more quickly than previously forecast due to economic growth, electrification, and evolving technologies.[25] DSM and load flexibility will play an increasingly important role to ensure reliable and affordable electricity. Ontario's new eDSM (Electricity Demand-Side Management) framework is a 12-year plan to leverage DSM to temper electricity demand growth, help consumers manage electricity use, reduce costs, and improve system reliability. It will include new and expanded programs, significant investment, and a focus on strategic electrification and customer engagement, including targeted efforts for mining, wastewater treatment and transportation.

SECTOR	TRENDS & CHALLENGES
Mining	DSM efforts in Ontario's mining sector are primarily driven by electrification and province-wide industrial energy efficiency programs delivered by the IESO Save on Energy initiative. The Ontario government, via its Critical Minerals Strategy, also supports mining-specific innovation and electrification to manage energy needs.

[25] IESO. April 2025. "Annual Planning Outlook Ontario's electricity system needs: 2026–2050"

Wastewater Treatment	Water treatment accounts for the largest share of energy use for most municipalities, representing over a third of municipal energy consumption in Ontario. Annual electricity and natural gas consumption across all water treatment sectors in Ontario is approximately 3.57 eTWh (with annual electricity consumption representing 2.88 TWh). WWTPs consume most of this energy (up to 45%).[26] Wastewater treatment facilities in Ontario have access to DSM incentives and support through energy efficiency programs and operational optimization through the IESO's Save on Energy programs. The new eDSM Framework will also include funding for municipal facilities.
Transportation Decarbonization	Ontario has implemented pricing structures to encourage EV drivers to charge during low-demand periods (e.g., TOU and Ultra-Low Overnight rates) and the eDSM framework supports beneficial electrification. While the eDSM framework is currently focused on building electrification, there is room to expand to transportation. EV charging represents one of the most flexible end-uses of electricity and can be integrated into DSM and DR portfolios to optimize grid efficiency.

4. Grid Modernization and Distribution Readiness

Ontario "Energy for Generations Plan," aims to enable smarter decision-making, better system coordination, and more cost-effective investments. It is guided by four principles: affordability, security, reliability and clean energy. Efforts focus on improving efficiency, integrating distributed energy resources (DERs), and enhancing the grid's ability to handle increasing demand from electrification. Mining, wastewater treatment and transportation sectors can contribute to grid modernization efforts.

SECTOR	TRENDS & CHALLENGES
Mining	The mining sector is a major driver of increased electricity demand and a key part of the province's clean economy strategy. The provincial government is accelerating the development of new transmission lines in Northeastern Ontario to support mining opportunities and electrification and the IESO explicitly includes mining demand in its forecasts and planning activities. Moreover, Ontario's clean grid offers a competitive advantage for attracting mining sector investments as it allows for the development of cleaner, lower-emissions mining operations to meet environmental, social, and governance (ESG) standards and supply chain demands for critical minerals.

[26] Posterity Group. 2018. Study Report Market Characterization & Conservation Potential for Ontario's Drinking Water & Wastewater Treatment Plants.

Wastewater Treatment	Energy efficiency and the use of wastewater facilities to generate renewable energy (biogas) are important considerations in Ontario's efforts to modernize their grid. Improving the energy efficiency at these facilities can help improve grid reliability and create space for greater electrification in other sectors.
Transportation Decarbonization	Through the IESO's DER Market Vision and the OEB's Framework for Energy Innovation, DERs, including EVs, are beginning to provide services such as peak shaving, load shifting, and voltage support.

5. Markets and Industry Dynamics

The three sectors we reviewed have several competing priorities, such as managing near-term cost pressures while investing in growth and decarbonization.

SECTOR	TRENDS & CHALLENGES
Mining	Ontario is investing heavily in becoming a leading producer of critical minerals. In 2022, the province released its Critical Minerals Strategy and launched the Critical Minerals Fund, allocating over $30 million to support exploration, mine development, and processing. Ontario's mining sector generated $13B worth of minerals – accounting for 24 per cent of Canada's total mineral production value. Mining in Ontario also supports approximately 31,000 jobs directly and 46,000 jobs associated with mineral processing and mining supply and services.[27]
Wastewater Treatment	Electricity services play a central role in critical infrastructure, including water safety. New effluent requirements from ECCC and the Ministry of Environment, Conservation and Parks (MECP) will impose stricter ammonia limits, requiring greater nitrification, which is an energy-intensive process. At the same time, municipalities must contend with aging WWTP infrastructure and the need to expand capacity to meet growing housing development and service demands, all while managing constrained budgets and elevated debt burdens following COVID-19.
Transportation Decarbonization	A key challenge for utilities is justifying near-term investment in grid modernization and flexible resources when reliability risks, regulatory constraints or capacity constraints may not yet appear imminent. EV load is modest today, but growth will be substantial, requiring proactive planning. While current projects often rely on cost savings to support the business case, forward-looking efforts must focus on preparing for electrification and demand impacts while still aligning internal utility targets with external policy mandates.

[27] Province of Ontario. 2025. Energy for Generations Ontario's Integrated Plan to Power the Strongest Economy in the G7.

PART 3

Findings & Analysis

This section outlines the findings and analysis from the three evaluation activities: (1) Demand-Side Impact Evaluation; (2) Ontario Energy Sector Impact Assessment; and (3) Value for Money. For each activity, we recap the evaluation approach, followed by a synthesis of cross-project findings and key lessons learned. A detailed project-level analysis is then provided to substantiate the results.

Demand-Side Impact Evaluation

The demand-side impact evaluation combined a quantitative impact analysis with qualitative process insights to provide a comprehensive assessment of project outcomes. Dunsky could only conduct an impact evaluation on four projects that reported energy and/or demand savings, while a process evaluation was conducted on all five. Based on the four pilots with impact results, we also estimated the achievable potential if projects were to scale across Ontario.

Summary of Demand-Side Impact Insights

Table 3: Demand-Side Impact Results

Project	Verified Energy Savings (kWh)	Verified and Estimated Demand Savings (kW)	Project Costs	Estimated Cost Savings
Borden Mine	5,900,000	~675	Planned: $1,517,460 Actual: $1,971,805	~$413,165
Hespeler MABR	102,000	~23	Planned: $4,696,400 Actual: ~$8,012,240	$7,145
Aisla Craig & Watford DVA	Watford: 43,235 Ailsa Craig: 14,305	~6kW	Planned: $146,400 Actual: $146,400	$3,025 (Watford) $1,000 (Aisla Craig)
Alectra Drive@Home	N/A	Time-based pricing: avg 0.08 kW/EVSE DR events: avg 0.92 kW/EVSE (MURB); -0.65 kW/EVSE (SFH) Peak Demand Mgnt: <0.15% of building demand	Planned: $1,724,430 Actual: $3,400,000	~$115 lifetime avoided costs/EVSE
Elocity	Not reported	Not reported	Planned: $1,005,275 Actual: Not reported	Could not calculate

Overall, the pilots collectively demonstrate promising energy and demand savings along with technical and operational lessons learned, while underscoring the importance of rigorous evaluation design, data integrity, and adaptive implementation to support future scaling and replication.

Energy and demand savings were verified across all pilots but one. Decentralized compressed air (CA) systems at Borden Mine demonstrated high scalability and flexibility for both new and expanding mines in addition to non-energy benefits such as noise reduction and enhanced safety. The MABR pilot demonstrated that site geometry and vendor selection strongly affect cost and performance and shows promise with potential to extend to broader municipal and industrial applications. Modular technologies (e.g., decentralized CA, DVA) show strong replication potential. Alectra Drive@Home and Elocity revealed future potential for scaling managed charging and DERMS platforms, though robust utility–vendor–customer coordination is essential. Alectra Drive@Home also showed that cross-disciplinary coordination between technical, regulatory, and operational teams strengthens project delivery and outcomes.

While the pilots demonstrated savings, all were subject to data uncertainty reducing confidence. Pilot design must balance innovation with targeted focus to manage complexity and ensure measurable results. Specifically, pilots would benefit from a pilot theory and logic model describing expected outcomes and how they will be achieved; evaluation planning following established protocols to develop baselines, make seasonal adjustments, plan for data challenges, track and validate data and conduct rigorous measurement and verification.

Across all pilots, the potential opportunity analysis projects total gross energy savings of approximately 70 GWh, without accounting for potential free ridership, spillover, or rebound effects. If effectively scaled, the pilots show potential savings equivalent to 2.4%–4.9% of total end-use energy consumption and 6.8% of peak load within the targeted market segments over the next five years . However, extrapolating pilot-level data to sector-wide impacts remains challenging due to scale, context specificity, and small sample sizes. Broader sectoral impacts on energy, emissions, and costs should therefore be interpreted with caution.

Results by GIF evaluated project are detailed below.

Impact Results

PROJECT 1

Borden Mine

PROJECT THEME: Mining Energy Efficiency
ANNUAL ENERGY SAVINGS: 5,900 MWh
ANNUAL DEMAND SAVINGS: 675 kW (estimated)
TOTAL PROJECT: $1,971,805
ANNUAL COST SAVINGS: $413,170
INVESTMENT: $0.03/kWh of first year energy saved

Borden Mine is an underground gold mine located in Chapleau, Ontario, producing approximately 300,000 tonnes of ore each month. In 2019, Borden mine opened becoming Canada's first all-electric underground mining operation, positioning it at the forefront of innovation within Canada's mining industry. Borden Mine's entire underground fleet is battery electric vehicles (BEVs), decentralized compressors and by replacing pneumatic equipment with electric alternatives (e.g., dewatering pumps).

Compressed air (CA) systems are critical in underground mining operations primarily used for powering pneumatic equipment and serving as a secondary oxygen source in emergencies. CA systems can account for up to 20% of a mine's total electricity consumption. Traditional underground mines rely on large, centralized compressor plants located at the surface of the mine that distribute air through extensive piping networks to work areas. This setup leads to significant energy losses due to joint leaks, corrosion, and frictional pressure drops along the piping. Leak detection and repair programs are costly and resource-intensive, making CA systems a prime energy efficiency opportunity.

Borden implemented decentralized compressed air, electric dewatering pumps, and new safety systems to achieve the following:

- **Reduce energy consumed by CA systems** by deploying smaller decentralized compressors near points of use or onboard mobile equipment and switching pneumatic equipment with electric alternatives (e.g., dewatering pumps).
- **Implement a new safety system** independent of CA infrastructure, eliminating reliance on current emergency measures such as stench gas alerts and CA-based oxygen backup.

Key Findings/Insights

The Borden Mine delivered verifiable energy and demand savings; however, there is room to improve transparency and enhance confidence in results. Because Borden Mine was a new mine, the project baseline is hypothetical assuming a centralized, above surface CA system powered by three 315 kW compressors, supplying air through an underground piping network. The reported savings were verified to be accurate, but certain aspects of the calculations involved noteworthy uncertainty:

- Baseline assumptions related to the mine's layout, such as ramp length and depth to the centroid, could not be validated without detailed plans. These dimensions impact compressor pressure calculations which are key to sizing above ground compressors. However, the baseline compressor was sized generously such that small discrepancies within these distances would fall within its operating range resulting in low overall impact.
- Doubling of ore production rates and excluding specific proposed equipment, triggered a baseline adjustment. While the resulting baseline energy adjustment calculations were verified accurate, underlying assumptions could not be validated.
- Operating parameters such as annual working hours for upgraded equipment and energy consumption of electric dewatering pumps could not be verified due to lack of underlying data.

Measurement challenges led to delays and cost increases, underscoring need for strong evaluation planning and measurement and verification. The project experienced challenges following an oversight in data collection for the new electric dewatering pumps. The pumps did not initially include integrated data loggers preventing accurate measurement of electricity consumption - a key metric for verifying savings. This oversight resulted in a 1.5-year delay and approximately $10,000 in additional costs to retrofit loggers and SD cards. Integrating metering and data collection protocols early in project design is crucial to avoid delays in future initiatives.

Decentralized CA systems demonstrate strong implementation potential owing to their plug-and-play configuration. While decentralized system's are well-suited for new mining developments, they can also benefit existing mines expanding to greater depths. These mobile systems eliminate the need to extend CA piping networks or increase surface compressor capacity, enabling scalable deployment without major infrastructure modifications.

In addition to energy and demand savings, the project delivered notable non-energy benefits, including noise reduction, operational improvements and safety. Replacement of large surface compressors and pneumatic pumps with quieter alternatives reduced noise pollution for nearby First Nations communities and cottages, supporting ESG objectives. The upgraded system offers improved operational reliability and reduced maintenance compared to a traditional compressed air piping network, which is more prone to leaks, joint failures, and corrosion. Lastly, the project generated critical safety innovations. Without traditional CA piping for emergency oxygen, Borden Mine adopted Dräger Refuge Stations—self-contained units providing oxygen for 48–72 hours. It also introduced OXY self-contained breathing apparatuses (SCBA), offering reliable chemical oxygen generation. These solutions significantly improved miner safety, comfort and reliability and are now used across all regional sites.

PROJECT 2

Hespeler MABR

PROJECT THEME: WWTP Energy Efficiency

ANNUAL ENERGY SAVINGS: 102 MWh

ANNUAL DEMAND SAVINGS: 22 kW

TOTAL PROJECT: ~$8,012,240 (almost double the planned budget)

ANNUAL COST SAVINGS: ~$7,145 (estimated assuming average electricity rate of $70/MWh. OCWA did not report cost savings to verify.)

INVESTMENT: $78.5/first year kWh saved. The baseline selected likely underestimates cost-effectiveness (see text box below).

Serving the City of Cambridge and operated by the Ontario Clean Water Agency (OCWA), the Hespeler WWTP treats 7000 m^3 of wastewater per day on average serving ~ 41,000 people.[28] As a conventional activated sludge (CAS) plant, Hespeler consists of a lift station, de-gritting facility, two aeration tanks retrofitted with fine bubble diffusers, a flocculation/distribution chamber and two circular secondary clarifiers.

Federal effluent regulations now require more stringent nitrification performance to meet new ammonia limits. A previous study and report showed to achieve compliance and meet new demand (largely due to housing growth) plant capacity would need to increase by 50% by 2031 and require capital intensive aeration tank expansions[29] Membrane Aerated Biofilm Reactors (MABRs) were identified as a more cost-effective alternative.

MABRs use gas permeable, hollow fiber membranes as both a medium to supply oxygen for aerobic treatment as well as a surface for biological film growth. Compared to air diffusers typically placed at the bottom of an aeration tank, MABRs allow for much lower static pressure at the air blower. Reduced oxygen demand, higher oxygen transfer efficiency, increased microbial concentrations and reduced discharge pressure requirements allow for the aeration blowers to operate at significantly lower electrical demands. MABRs also facilitate simultaneous nitrification (aerobic) and denitrification (anaerobic), reducing the overall concentration of nitrogen in the effluent.

The primary objective of this project was to optimize conventional wastewater aeration processes by integrating MABR to reduce effluent ammonia concentrations while lowering electricity consumption.

Key findings/Insights

The Hespeler project achieved verified energy and demand savings, though confidence in results could be strengthened by reducing data uncertainty. Original 2020 baseline data were invalidated after upgrading to 150 hp Neuros turbo-blowers with VFDs and fine bubble diffusers,

[28] https://www.regionofwaterloo.ca/en/living-here/resources/Documents/water/reports/2024-Water-and-Wastewater-Monitoring-Report-FINAL-s-ACCESS-.pdf

[29] Hespeler's M&V Plan references a RVA/XCG Predesign Study; "Region_of_Waterloo_-_GIF_Contribution_Agreement (fully executed)" p.26., aims to increase plant capacity by ~50% by 2031.

which were installed for both energy efficiency and noise reduction. Updated baseline data was collected from February to August 2022, with earlier data (September 2021–January 2022) estimated through regression models reliant on historical plant process and weather data. The regression models claimed to show strong correlations; however, their accuracy could not be verified since the underlying spreadsheet was not provided. Additionally, energy monitoring of the two MABR blowers faced equipment failures with Fluke 1735 Power Monitors, resulting in two months of lost data. However, 300 days of valid readings provided sufficient data to estimate annual energy use.

Baseline Selection Likely Underestimates Potential Energy and Cost Savings

It's important to note that the pilot energy savings were calculated using the existing plant's size and capacity as the baseline. However, since the goal of testing MABR technology was to evaluate a lower-cost alternative to plant expansion, the baseline should have reflected a hypothetical expanded plant. Using this alternative baseline would have provided more accurate savings and cost estimates. The cost of a potential expansion was not provided.

Implementation of MABR at Hespeler experienced significant cost overruns - nearly twice the original budget; however, the project resulted in notable lessons learned around technology placement, monitoring, operations and vendors. The lessons learned at Hespeler enabled subsequent installation of MABR at a sister facility, Elmira, that is similar in size (rated capacity of ~7,800 m^3/day) to be completed at a fraction of the cost ($2.5M).[30]

- **Selecting a site with favourable tank geometry and tailoring cassettes can increase the cost-effectiveness of future MABR implementation**. Hespeler's existing aeration tanks were V-shaped, making them impractical to house the cuboidal MABR cassettes. This necessitated the construction of a new MABR tank upstream of the existing aeration tanks, leading to additional civil and mechanical works costs.
- **Proper planning, selection, installation, and maintenance of monitoring equipment is crucial to measure impacts**. Initially, the MABR blowers weren't equipped with power monitors, and later, Fluke monitors failed to record data on multiple occasions leading to data gaps. Additionally, monitoring equipment such as ammonia probes were ineffective after exposure to bacteria and air exhaust probes measuring oxygen levels provided inaccurate readings due to condensation triggered by cold and humid tank conditions.
- **Proper equipment, sizing and insulation are needed to achieve sufficient airflow, mixing and control.** The initial blowers were undersized and unable to provide sufficient airflow for proper mixing resulting in accumulated solids and clogging. Additional diffusers need to be installed to ensure optimal mixing and operating conditions. Increasing airflow to the MABR tank was also necessary to control biofilm growth, which can limit ammonia diffusion and reduce

[30] "Hespeler WWTP MABR Installation Project / MABR Technology Adoption Report", 2024.

overall nitrification performance. To address this, the airflow and sparging rate[31] were increased to regulate biofilm thickness and restore consistent ammonia removal and nitrification efficiency. Lastly, MABR tank and condensate lines froze in winter requiring added insulation.

- **Where feasible, testing technologies from multiple vendors can help to avoid bias**. The Elmira facility selected a different vendor to supply the MABR technology allowing the Region of Waterloo to not only test the robustness of the MABR technology but also encourage innovation and competition between vendors.

Beyond public wastewater treatment, MABR shows strong potential for private sector applications. In Ontario, some industries (e.g., food processing facilities) are required to pre-treat their wastewater onsite before discharging to a municipal sewer system to ensure the discharge meets specific quality and quantity limits set by both provincial regulations and municipal bylaws. MABR presents an efficient solution for industry and OCWA and the Region of Waterloo are exploring the potential to treat private wastewater to increase savings and revenue.

PROJECT 3

Ailsa Craig & Watford DVA

PROJECT THEME: WWTP Energy Efficiency

ANNUAL ENERGY SAVINGS: Watford Lagoons – 43,235 kWh; Ailsa Craig WWTP - 14,305 kWh

ANNUAL DEMAND SAVINGS: 6 kW (estimated)

TOTAL PROJECT: $146,400

ANNUAL COST SAVINGS: $3,025 (Watford) & $1,000 (Ailsa Craig). Estimated based on avg electricity rate of $70/MWh

INVESTMENT: $2.55/first year kWh saved

This project involves piloting the installation of IPEX's Double Vortex Aerator (DVA) at two municipal wastewater treatment facilities (Watford Lagoons and the Aisla Craig) operated by OCWA. The Watford Lagoons, located in the Township of Warwick, includes a raw sewage lift station, alum dosing system, aeration and sedimentation lagoons, and intermittent sand filtration with a rated capacity of 1,211 m^3/day and average daily flow of 576 m^3/day.[32] The Ailsa Craig WWTP, is in the Municipality of North Middlesex and serves the communities of Ailsa Craig and Nairn with a rated capacity of 1,210 m^3/day and average daily flow of 632 m^3/day.[33] Treatment includes headworks, secondary and chemical treatment, tertiary filtration, disinfection, and aerobic digestion to meet effluent quality requirements.

At the Watford Lagoons, existing mechanical aerators were directly replaced with high-efficiency IPEX DVA units mounted onto pontoon assemblies. These were installed without major modifications

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[31] Sparging rate is the rate at which a gas (typically air or biogas) is injected into a liquid medium. It is essential for oxygen supply, mixing and agitation, foulant control (e.g., removing biomass on the membranes).

[32] https://www.warwicktownship.ca/en/our-government/resources/Documents/5879-Watford-Lagoons-Annual-Report-2023-CLI-ECA.pdf

[33] https://pub-northmiddlesex.escribemeetings.com/filestream.ashx?DocumentId=5456

to the power system, allowing in-situ performance comparisons between the baseline and upgrade aeration technologies to validate previous lab results.

The Aisla Craig DVA provided pre-aeration during periods of high oxygen demand to improve nitrification and reduce the existing aeration system's energy consumption. The DVA operates by splitting the incoming flow into two opposing vortices, one clockwise and one counterclockwise, which intersect in a drop shaft creating intense turbulence. Turbulence draws air into the flow, breaking it into fine bubbles that allow rapid oxygen transfer. The project's primary objective was to quantify the energy savings achieved by supplementing or replacing existing aeration equipment with DVAs, while maintaining acceptable effluent concentrations at the two plants.

Key Findings/Insights

The reported energy savings at Watford and Aisla Craig were verified to be accurate. However, as with other projects evaluated, there are opportunities to enhance confidence.

- **Develop and clearly document the methodology to account for seasonality when adjusting short-term data to reflect year-round performance.** Seasonal variations are important considerations when evaluating system performance, particularly for aeration processes that rely on biological activity. Baseline and upgrade data collection at both facilities were conducted during different months of the year and the measured electricity use was then extrapolated to estimate annual energy use. It is unclear to what extent weather and seasonal effects were accounted for, as the energy specialist responsible for calculations is no longer with OCWA.
- **Proactively commission equipment to avoid data gaps and uncertainty**. A faulty variable frequency drive rendered one DVA at Watford non-operational during the initial monitoring period. Even after repair, the unit could not reach the target frequency. To maintain realistic energy estimates, average power from the two functional units was used to infer overall performance. While this approach introduced slight uncertainty, its impact was likely minor given the operational consistency across the units.

DVAs posed unique challenges across facilities. At the Watford Lagoons, the custom pontoon system caused delays but ultimately produced a more stable configuration. At Ailsa Craig, installing the DVA at the plant inlet made it difficult to measure its aeration contribution, as dissolved oxygen (DO) probes could not be placed before the aeration tanks without disrupting operations. This underscores the importance of strategically locating monitoring instruments during pilot design.

In addition to direct energy savings, DVAs offered several notable advantages. The units were well received by staff as they required minimal maintenance. At Aisla Craig, the DVA demonstrated strong operational reliability by remaining free of clogging, which could have otherwise caused plant shutdowns. At Watford, the portable units allow them to be relocated for treating stormwater ponds during bypass events. This operational flexibility, coupled with a simple design, make DVAs easy to scale and implement in most applications involving aeration systems beyond wastewater treatment (e.g., chemical dosing plants).[34]

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[34] Interview with OCWA representatives on May 23, 2025

PROJECT 4

Alectra Drive@Home

PROJECT THEME: EV Demand Flexibility

ANNUAL ENERGY SAVINGS: No savings reported

ANNUAL DEMAND SAVINGS[35]:

- Time-based pricing demand savings average of 0.08 kW/EVSE (SFH) and 0.37 kW/EVSE (MURB)
- DR events demand savings average 0.92 kW/EVSE (MURB) 0.65 kW/EVSE (SFH)
- Peak Demand Management impacts of less than 0.15% of peak building load

TOTAL PROJECT: $3,400,00

ANNUAL COST SAVINGS: Lifetime avoided cost benefit of both generation and capacity from DR and pricing is $115/EVSE (over 7 years).

INVESTMENT: $37,700/kW of first year peak capacity saved

Alectra Drive@Home was a residential managed-charging pilot designed to explore how smart technologies and behavioural incentives can help shift EV charging to periods when grid demand is lower and more capacity is available. Alectra installed Level 2 chargers and/or telematics devices for participating EV owners to test both behavioural approaches (off-peak "Charge Rewards" incentives) and technical controls (scheduled demand-response and peak-demand management events).

The goal was to understand how these strategies could reduce evening peak load, manage local grid capacity constraints, and support Alectra's long-term grid planning as EV adoption grows. The pilot was used to assess customer engagement and experience, behavioral response to pricing and incentives, and technical feasibility of managed EV charging in single family homes (SFH) and multi-unit residential buildings (MURBs).

In Ontario, EV charging demand typically rises after 7 p.m. coinciding with the start of off-peak hours under Alectra's time-of-use (TOU) pricing. The average EV driver consumes about 3,850 kWh per year, so shifting that load just a few hours later could have a significant impact on local capacity needs. The pilot tested new price signals encouraging charging after 9 p.m., while demand-response (DR) and peak-demand management (PDM) events measured how willing participants were to adjust their charging behaviour at specified times.

The pilot included three groups to test managed residential EV charging and behavioural approaches with 198 participants, living in SFH and MURBs.

- **Group 1 – Managed Charging (30 participants; 18 SFH /12 MURB).** Participants received FLO Level 2 chargers (EVSE) at a subsidized rate and free installation, paying a monthly subscription fee of $30 SFH / $35 MURB. Charging operated under time-based pricing, with scheduled DR events allowing two opt-outs before a $10 penalty/event applied for subsequent opt-outs. MURBs also participated in PDM events.

[35] Note that pilot results were not statistically significant due to the small sample size.

- **Group 2 – Reward-Based Charging (82 participants; 79 SFH /3 MURB).** Geotab telematics were used for time-based charging with financial incentives. Participants received monthly and sign-up bonuses and were rewarded for off-peak charging.
- **Group 3 – Control Group (86 participants; 85 SFH /1 MURB).** Geotab telematics were also used but participants did not receive incentives. Charging behavior was tracked under time-based pricing alone to provide a baseline comparison.

Key Findings/Insights

Alectra Drive@Home ran from 2018 – 2023 and was heavily impacted by the COVID-19 pandemic. The project required direct supplier and customer interactions, including in-home charger installations, which became logistically challenging under public-health restrictions. Alectra staff and contractors worked from home and trying to coordinate low-touch interactions, and many participants were had other concerns like remote work, work stoppages, online schooling, and general uncertainty. These factors introduced extreme circumstances that may have influenced participation rates and pilot results.

The pilot delivered demand savings, but findings should be treated as indicators of trends for early adopters versus conclusive evidence of the program's full potential.

The analysis was based on data from 25 EVSE units, making demand savings results highly uncertain. Some of the statistical uncertainty stems from leveraging load curves derived from limited charging data, minimal demand response events, and a small number of participants. The calculated lifetime avoided cost benefit of $115 per EV is credible as a pilot-level valuation but the calculation likely undervalues future capacity and grid benefits from managed charging. The calculation uses the IESO's published avoided-cost values from the IESO's Cost-Effectiveness Tool, which include generation but exclude transmission, distribution, and ancillary services. Managed EV charging will likely need to move beyond an energy efficiency style lens to reflect its full value as a flexible grid resource and should be assessed like other DERs through market-based mechanisms (e.g., the IESO Capacity Auction) and non-wires solutions benefit-cost analyses that explicitly account for distribution deferral and broader system services.

From a strict resource-acquisition perspective ($/kW saved), the pilot was not cost-effective, largely because its size, scope, and delivery costs expanded beyond initial estimates. As a novel initiative involving new technology, processes and systems, full project costs were difficult to anticipate, and implementation coincided with COVID-related supply-chain disruptions and constraints on customer and contractor engagement. The results are indicative of early stage learning and should not be interpreted as a negative outcome.

The program evaluated a lot of measures and groups. Alectra Drive@ Home tested multiple technologies, customer segments, and program designs within a relatively small pilot. The project may have benefited by being more targeted, focusing on fewer metrics to measure impacts and draw clearer insights and next steps.

Time-based pricing impacts EV drivers' behaviour. Pilot participants reduced their EV charging demand by over 80% during on-peak times with price signals alone. While pricing was shown to be effective at shifting load it also created localized peaks or “snapbacks” when price signals ended. Managed charging was found to be the measure that can avoid snapbacks and allow the utility to address localized capacity constraints through geotargeting.

EV load-shifting potential depends on having charging load available to curtail, which was found limited when events were scheduled during system peaks. As a result, Alectra adjusted DR event times later when EVs were typically charging, highlighting that EV charging peaks don’t always coincide with system peaks.

Uncertainty on peak demand management reductions potential. The pilot found modest demand reductions (non-coincident peak demand impacts of less than 0.15% of peak building load); however, uncertainty is high to be conclusive. Despite conducting 297 events, findings are mixed and uncertain due to the small sample size. Only four MURBs were piloted for PDM, two of which had a low frequency of events.

MURBs are significantly more costly and complex than SFHs. MURBs vary widely in building type, size, electrical capacity, management/legal structures, and stakeholder involvement (e.g., property management companies, property managers, condo boards, individual owners and tenants). Challenges such as individually owned parking spaces and infrastructure needs (e.g., installing cables across multiple floors to reach transformers) can increase costs depending on the building layout. While the pilot highlighted critical challenges and that MURBS require tailored solutions, the small pilot size, short duration and delays due to the COVID pandemic limited Alectra’s ability to identify or test more specific solutions to address technical and administrative hurdles. MURBs still have considerable uncertainty and risk becoming a “lost EV segment”. Further study is required.

The project delivered notable non-energy benefits, including enhanced internal communications, relationships & readiness. Alectra gained the ability to identify infrastructure needs (e.g., managed residential EV chargers and distributed energy management system (DERMS) - foundational for utility managed changing), and selecting and contracting vendors. Alectra also reported that the project strengthened internal collaboration, communication, and overall readiness for future EV and grid initiatives. It brought together teams across meter data, system planning, and regulatory affairs, improving coordination and elevating EV expertise into other utility processes (e.g., load capacity mapping). The experience increased Alectra’s confidence to deliver subsequent projects such as ZEVIP and Alectra Drive@Work and expanded external relationships by fostering peer learning with other utilities and participating in national working groups.

PROJECT 5

Elocity

PROJECT THEME: EV Demand Flexibility

ANNUAL ENERGY SAVINGS: Not reported

ANNUAL DEMAND SAVINGS: Not reported

TOTAL PROJECT COST: $1,005,275

ANNUAL COST SAVINGS: N/A

INVESTMENT: N/A

Elocity's pilot tested and validated the company's Hyper Integrated Electric Vehicle (HIEV) platform – an end-to-end, AI-enabled, vendor-agnostic system designed to manage EV charging loads and integrate with utilities and the distribution grid. Delivered in partnership with Toronto Hydro and Enova Power (formerly Waterloo North Hydro), the pilot engaged 58 residential participants (30 in Toronto Hydro's service area and 28 in Enova's). The project evaluated how HIEV technology could encourage EV owners to shift charging to off-peak hours through behavioural incentives and automated load management. The pilot had the following objectives:

- Provide utilities with real-time visibility into EV load patterns, enabling demand forecasting and active charging management.
- Validate system interoperability, testing the HIEV platform's ability to integrate with multiple EVSE brands and showcase how smart charging can serve as a grid asset rather than a constraint.

The pilot focused on changing EV driver charging behaviour through active engagement, incentives, DR strategies and increased awareness and assessing process (e.g., integration and interoperability, customer recruitment) versus impact. While shifting demand and reducing peak-load can be a cost-effective alternative to traditional grid infrastructure investments, no data on peak-load reductions and cost savings were provided by Elocity to review and validate.

Key Findings/Insights

Working with local distribution companies (LDCs) took longer than expected. Contracting timelines that were expected to be around three months extended to nine months, contributing to cost overruns and creating challenges for both Elocity and the participating LDCs. These delays unfolded in the context of the COVID-19 pandemic, which further strained utility resources and slowed internal processes.

Regulatory expertise and adaptable frameworks can be helpful enablers. Regulatory experience or support is helpful for technology companies working with utilities. Elocity had limited regulatory experience and did not fully understand the requirements LDCs must follow for regulatory approval and direction to implement new technologies. Elocity suggested that a more adaptable regulatory framework could better accommodate emerging technologies and new demand patterns.

Key learnings discovered in the customer recruitment process. Participant enrollment can be maximized by diversifying recruitment channels and making sure programs can include customers with hardwired chargers by supporting open communication standards like OCPP. Incentives must also be high enough to attract participants. For example, the initial incentive of $25 -$50 was not high enough and needed to be adjusted to $100.

Technology must be simple and reliable for end users. Hardware solutions need to be easy to use to maximize accessibility and participation. Connectivity remains a key barrier for EV charging, as many chargers are installed in garages where Wi-Fi signals from the house are weak or unreliable, underscoring the need for more robust and user-friendly connectivity options.

Ontario Potential Opportunity Assessment

Following the impact assessment, we estimated scalability and future achievable potential of the projects in terms of energy savings, demand reduction and system-wide benefits.

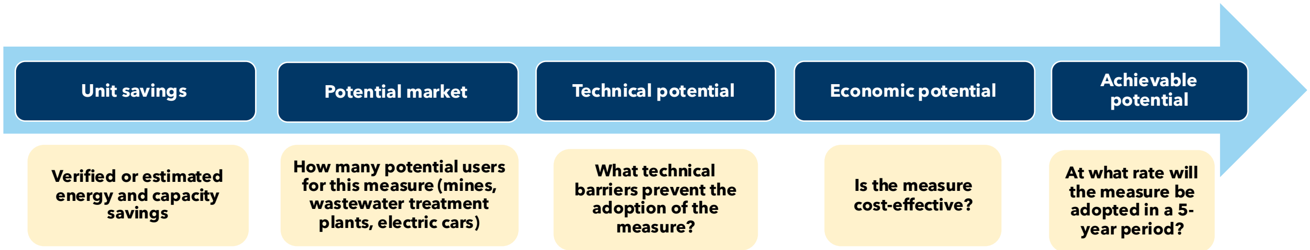
Potential Opportunity Assessment Results Are Indicative Not Conclusive

This assessment provides a high-level estimate of the potential energy and demand savings and should be interpreted as indicative rather than definitive; more precise estimates would require detailed market studies.

All technologies were included in the potential estimates regardless of whether they were cost-effective or not at the pilot stage assuming that they will be cost-effective at scale. Under a traditional potential opportunity assessment, non-cost-effective measures are excluded. While some GIF supported pilots appeared costly relative to savings, this may reflect factors such as higher pilot set up, administration and/or EM&V costs, unclear baselines, early-stage technologies, or one-time installation/project changes, delays (e.g., due to COVID) that are unlikely to persist at scale.

The achievable potential reflects Ontario energy sector trends, professional judgment, high-level assumptions using publicly available data and other program benchmarks. However, since programs/technologies are not yet at scale, final design and adoption strategies remain uncertain, all of which can impact the actual results across Ontario.

The opportunity potential assessment approach is summarized in the figure below followed by a detailed description of each step.



Market potential refers to the size of the market. Specifically, the number of opportunities to install measures over the next five years. The market potential assumptions for each sector are as follows:

- **Existing and future underground mines:** Ontario has a total of 36 operating mines. Of those, 26 are underground mines (see Section 3). We assume that Borden is similar in size and compressed air requirements are the same for the average mine in Ontario; however, this could not be verified. Because the technology is applicable to all underground mines – not just gold mines[36], the findings are assumed to be applicable to other Ontario underground mines as well. In addition to existing mines, 6 new mines are under development. We assume that 3 of them will be underground mines and that they will be completed within 5 years.[37]
- **Wastewater plants and average daily effluent:** We summed daily effluent volumes of all operating plants.[38] Based on pilot project plant size, volumes for plants that treat 1,000 m3/day or less were attributed to the IPEX market, and those with 1,000 m3 and more, to the MABR market. The total m3 values were then converted to number of plants of equal size similar to the pilots (~600 m3/day for IPEX based on the average of Ailsa Craig and Watford, and ~7,000 m3/day for MABR based on Hespeler)
- **EV sales:** Forecast of BEV sales of 799 262 light-duty BEVs, under a "Medium Growth" scenario, 2026-2030 total[39]. Existing EVs have not been included because their charging station is unlikely to be replaced in the 5-year assessment period.

Technical potential assumptions for each sector are described below:

- **Mining:** No significant technical barriers were found through this pilot. The pilot validated the business case for decentralized CA systems and other electric equipment, and alleviated safety concerns. Thus, we assumed that there were no technical barriers in future mining operations (100% multiplier).

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[36] Reported in interviews with the Borden Mine Project Lead (May 5, 2025).
[37] Ontario Mining Association. 2024. State of the Ontario Mining Sector.
[38] Environment and Climate Change Canada (ECCC) Effluent Regulatory Reporting Information System. Reports are submitted to ECCC to assess compliance with the national effluent quality standards.
[39] Electric Mobility Canada. 2025. Powering Up - A national and sub-national outlook on electric vehicle adoption, barriers, and impacts to the grid. Ontario Provincial Report.

- **Wastewater:** A multiplier of 80% was applied (i.e., 20% of technical potential was removed) for MABR due to water tank constraints. For example, tanks must have appropriate shape and depth to accommodate MABR. There were no technical barriers for IPEX.
- **EV load management:** A multiplier of 68% was applied across all dwellings due to an 80% penalty on MURBs. The 68% multiplier was calculated based on MURBs representing 40% of residential dwellings in Ontario[40] x 80% penalty = 32% overall penalty (1 – 32% = 68% multiplier). The 80% penalty was based on Alectra Drive@Home pilot results and interviews. MURB pilot participation was much lower than expected due to several technical constraints. For example, only 4 MURBs participated in PDM events and only 2 provided meaningful results.

Achievable potential estimates the rate of technology/program adoption. Assumptions for each sector are described below:

- **Mining and Wastewater:** The pilots' findings were used to estimate the parameters of a Bass diffusion model for these two sectors.[41] We assumed that best-in-class programs would be put in place to increase the visibility of new technologies, offer incentives, and address market and organizational barriers. Differences in achievable rates between the two sectors can be attributed to different factors including risks and technology maturity.
- **EV demand flexibility:** Participation rates from similar programs in other jurisdictions[42] were used to estimate the achievable rate of an EV load management program in Ontario.

The table below summarizes the inputs and assumptions made for each part of the analysis.

[40] Statistics Canada. Household type including multigenerational households and structural type of dwelling: Canada, provinces and territories, census metropolitan areas and census agglomerations (Table: 98-10-0138-01), Release date: 2022-07-13.
[41] The Bass diffusion model predicts the adoption of a new product or technology over time based on different adopters: innovators, early adopters, early majority, late majority and laggards.
[42] From Parrish, B., Gross, R., and Heptonstall, P. 2019. "On demand: Can demand response live up to expectations in managing electricity systems?", Energy Research & Social Science, Vol. 51, Pages 107-118. Cited by Smart Electric Power Alliance. 2023. "Managed Charging Programs: Maximizing Customer Satisfaction and Grid Benefits. The original paper reviewed "83 residential demand response schemes, of which 19 were established programmes and 64 were trials. (…) The evidence base is drawn from 18 countries, including the US, Canada, Australia, New Zealand, the UAE, and several countries in Europe. 63% of the evidence is from North America and 30% from Europe."

Sector	Market Potential	Technical Potential	Economic Potential	Achievable Potential
Mining	Number of existing and future underground mines	No technical barriers (100%).	Assumed to be cost-effective (100%).	Assume 33% of mines will install decentralized CA systems based on professional judgement, interviews
Wastewater Treatment	Number of wastewater plants and average daily effluent	Some MABR technical barriers due to water tank constraints (80% multiplier applied)	Assumed to be cost-effective (100%)	Assume 24% of WWTPs will install efficient measures based on professional judgement, interviews
EV Demand Flexibility	EV sales over the next 5 years	68% multiplier applied due to an 80% penalty on MURBs[43] based on pilots and interviews	Assumed to be cost-effective (100%)	Assume 30% of market will participate based on professional judgement, interviews and program data

Example: Potential Ontario-wide Savings From Decentralized Compressed Air Systems

Ontario-wide Achievable Savings (5-year potential) = *(Per-site Annual Savings)* × *(Market Potential)* × *(Technical Potential)* × *(Economic Potential)* × *(Achievable Potential)*

5,902 MWh savings x 29 underground mines x 100% (technical) x 100% (economic) x 33% (achievable) = 56,482 MWh savings (5-year potential)

Estimated Achievable Potential Results

The results of the achievable potential analysis are shown in the table below.

Table 4 : Estimated Achievable Potential

Savings	Mines	WWTP	EV Charging	TOTAL
Savings - MWh	56,480	16,110	n/a	**72,590**
Savings - kW	6,450	3,570	81,525	**91,545**

[43] For simplicity, we use the term "MURBs" to include both multifamily building and row houses which may present some of the challenges encountered for program participation. "Single family" includes detached and attached dwellings.

To ensure our achievable potential estimates above were reasonable, we compared the results to a top-down approach to end-use total annual (or peak) consumption. We found achievable potential of about 0.4% to 1.3% per year for evaluated measures (2.0% to 6.4% over a 5-year period). Best-in-class electric DSM portfolios typically attain over 1% of annual savings[44], but with multiple measures by end-use, supporting our high-level assessment.

Table 5: Estimated Contribution to Total Energy End Use Reductions

Savings	Unit	Savings	End-use total	%
Share of mine savings on estimated mining **CA electricity consumption**	**MWh**	56,482	1,160,000.45	**4.9%**
Share of WWTP aeration savings on estimated **aeration consumption**	**MWh**	16,111	674,128.46	**2.4%***
Share of EV savings on projected **EV peak load**	**kW**	81,525	1,198,893.47	**6.8%**

* WWTP savings as a share of aeration is lower than the other measures assessed, but our aeration estimate includes drinking water treatment. If we adjust and prorate with the share of total electricity peak demand by both types of treatment plants (128 GW for WWTP vs 93 GW for DWTP), we obtain 2.4% x (128 + 93) / 128 = 4.1%.[46]

Key Findings

The potential opportunity analysis projects **total estimated energy savings of approximately 70 GWh**, driven primarily by the adoption of decentralized CA systems in mining operations. In addition, **peak demand reductions of up to 90 MW** are estimated, largely attributable to managed electric vehicle (EV) charging initiatives. The results represent gross savings, without accounting for potential free ridership, spillover, or rebound effects.

If effectively scaled through robust program design and delivery, the pilots indicate **potential savings equivalent to 2.4%–4.9% of total end-use energy consumption and 6.8% of peak load** within the targeted market segments over the next five years. These projects could contribute to the province's efforts to minimize electricity demand growth, help consumers manage electricity use, reduce costs, and improve system reliability.

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[44] Nippard. A, Gaede. J, 2023. "Benchmarking 2021 Canadian province/territory and American state energy efficiency program savings and spending." Efficiency Canada, Carleton University, Ottawa ON.

[45] Average electricity consumption ~200,000 MWh/year for two Ontario gold mines where data was available (Alamos Gold, ESG Report 2024). Compressed air was estimated to be 20% of electricity (EMERSON, "Compressed air in a mine", 2024, www.emerson.com/documents/automation/case-study-compressed-air-in-a-mine-en-10214228.pdf)

[46] Annual aeration consumption. Posterity Group, 2018, "Market Characterization & Conservation potential for Ontario's Drinking Water and Wastewater Treatment Plants", p. ii

[47] Assume normalized power draw with vehicles charging at different times of 1.5 kWh per vehicle, multiplied by forecasted EV sales.

Ontario Energy Sector Impact

This section assesses how GIF-supported projects have contributed to Ontario's broader electricity system innovation, policy discussions, and market evolution. The assessment aimed to answer the following research questions:

- **What key learnings were derived from each project?**
- **To what extent have project learnings and outcomes informed sector discussions?**
- **What additional market effects did each project achieve?**
- **To what extent have projects impacted organization growth?**

We qualitatively assessed and ranked each project considering the current trends and challenges faced in Ontario's electricity sector (see Electricity Sector Trends, Challenges and Opportunities). The table below describes the qualitative assessment tool used to assess and rate each project.

Table 6: Ontario Energy Sector Impact Qualitative Assessment

Indicator	●●● STRONG	●● MODERATE	● DEVELOPING
1. Key Learning	• **3+ and/or significant lessons learned** (impact, process, technical, regulatory, policy, market-rule) • Address **key barriers** (cost, risk, integration)	• **1-2 learnings and/or less significant lessons learned** • Somewhat address **barriers**	• **Little/no lessons learned** and/or are **not well understood** • **Did not clearly address barriers**
2. Informed Sector Discussions	• **Learnings shared widely** (conferences, site visits, peer-peer, media coverage) • **Clear evidence project informed sector discussions** (cited in policy/ regulatory decision, studies)	• **Learnings shared somewhat** • **Anecdotal evidence** that project informed sector discussions	• **No / limited sharing of learnings** beyond GIF recipient

Indicator	STRONG	MODERATE	DEVELOPING
3. Market Effects	• Supported tech. **commercialization or adoption** • **3+ jobs** created or **used existing resources** • Additional **Ontario investment** • Informed 3+ projects implemented	• **Some additional market effects** • **1-2 jobs** created or **minimal impact** on existing resources • **Informed other projects** (<3 implemented or planned)	• **No additional market effects** • **No new jobs** created or **increased existing resource effort** • No evidence informed other projects
4. Organization Growth	• Received **additional seed funding,** increased **revenue** and/or **customer acquisition/ satisfaction** • **Operational savings/efficiencies**, increased **cross-functional collaboration** and performance	• **Demonstrated potential to increase revenue** and/or customer acquisition/ satisfaction • **Potential for operational savings/efficiencies**, and/or **cross-functional collaboration** and performance	• **Little / no revenue or profit potential** and/or **customer acquisition/ satisfaction** • **No operational savings/efficiencies**, and/or **cross-functional collaboration** and performance

Ontario Energy Sector Impact Project Performance

Each project's performance is summarized in the table below. The ratings reflect the degree to which projects achieved learned lessons, informed or influenced sector-level discussions, additional market activity, and organizational growth.

Table 7. Ontario Energy Sector Impact Results by Project

Project	1. Key Learnings	2. Informed Sector Discussions	3. Market Effects	4. Organizational Growth
Borden Mine	●●● STRONG	●●● STRONG	●● MODERATE	●●● STRONG
Hespeler MABR	●●● STRONG	●●● STRONG	●● MODERATE	●● MODERATE
IPEX DVA	●●● STRONG	● DEVELOPING	● DEVELOPING	●● MODERATE
Alectra Drive@Home	●●● STRONG	●●● STRONG	●● MODERATE	●●● STRONG
Elocity	●●● STRONG	● DEVELOPING	●● MODERATE	●●● STRONG

The pilots provided **strong technical learnings** that can help to accelerate technology commercialization by proving technical viability, reducing uncertainty, and opening pathways for market adoption.

Sector and market diffusion ranged from strong to developing. All projects resulted in learnings shared with industry, which will help drive broader efficiencies down the line when these technologies are adopted by others. However, while the projects showed that these technologies can help balance competing priorities such as growth and cost pressures, continued support and ongoing regulatory/policy discussions are needed.

PROJECT 1

Borden Mine

PROJECT SNAPSHOT

Borden Demonstrates that Electrification is Feasible, Cost-effective and Beneficial. Borden Mine demonstrates that Ontario's mining industry is capable of meaningful innovation, proving that decentralized and fully electrified systems can deliver major energy, cost, and operational benefits. It has helped position Ontario as a leader in mining electrification and efficiency, sparking widespread industry discussion, interest and adoption.

Indicator	Performance	Analysis
1. Key Learnings	●●● **STRONG**	Borden Mine confirmed that eliminating centralized compressed air is possible for an underground mine. Decentralized compressors can lead to significant energy and cost savings (5,902 MWh and $415k) and other non-energy benefits, such as quieter operations. The project led to the discovery of a Self-Contained Breathing Apparatus (SCBA) which eliminates the need for compressed air completely, is easier to use and has a low maintenance cost.
2. Informed Sector Discussions	●●● **STRONG**	The project has played an important role in advancing sector-wide discussions on decentralized compressed air systems, including formal knowledge-sharing efforts such as presentations delivered to members of the Ontario Mining Association (OMA) in 2024 and conversations with "nearly all major mining companies". Borden Mine has received significant press coverage on its all-electric operations and is seen as a leader in electrification and energy efficiency. The project has been promoted by NRCan, Mining Association of Canada (MAC) and multiple news outlets, including Canadian Mining Journal, Mining Digital, Mining Technology, Mining.com and Electric Autonomy.
3. Market Effects	●● **MODERATE**	Electrification of Canada's mining sector is advancing rapidly, propelled by technological innovation, supportive government policies, and strategic investments (see Electricity Sector Trends, Challenges and Opportunities). In response, mining companies across Canada are adopting electrified technologies to enhance efficiency, reduce emissions, and strengthen Canada's position in the global clean economy. Several underground mines in Ontario, are either actively electrifying or thinking about doing so, including

Indicator	Performance	Analysis
		Vale's Coleman mine[48], Kirkland Lake Gold's Macassa mine[49], Glencore's Onaping Depth project[50], IAMGOLD Corporation's Côté Gold mine[51], Magna Mining Inc.'s Shakespeare and Crean Hill mines[52], and Wesdome's Eagle River Mine[53]. We cannot find direct evidence that the mines listed above cite Borden Mine as an example or justification for moving forward with their own electrification plans or that they have specifically implemented decentralized CA systems. However, Borden is recognized as being part of the Ontario mining electrification narrative.
4. Organizational Growth	●●● **STRONG**	Borden Mine successfully secured additional NRCan funding to fully electrify its underground vehicles and the Ventilation On Demand system. It is a recognized leader being the first fully electric underground mine in Canada. The project demonstrated operational savings and efficiencies and customer (i.e., neighbouring communities) and worker satisfaction. Discovery Silver has deployed decentralized CA systems in one exiting mine as it goes deeper demonstrating some cross-functional collaboration and performance.

[48] Vale. 2022. Vale's Low Carbon Journey and the Green Energy Vehicle Program.
[49] International Mining. 2021. Kirkland Lake Gold says it remains a battery electric pioneer and was happy to be a guinea pig.
[50] Electric Autonomy. 2024. Glencore secures federal funding for electric fleet at Onaping Depth mine.
[51] Environment and Climate Change Canada. 2025. Government of Canada funds IAMGOLD Corporation to electrify mining operations and reduce emissions in Ontario.
[52] Natural Resources Canada. 2024. Supporting Critical Minerals Development in Northern Ontario.
[53] Wesdome. 2021. Wesdome Announces 2020 Fourth Quarter and Full Year Production Results; Provides 2021 Guidance.

PROJECT 2

Hespeler MABR

PROJECT SNAPSHOT

MABR Proves Effective, Driving Interest and Cost-Effective Replication. The Hespeler pilot confirmed that MABR technology can meet ammonia limits while cutting energy, demand, and N_2O emissions. Its compact design enables lower-cost upgrades without major expansion, and further savings could be achieved with variable-speed blowers. Results were broadly shared through conferences and publications, spurring interest from other municipalities. While the initial project came at a high cost, it informed successful replication at lower cost in the Region and supported early commercialization, positioning MABR as a promising, scalable solution for wastewater treatment in Ontario.

Indicator	Performance	Analysis
1. Key Learnings	●●● **STRONG**	The project confirmed that MABR can meet upcoming ammonia requirements while reducing energy use (102 MWh), demand (23 kW), and N_2O emissions. It also demonstrated that MABR systems require less space than conventional aeration, enabling lower-cost upgrades compared to costly expansions without operational disruption. OCWA also reported that there is potential for additional savings by reducing the size and speed of blower downstream; however, additional study is needed to ensure minimum air flow for velocity is maintained to ensure full aeration.
2. Informed Sector Discussions	●●● **STRONG**	The insights gained from this pilot project have been shared widely through conference presentations (e.g., Toronto IWA Conference included a tour of Hespeler, with over 50 attendees visiting the facility), online publications, and peer-reviewed journals (Environmental & Science Engineering Magazine[54], Jacobs in the kNOW Webinar Series[55]).

[54] Environmental & Science Engineering Magazine. August 21, 2023. https://esemag.com/wastewater/mabr-modules-installed-elmira-wwtp-upgrade/

[55] Jacobs in the kNOW Webinar Series. March 2, 2023. https://www.jacobs.com/sites/default/files/2023-04/MABR_Technology_Presentation_final.pdf

Indicator	Performance	Analysis
3. Market Effects	●● **MODERATE**	The project helped to support technology demonstration and commercialization. North Toronto adopted MABR technology as part of a larger plant upgrades completed in 2024.[56] OCWA reports that the technology has since attracted considerable interest from neighbouring municipalities (e.g. Guelph, London, Halton Region) as well as from international organizations. This pilot also served to derisks future MABR projects for lower-tier municipalities that rely on Tier 1 municipalities. *"Tier 3 municipalities rely on Tier 1 municipalities for testing, data and information to derisk projects…. The additional costs that we experienced could have been catastrophic for smaller municipalities."* - OCWA Representative
4. Organizational Growth	●● **MODERATE**	While initially a high-cost project, valuable lessons learned enabled the same technology to be installed at another WWTP in the Region for significantly lower cost. OCWA considers this solution a more affordable alternative to major plant expansions that would have otherwise been required to meet projected 2031 capacity growth and new ammonia limits. However, OCWA did not provide a baseline assumption for major plant expansion to confirm. MABR presents an opportunity for municipal WWTPs to potentially generate new revenue by expanding their capacity to treat industrial wastewater, such as from food and meat processing facilities; however, more study is required.

[56] The North Toronto Treatment Plant (NTTP) is one of four WWTP operated by the City of Toronto. This facility has a rated capacity of 45.5 mega litres (45,500m^3)/day and serves a population of approximately 183,000. City of Toronto. North Toronto Treatment Plant 2024 Annual Report. March 31, 2025. https://www.toronto.ca/wp-content/uploads/2025/04/8d9a-2024-TNT-Annual-Report-Final-AODA.pdf

PROJECT 3

Aisla Craig and Watford DVA

PROJECT SNAPSHOT

DVA Technology Shows Promise for Wastewater Efficiency but Limited Market Uptake. The IPEX DVA pilot demonstrated that decentralized variable aeration systems can effectively meet emerging ammonia limits while reducing energy. Testing two configurations confirmed that lagoon-based installation replacing existing aerators delivered the best performance and highlighted the technology's operational flexibility, including potential use in stormwater and chemical dosing applications. While OCWA has shared results across facilities strengthening understanding of DVA performance and scalability, the project has yet to translate into widespread market or policy impact.

Indicator	Performance	Analysis
1. Key Learnings	●●● **STRONG**	The project confirmed that DVAs can effectively meet upcoming ammonia requirements while reducing energy consumption by 14–43 MWh. Two different installation configurations were tested, revealing that placing the DVA within the lagoon to replace an existing aerator was the more effective setup. In addition to these performance benefits, the technology offers valuable operational flexibility, as its portable design allows it to be deployed for various applications, such as stormwater management.
2. Informed Sector Discussions	● **DEVELOPING**	OCWA has presented DVA technology to multiple facilities; however, it is unclear whether project has supported broader sector, market or policy discussions.
3. Market Effects	● **DEVELOPING**	The project demonstrated potential for other WWTPs to adopt the technology without needing to expand existing aeration systems. While the project successfully gathered valuable field data to support further development, and there is market interest, adoption at other facilities has been limited.
4. Organizational Growth	●● **MODERATE**	IPEX has now included their DVA product as part of their commercial offering to municipalities and industry. In addition to the operational and financial benefits, DVAs could be used within chemical dosing systems to expand market potential. However, it was unclear how the project may have impacted organizational growth and financial success.

PROJECT 4

Alectra Drive@Home

PROJECT SNAPSHOT

Alectra Building Capacity for EV Managed Charging. The Alectra pilot advanced Ontario's readiness for managed EV charging, demonstrating that price-based incentives can reduce on-peak charging. While overall peak reductions were modest, the project provided strong technical and operational learnings, particularly around technology integration, regulatory needs and challenges in MURBs. Alectra actively shared results across industry and regulatory forums, influencing sector discussions and future program design. The pilot strengthened internal collaboration and capacity within the utility, positioning Alectra, and Ontario more broadly, for more effective EV integration, despite limited direct market or investment impacts.

Indicator	Performance	Analysis
1. Key Learnings	●●● **STRONG**	Price signalling proved highly effective at reducing on-peak EV charging by over 80%, offering a clear benchmark for utilities exploring similar strategies. This pilot did not generate significant overall peak load reduction or customer bill savings but demonstrated the ability to avoid post-event "snapback" peaks and localized constraints, both of which are critical to address as EV adoption grows (see Electricity Sector Trends, Challenges and Opportunities). Participants were generally well-informed and motivated to shift charging to off-peak periods; however, participants were likely early adopters and may not reflect the broader population. As such, additional study may be needed as EV adoption expands. Similarly, customer satisfaction was strong (82% positive feedback through surveys conducted by Alectra), though a more hands on approach was offered at the pilot stage that may not be replicable at scale. The pilot highlighted the need for clearer regulatory mechanisms and codes and standards to support utility-managed charging. Additionally, implementing managed charging in MURBs remains significantly more complex and costly than in SFHs.

Indicator	Performance	Analysis
2. Informed Sector Discussions	●●● **STRONG**	Alectra shared its learnings across the industry and regulatory forums, including the OEB EV Connections Subgroup, DistribuTECH, and the OEB Innovation Sandbox 2.0 Report and 2024 Innovation Handbook. The company also published pilot results through its reports and website and exchanged insights with peers such as Toronto Hydro and BC Hydro. The pilot insights informed a joint FCM/Dunsky/Alectra report Futureproofing Multifamily Buildings for EV Charging and have anecdotally supported regulatory discussions on public charging rates and new DSM guidelines on EV charging connection procedures (EVCCP).
3. Market Effects	●● **MODERATE**	The project contributed to the growing awareness of EVs as grid assets, created 1 new position, and coordinated with 3–5 Alectra GRE&T Centre staff and 3 Energy Solutions team members. It supported adoption of smart EVSE and telematics technologies, while enhancing market understanding of vendor capabilities, partnerships, and evolving technology offerings in the managed EV charging space. The project received a moderate score as it created additional market effects, one full time position and informed other planned projects. It is unclear if it resulted in additional investment in Ontario.
4. Organizational Growth	●●● **STRONG**	The pilot strengthened communication and collaboration across Alectra's departments, including system planning, regulatory affairs, metering, and data management. It sparked internal dialogue, built skills and relationships, and improved overall readiness for EVSE integration. The project informed other initiatives, such as the Alectra eMobility Platform and the EV Fleet Pilot (Alectra Drive@Work), enhancing the utility's capacity and confidence to deliver future programs. It was unclear whether project resulted in increased revenue, profits or operational savings/efficiencies. *"The pilot created conversations internally, led us to others, built our skills and internal readiness, and enhanced relationships between different groups. For example, our load capacity mapping now includes EV subject matter experts. It got us involved in regulatory proceedings that we may not have been involved with in the past. "* *- Alectra representative*

PROJECT 5

Elocity

PROJECT SNAPSHOT

Elocity's HIEV Shows Strong Technical Progress but Early Market Maturity. Elocity's HEIV is growing technical capability but remains in the early stages of market readiness. The project generated strong operational learnings on shifting EV charging to off-peak hours, optimizing incentives, and enabling participation through smart-adapter technology. While collaboration with utilities improved, the pilot highlighted the need for clearer regulatory frameworks to support managed charging and define value for utilities and consumers. Broader market influence remains limited, though the project strengthened Elocity's organizational capacity and contributed to new domestic and international partnerships, signaling emerging momentum in Ontario's EV sector.

Indicator	Performance	Analysis
1. Key Learnings	●●● **STRONG**	Elocity gained practical insights into how to shift EV charging to off-peak hours. It showed that financial incentives drive participation and tested varying incentive levels. Not surprising, higher rewards led to stronger engagement. Elocity's adapters helped to bridge the gap between smart and non-smart chargers allowing more EV owners to participate in managed charging. Elocity learned how to collaborate more effectively with local utilities and that partnerships with LDCs takes time. The pilot underscored the need for clear regulatory frameworks to define how managed charging is valued and compensated so that utilities, suppliers and customers benefit. *"Managed charging needs a regulatory framework, and we need clarity on valuation and compensation. LDCs don't have enough money or can't invest without regulatory approval and direction." - Elocity representative*
2. Informed Sector Discussions	● **DEVELOPING**	Elocity noted that project outcomes have minimally informed sector discussions in Ontario. However, the company continues to share pilot findings with potential partners across the province.
3. Market Effects	●● **MODERATE**	The pilot created five new full-time positions. Elocity successfully secured another Canadian project with Sault Ste. Marie Public

Indicator	Performance	Analysis
		Utility Company to set up a smart charging network and Elocity is now partnering with Milton Energy and Generation Solutions Inc. and Burlington Electricity Services Inc., with Ontario Vehicle Innovation Network (OVIN) to pilot a nano-grid EV charging solution for commercial and residential use.[57] It is unclear whether the project attracted other Ontario investment.
4. Organizational Growth	●●● **STRONG**	The project positively impacted the growth and financial success of the company. Elocity, with the Ontario government, attended the California EVS36 (an electric vehicle symposium) and gained interest from the US market. The successful HIEV Platform demonstration led to new international purchase orders and technology adoption from international utilities across Asia including India, Saudi Arabia, and Singapore.

[57] https://electricautonomy.ca/charging/v2g/2025-06-24/hiev-nano-ontario-v2g-charing-evs/

Value For Money

The value for money assessment evaluated projects and GIF across **three indicators**:

1. **Strength of Investment** focuses on the financial performance and grid benefits
2. **Strategic Alignment** examines alignment with GIF objectives (See Section 1).
3. **Risk Management** evaluates potential uncertainties and vulnerabilities that may impact success

Each project received a score (**Strong**, **Moderate** or **Developing**) for each indicator. The qualitative assessment criteria for each indicator and score are detailed in the following table.

Indicator	●●● STRONG	●● MODERATE	● DEVELOPING
1. Strength of Investment	• **Cost-effective** at measure/pilot- stage[58] • **Demonstrated potential to significantly advance grid modernization** – enhance visibility, control, & flexibility; strengthen reliability/ resilience as electrification/ extreme events grow	• **Potential to be cost-effective** at measure/pilot- stage or with adjustments at scale • **Potential to somewhat advance grid modernization**	• **Not cost-effective/unclear** at measure/pilot- stage; requires more study/ changes before scaling • **Minimal/uncertain impact on grid modernization**
2. Strategic Alignment	• **Projects align closely with 3+ GIF objectives**	• **Fair alignment with 1 – 2 GIF objectives**	• **Weak alignment or significant misalignment** with GIF objectives
3. Risk Management	• **No significant technical, financial, or operational risks** or where risk exists, viable solutions in place/identified • **Clear path to scale** with minimal additional uncertainty • **Learnings transfer well to other applications**	• **Minor technical, financial, or operational risks** that must be addressed prior to scale-up • **Some uncertainty about additional risks** at scale • **Learnings likely transfer to other applications** with adaptations	• **Major technical, financial, or operational risks** with unclear or unproven solutions • **High risk uncertainty** at scale • **Low confidence in transferability** to other applications

[58] The team took a high-level approach to assess if solutions were cost-effective using the project's costs and impacts expressed as the cost per unit of energy or demand saved ($/kWh or $/kW saved). Cost effective projects generally fall within the range of 2 to 4 cents per kWh. The pilots' purpose is to explore innovative technologies or approaches, where costs and benefits are uncertain and learning value is the primary objective, thus applying strict benefit cost analysis at this stage is not recommended.

Summary of Value for Money Insights

The table below summarizes how each project and GIF scored for each indicator.

Table 8. Value for Money Results by Project

Project	1. Strength of Investment	2. Strategic Alignment	3. Risk Management
Borden Mine	●●● STRONG	●●● STRONG	●●● STRONG
Hespeler MABR	●● MODERATE	●●● STRONG	●● MODERATE
Ailsa Craig/Watford DVA	●● MODERATE	●● MODERATE	●● MODERATE
Alectra Drive@Home	●● MODERATE	●●● STRONG	●● MODERATE
Elocity HIEV	● DEVELOPING	●●● STRONG	●● MODERATE
GIF Overall	●● MODERATE	●●● STRONG	●● MODERATE

The results reveal the following:

- **Pilots align well with GIF objectives** that will help facilitate their transition from pilot stages to broader market adoption.
- **Moderate scores in investment and risk management indicators show GIF effectively identified early-stage innovation barriers (i.e., costs, risks and integration).** However, post-pilot scaling is limited, suggesting that while early support was successful, longer-term market uptake remains a challenge.
- **Pilots generated valuable technical and operational learnings to strengthen future implementation of innovative technologies.** While their small scale had limited direct system-level impacts, industrial projects had measurable energy and cost savings/process learnings, and EV pilots provided insights into demand flexibility potential and integration and regulatory challenges.
- **Clearer objectives and stronger pilot design and evaluation plans are needed.** This will help turn learnings into more actionable next steps to scale.
- **High-quality data, reporting and evaluation metrics are essential to capture a pilot's value and learnings** (e.g., cost-effectiveness is important but achieving it at the pilot stage is not necessary).

PROJECT 1

Borden Mine

Indicator	Performance	Analysis
1. Strength of Investment	●●● **STRONG**	The project delivered significant energy savings of 5,902 MWh, equivalent to approximately $415,000 annually, along with non-energy benefits such as quieter operations and enhanced safety. With an investment of $1.97M, the initiative proved highly cost-effective, achieving savings at approximately $0.03 per kilowatt-hour. The technology shows strong potential for broader implementation, with estimated achievable savings of over 55 GWh. While it does not directly contribute to grid modernization or resiliency beyond energy and capacity reductions, its role in supporting a fully electric underground mine underscores the importance of efficiency in minimizing grid impacts and ensuring reliable operations.
2. Strategic Alignment	●●● **STRONG**	The project proved that eliminating centralized CA in an underground mine is feasible and led to the discovery and adoption of a new SCBA that is easier to use and has low maintenance costs. This cost-effective and energy-efficient solution has generated strong interest across the mining industry. Borden Mine's all-electric operations have received significant press coverage, establishing it as a leader in electrification and energy efficiency. The project's results were presented to the Ontario Mining Association in 2024, received significant media attention and have since prompted discussions with nearly all major mining companies.
3. Risk Management	●●● **STRONG**	• **Technical risks (Low):** The project was proven in a new mine and was later implemented in an existing mine expansion with minimal technical challenges reported. It also helped address and lift initial concerns about safety and adoption by miners. The learnings will help to reduce risk in future mining electrification projects. • **Financial risks (Low):** The project built a strong business case at the outset (even without GIF funding) and demonstrated that it was very cost effective. • **Operational risks (Low):** There were no significant operational risks identified.

PROJECT 2

Hespeler MABR

Indicator	Performance	Analysis
1. Strength of Investment	●● **MODERATE**	The project demonstrated that MABR technology can meet new ammonia requirements while reducing energy consumption by 102 MWh, demand by 23 kW, and N_2O emissions. While it does not directly contribute to grid modernization or resiliency beyond energy and capacity savings, it offers important environmental and operational benefits. Although the project incurred relatively high costs compared to the immediate savings achieved, MABR is considered a more cost-effective alternative to full plant expansion considering increasingly stringent water quality regulations and projected capacity demand. The true measure of cost-effectiveness depends on the cost and efficiency of the required upgrades; however, comparative data for alternative options were not provided.
2. Strategic Alignment	●●● **STRONG**	The project met several GIF objectives. It identified key learnings to mitigate barriers around costs and risk providing valuable insights for future implementation. While MABR technology was found not to be cost-effective purely as an energy efficiency measure, it may represent a more economical and practical alternative to plant expansion. Additionally, applying lessons learned have results in significant cost reductions in other plants. Through several presentations and knowledge-sharing efforts, the project helped advance the commercialization of MABR technology. As a result, other municipalities such as Guelph, London, and Halton Region are now considering its adoption, and North Toronto has already implemented the technology.
3. Risk Management	●● **MODERATE**	• **Technical risks (Moderate):** A moderate was given due to the need for customization and data challenges experience, which may lead to some uncertainty impacting future projects. • **Financial risks (High):** The project went seriously overbudget; however, the MABR technology was installed in a similar WWTP at significantly lower cost. Costs for future projects may be difficult to control because the solution is customized. • **Operational risks (Moderate)**: The pilot highlights the need for diffusers to avoid sludge build up. Custom installations require regular monitoring and adjustments.

PROJECT 3

Ailsa Craig and Watford DVA

Indicator	Performance	Analysis
1. Strength of Investment	●● **MODERATE**	The project confirmed energy savings of 14–43 MWh; however, the pilots were not cost-effective due to high set up and implementation costs. In particular, the Waterford site required a specialized installation that significantly increased expenses, and it remains unclear whether similar costs would apply to future projects.
2. Strategic Alignment	●● **MODERATE**	GIF support was essential in offsetting the full equipment capital cost, as the municipality lacked the financial capacity to proceed independently. The project provided the opportunity to test two different DVA placements and confirmed that installation within the lagoon, replacing an existing aerator, was the more effective configuration. There is potential for other WWTPs to adopt DVAs without expanding their existing aeration systems, and the technology could also be applied in chemical dosing systems to broaden its market reach. While the project successfully gathered valuable field data, it has not yet led to adoption at other plants, and market effects remain minimal. OCWA has presented the DVA technology to multiple facilities, though it is unclear whether the project directly contributed to wider sector discussions.
3. Risk Management	●● **MODERATE**	• **Technical risks (Low):** There are some technical considerations but no significant risk; however, dissolved oxygen probes were located too far downstream to measure the unit's effect accurately, which raises some technical risk for projects. • **Financial risks (Moderate):** There are some risks due to high costs compared to savings. Further assessment is required before offering the measure in a regular program. • **Operational risks (Moderate):** DVAs require minimal maintenance and are well-received by the operations team. However, there remains some operational uncertainty. For example, isolating DVA impacts at Ailsa Craig would require shutting down downstream aerators, rendering the plant temporarily non-operational. Ailsa Craig also lacked VFDs, causing over/under aeration.

PROJECT 4

Alectra Drive@Home

Indicator	Performance	Analysis
1. Strength of Investment	●● **MODERATE**	As a small, early-stage pilot, Alectra Drive@Home showed limited cost savings from utility-managed charging but highlighted important lessons for future scale-up. Direct utility control produced low lifetime customer cost savings and achieved modest peak-reduction potential of 3.3%for targeted segments. While the pilot's cost-effectiveness remains uncertain, Alectra recognizes that demonstrating value will be critical before scaling up the program. The pilot also showed that simple price signals can be enough to shift charging to off-peak times for many customers and the benefit of managed charging was in reducing "snap-back" effects and addressing localized grid constraints. With growing EV adoption, managed charging is expected to play an increasingly important role in reducing "snap-back" effects and evening out peak demand, with benefits that strengthen as EV adoption grows.
2. Strategic Alignment	●●● **STRONG**	The pilot aligned strongly with GIF objectives: **1.** It deployed EV charging solutions (installed utility-controlled Level 2 EVSE (FLO CoRe+)) to support the development and deployment of grid-enhancing technologies. **2.** Although the pilot was not cost-effective, by testing grid flexibility using utility managed charging and innovative pricing to shift peak load the pilot encouraged the adoption of cutting-edge energy solutions. **3.** Exploring new technology deployment in SFHs and MURBs, Alectra helped uncover key barriers and challenges to innovation and opportunities to mitigate. **4.** Alectra helped inform Ontario's industries of these grid-enhancing technology developments by participating in the OEB – EV Connections Subgroup, Industry conferences (DistribuTECH), OEB Innovation Sandbox 2.0, OEB 2024 innovation handbook, peer to peer sessions, and the joint FCM, Dunsky and Alectra report: Futureproofing Multifamily Buildings for EV Charging.

Indicator	Performance	Analysis
3. Risk Management	●● **MODERATE**	• **Technical risks (Moderate):** The pilot uncovered device and interoperability issues, vendor coordination, and costly MURB challenges. Alectra reported Wi-Fi connectivity problems due to EVSE installation locations appear to have constrained MURB driver price response and program satisfaction. Solutions to reduce the complexity of MURB EV charging include updating the national energy code for buildings and national building code to require EV ready new construction, provide clear design and installation guidance for MURB owners, and update utility policy constructs, regulation, rates and programs to support widespread deployment of EV charging, and broader beneficial electrification[59]. Additional solutions for Wi-fi connectivity include Wi-Fi extenders or integrated cellular services for better charger connectivity. • **Financial risks (Moderate):** Some cost surprises on technical devices and chargers. Make ready infrastructure can help alleviate costs, as well as codes and standards improvements in MURBs. • **Operational risks (High):** The pilot had a complex pilot design; streamlined program design can cut risks and clarify learnings. Programs will take increased staff time as EV adoption scales.

[59] Dunsky Energy + Climate Advisors; Alectra GRE&T Centre; and McCarthy Tétrault LLP. Federation of Canadian Municipalities Low Carbon Cities Canada. "Futureproofing Multifamily Buildings for EV Charging"

PROJECT 5

Elocity

Indicator	Performance	Analysis
1. Strength of Investment	● **DEVELOPING**	The strength of investment could not be assessed as the pilot did not provide demand savings that could be verified, although a maximum net curtailment of 174 kW was reported for several DR events. The technology has potential to advance grid modernization by improving load flexibility and peak reduction if HIEV interoperability technology scales, but it was unclear what direct grid contributions were achieved at the pilot stage.
2. Strategic Alignment	●●● **STRONG**	The pilot aligned strongly with four GIF objectives: **1.** Tested and validated HIEV-EV Plug's grid interconnection and interoperability and addressed privacy issues for utility managed EV charging. **2.** Supported the adoption of cutting-edge energy solutions. **3.** Identified technology and operational barriers (e.g., network connectivity barriers for EV charging) **4.** Provided insights into incentives and load shifting strategies that can enhance grid resilience.
3. Risk Management	●● **MODERATE**	• **Technical risks (Moderate):** The pilot highlighted EVSE connectivity as a key technical issue. Wi-Fi extenders or integrated cellular service could be possible solutions but should continue to be evaluated. Supply chain challenges occurred impacting electronic component deliveries, but the project was still able to procure the technology on time. Future risk is low as Elocity has refined their technology design allowing for alternative electronic components if shortages occur again. It is important to note that this pilot took place during COVID-19, which disrupted global supply chains. • **Financial risks (High):** Given the project did not report savings, the financial risks and cost-effectiveness remain unclear. • **Operational risks (Moderate):** The pilot highlighted the need for flexible regulatory frameworks that can keep pace with emerging technologies, new demand patterns and clear rules around managed charging valuation and compensation. Utilities, suppliers and customers need a fair, consistent structure that reflects the full value stack. The operational lessons learned, and regulatory uncertainty experienced will likely transfer with potential adaptations to other utilities across Ontario and should continue to be explored.

GIF Lessons Learned

The GIF scores represent the average of individual pilot project assessments. The aggregated results and corresponding rankings provide insight into lessons learned, the effectiveness of GIF investments, and opportunities to strengthen alignment with the IESO's strategic objectives. These findings reflect the current structure of the GIF. Specifically, its focus areas versus broader market needs, evaluating and selecting innovation projects for funding, defining pilot expectations, and assessing outcomes and impacts. While the GIF has played a critical role in advancing innovation within Ontario's electricity sector and has delivered meaningful successes, the results also indicate areas where refinements to program design and evaluation processes could further create value and impact.

1. Strength of Investment

OVERALL RATING : ●● MODERATE

All pilot projects except for Elocity demonstrated verified energy and/or demand savings. The potential opportunity analysis estimates total gross energy savings of approximately 73 GWh and if pilots were to scale up across Ontario, potential savings equivalent to 2.4%–4.9% of total end-use energy consumption and 6.8% of peak load could be achieved within the targeted market segments over the next five years. However, pilot design should balance innovation with targeted focus and clear outcomes to manage complexity and ensure measurability. Future pilots would benefit from better evaluation planning using established protocols to develop baselines, make seasonal adjustments, validate data, and conduct measurement and verification. This would ensure redundancy in data collection equipment to mitigate loss from instrument failures, transparent documentation of all assumptions and improve measurability.

Recommendation: GIF should encourage pilots to focus their scope and strengthen evaluation planning and data collection methods so project outcomes can be clearly measured and validated.

2. Strategic Alignment

OVERALL RATING : ●●● STRONG

GIF has proven effective in supporting projects that identify and address key barriers such as cost, risk, and system integration. By providing funding that helps de-risk innovative initiatives, GIF has enabled participants to test new technologies and operational models with reduced financial pressure. For example, at Borden Mine, GIF played a valuable role in offsetting costs and facilitating demonstration, even though the project had already secured internal approval based on its strong business case. Similarly, for wastewater treatment and electric vehicle integration projects, GIF support helped organizations test and refine new technologies and manage integration challenges that might otherwise have been too risky or costly to pursue.

To further strengthen the program's impact, **clear and transparent evaluation criteria** are needed to assess project eligibility. These criteria should align with broader electricity sector trends and challenges, policy and regulatory goals, market needs, and GIF's own strategic objectives. This could prompt applicants to clearly think through the pilot logic and theory in a way that aligns with GIF objectives. Moreover, evaluation criteria should reflect what pilots can reasonably achieve. For example, expectations should be tempered on pilot cost-effectiveness and broader electricity system impacts given pilot size and scope, costs and benefits are uncertain and learning value is the primary objective.

Recommendation: GIF should supply clear, transparent evaluation criteria that aligns with sector trends and GIF's strategic objectives, guiding applicants to design pilots with strong rationale, defined outcomes, and demonstrable and measurable contributions to enhance Ontario's electricity distribution system.

3. Risk Management

OVERALL RATING : ●● MODERATE

Greater support at the application stage would help proponents develop robust pilot designs, clearly define expected outcomes, and establish strong evaluation frameworks. Ensuring that projects include high-quality data collection, reporting, and performance metrics will make it possible to accurately assess results against GIF-defined evaluation areas, such as demand-side impact, sector benefits, and value for money while recognizing that cost-effectiveness may not always be achievable during early pilot phases.

Additionally, there may be opportunities to **revisit funding levels and ongoing support mechanisms** to better accommodate pilot realities. Some proponents reported experiencing long gaps between application, approval, and implementation. Over that time, project costs increased and unexpected expenses emerged. Allowing for additional funding flexibility after approval could help address these challenges and ensure that innovative, grid-enhancing technologies continue to advance toward deployment and commercialization.

Evaluation processes and timing could be refined to reflect what small-scale pilots can realistically achieve. Current evaluation cycles, such as reviewing projects conducted between 2018 and 2023 only in 2025 can limit the accuracy and relevance of findings due to staff turnover, data gaps, and reduced recall. Conducting evaluations closer to project completion would enable more effective learning, faster feedback to participants, and greater momentum across the sector.

Finally, there is **opportunity for GIF to offer post-program support** ensuring that promising initiatives continue to receive visibility, technical guidance, or partnership opportunities after participation to achieve broader and lasting market impacts. Currently, project findings are shared publicly by recipients and by the IESO (e.g., website, OEB, Province) and results are often used by the IESO's DSM team to inform future programming. There are opportunities for IESO to further elevate GIF recipients and project learning. Examples of additional post-project support the IESO could consider to help recipients disseminate pilot findings are shown in the table below.

Table 9: Examples of Post-project Support

Financial Support	Non-Financial Support
• **Funding for knowledge transfer activities** such as workshops, webinars, conference presentations. • **Grants for publishing results** in technical journals, industry reports, or other platforms. • **Support for commercialization readiness** (e.g., follow-on funding to refine business cases, validate economics, or scale early deployments). • **Cost-sharing for replication studies** that test solutions in new contexts and generate additional evidence.	• **Dissemination through other channels** such as newsletters, social media, and annual reports. • **Hosting or co-hosting events** to showcase results (e.g., innovation forums, industry roundtables, knowledge-sharing sessions). • **Technical guidance on packaging insights** to help recipients refine reporting, develop case studies, or highlight key learnings. • **Partnership brokering** to connect pilot teams with utilities, municipalities regulator, industry, or other potential adopters. • **Mentorship or advisory support** to help translate findings into actionable next steps or market pathways.

Recommendation: GIF could offer stronger support during application and design stages, ensure flexible funding to accommodate pilot uncertainties, conduct evaluations closer to project completion to improve the accuracy and usefulness of results and provide post-program support to help promising technologies to deploy broadly, and disseminate information to the wider Ontario market.

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