Locals Only – the IESO's Innovative Programs to Target Geographic Demand Constraints

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ABSTRACT

In Ontario, the Independent Electricity System Operator (IESO) is taking an innovative approach to address Ontario's electricity system needs at the local level. Through their 2021-2024 Conservation and Demand Management (CDM) framework, the IESO is sourcing Demand Side Management (DSM) solutions through competitive mechanisms—enabling a broad range of participants to propose geotargeted DSM programs and opportunities where near-term grid constraints have been identified as well as addressing system capacity gap in 2026.

This local, market-driven approach encourages competition, cost savings, and customer-driven solutions that address geographic system constraints. Furthermore, by supporting market-driven, local solutions, the IESO is working to improve the economic and energy resiliency of unique and diverse communities.

The IESO's market-driven approach designed to address system capacity caps is the Local Initiatives Program (LIP). EcoMetric's team is currently evaluating the first round of Initiatives launched in 2023—the BizEnergySaver and CoolSaver programs. These programs provide free energy assessments to businesses and households and offer upfront incentives for energy efficient measures such as (Light Emitting Diode) LED upgrades, lighting controls, variable frequency drives (VFDs), efficient pumps and fans, and more. Potential Demand Response (DR)/Distributed Energy Resources (DER) technologies are also being considered through existing and planned initiatives. The impact and process evaluation of LIP will yield valuable insights into the successes and challenges of supporting market-driven solutions tailored to geotargeted communities. As part of the cost effectiveness evaluation of the program, benefits other than avoided energy costs, such as benefits from wire deferral and interim enhanced system reliability, will also be quantified.

Introduction

The IESO is a crown corporation responsible for operating the electricity market and directing the operation of the bulk electrical system in the province of Ontario, Canada. The IESO delivers key services across the electricity sector, including managing the power system in real-time, planning for the province's future energy needs, enabling conservation and designing a more efficient electricity marketplace to support electricity sector evolution. In September 2020, the IESO received a ministerial directive in connection with the 2021-2024 CDM Framework to enable additional CDM programming to address electricity and customer needs, which included

funding for local capacity constrained regions. The 2021-2024 CDM Framework will help the province cost-effectively meet its electricity system needs through the delivery of programs, training and other mechanisms that enable Ontario's electricity consumers to improve the energy efficiency of their homes, businesses, institutions and industrial facilities. As part of this framework, local initiatives were developed to deliver DSM savings in targeted areas of the province with identified system needs.

The IESO is taking an innovative approach to address Ontario's electricity system needs at the local level. Through the 2021-2024 CDM Framework, the IESO sourced DSM solutions through competitive mechanisms—enabling a broad range of participants to propose geotargeted DSM programs and opportunities where near-term grid constraints have been identified as well as addressing a system capacity gap in 2026. The approach is unique compared to traditional energy efficiency whereby the IESO does not conduct the program design and potential proponents (i.e. consultants, local distribution companies and delivery agents) were free to propose the design and delivery of their own programs on the condition that certain criteria such as budget, cost effectiveness, measurement and verification (M&V), and market feasibility in geo-targeted areas were met. This local, market-driven approach encourages competition, cost savings, and customer-driven solutions that address geographic system constraints. Furthermore, by supporting market-driven, local solutions the IESO is working to improve the economic and energy resiliency of unique and diverse communities.

Program Design – Addressing System Needs at the Local Level

In order to design local programs, the IESO first identified regional electricity system needs that could be targeted with DSM. The process began with an inventory review of all needs identified in the regional planning process, which included areas where electricity demand is forecasted to surpass the rated capacity of transmission and distribution system assets in the medium term. To assess the opportunity for DSM to address these needs, the IESO used the following criteria, which were developed for the first round of the LIP [1]:

1. Timing of need: Targeting DSM at areas with medium-term needs (e.g., 5-10 years), which allows for the possibility of wires deferral and some immediate needs.
2. Size of need versus load: Targeting needs that are less than 2 per cent of customer demand ensures that there is sufficient customer load that can be reduced by DSM measures.
3. Coincidence with provincial system peak: Targeting regional and local needs that occur during the provincial system's summer peak demand period primarily drives capacity needs and maximizes the value of the targeted DSM to the provincial system and, by extension, provincial ratepayers.
4. Community support and siting: Prioritizing areas with strong support from municipalities for DSM ensures community support for local programs. Local Distribution Companies (LDC) support is also a key factor in obtaining metered data.

Based these screening criteria, the IESO system planning team identified four regions within Ontario, Canada, the Belle River area in Windsor-Essex, Ottawa, Richview South area in Toronto and York Region. More details around the selection process can be found in the IESO Mid Term Review Report.[1]

The IESO pursued an open competitive procurement that allowed any market participant to propose potential programs which encouraged competition, innovation, cost savings and customer-driven solutions. Proposed programs must be cost-effective and not duplicative of other province-wide DSM programs currently available. Proponents were required to submit program design (measure savings assumptions, potential program in-take), budgeting, an outreach plan, and a work plan. The LIP aims to achieve savings of 57 MW of demand savings and 230 GWh of energy savings over four years across the identified regions. Successful programs were chosen and scored based on a mix of program delivery (i.e. budgeting, measure uptake and design), and technical components (i.e cost effectiveness, measure details/savings, and QAQC) This resulted in the successful launch of the following suite of local programs across the four regions:

- CoolSaver: An AC tune-up based program. (Richview South, York Region, and Ottawa)
- BizEnergySaver: Direct install lighting and VFDs for small businesses. (Richview South and Ottawa)

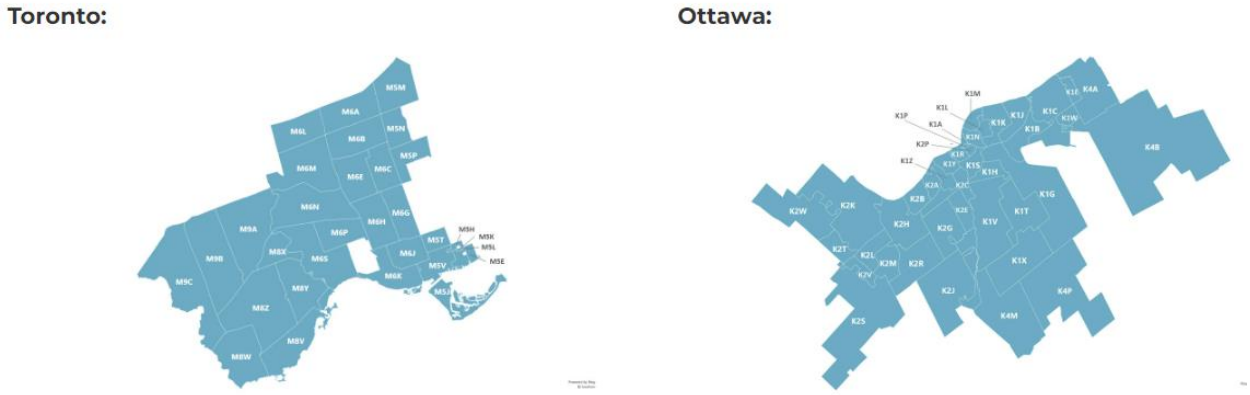

Figure 1: Geographical availability of the BizEnergySaver Program (Richview South area of Toronto and Ottawa). *Source:* The IESO 2024.

Figure 1 is for graphical reference only. Full postal codes of all eligible areas and programs can be found on the Save on Energy Website [2].

To appropriately carry out cost effectiveness evaluation, the IESO is conducting research to understand and quantify additional transmission benefits from locally targeted programs such as asset (i.e., wires) deferral and interim enhanced system reliability. Asset deferral aims to quantify the economic benefits of reducing demand for investments in new transmission lines, substations, or related facilities. By leveraging cost-effective non-wire approaches, such as demand-side management, energy efficiency (EE) measures, or distributed energy resources

(DERs), the IESO can alleviate the strain on existing infrastructure and defer capital-intensive investments. Benefits from interim enhanced system reliability can be quantified as the dollar benefit of the impact of DSM measures in reducing the number of hours and/or magnitude when demand is expected to exceed transmission equipment rating. Demand-side management can provide monetary benefits to a system in the form of reducing, shortening, and/or eliminating capacity overages, when demand exceeds capacity.

Program Impacts – Achievements in LIP's First Year

The IESO has contracted EcoMetric to evaluate several of their commercial and industrial programs in the 2021-2024 CDM Framework, including LIP. EcoMetric has formed a team to conduct the impact and process evaluation of LIP that includes DNV Energy Insights and Dunsky Energy + Climate Advisors (Dunsky). The first Local Initiatives were launched in 2023 and EcoMetric is conducting the first impact and process evaluation of the program throughout 2024. Evaluation planning and data collection began in late 2023 and EcoMetric will report impact and process results in August 2024. As such, this section will detail early insights into the successes and challenges of LIP in its first program year. EcoMetric expects the number of projects and savings impacts to significantly increase in future program years as the existing initiatives mature and new initiatives are launched. EcoMetric will leverage insights from the first evaluation of LIP to provide the IESO with actionable recommendations to support their efforts in reaching DSM goals through market-based offerings.

To conduct the impact evaluation and verify gross and net savings for LIP in PY2023, EcoMetric employs a stratified sampling approach. The evaluation sample is stratified by region to ensure that projects across the targeted regions are included in the sample, and the evaluation results are statistically valid in each region. The sample was designed to target ±10% precision at the 90% confidence level by region annually and to reach ±15% precision at the 85% confidence level by initiative. For the BizEnergySaver initiative, where measures are more diverse in technology, size, and scope, EcoMetric applies a certainty stratum to ensure the largest and most impactful projects are included in the evaluation sample. This stratified sampling allows EcoMetric to achieve a high level of precision and confidence in evaluation results.

For each sampled project, EcoMetric conducted a thorough engineering review to verify gross savings. Engineering reviews are the key to accurate evaluation of programs and an important task to verify the accuracy of the measurement and verification (M&V) conducted by the customer, contractor, technical reviewer, and other parties in the implementation process. As the majority of savings in LIP are deemed from the IESO's technical references and program Business Case, EcoMetric conducted a thorough review of the assumptions behind the deemed savings to ensure they result in accurate estimations of savings in each region and building type in the sample.

If key input assumptions appear inconsistent, the team flagged them for further investigation. EcoMetric attempted to gather information from program personnel, contractors or

participants via phone and incorporate them in the gross verified savings calculation. These efforts help refine operating parameters to improve the accuracy of the analyses and primary data collection at unique project sites adds diversity to assumptions used to estimate deemed savings. This is increasingly important when estimating savings for residential customers and small businesses in such diverse regions as those targeted by LIP.

To calculate gross savings, EcoMetric's engineering reviews utilize end use-specific or technology-specific workbooks to test the calculations and related assumptions used by implementers to estimate savings for each project following the International Performance Measurement and Verification Protocol (IPMVP) standards. Data collected from project audit activities will allow EcoMetric to verify the gross energy, winter peak demand and summer peak demand savings for each project.

EcoMetric used direct query surveys with decision-makers at the participating customer organizations to determine net-to-gross ratios (NTGR) by initiative. The free-ridership approach included questions on the program's effect on the efficiency level installed, quantity installed, and timing of the project. The timing, quantity, and efficiency effects of the program are each informative to understand how programs are benefiting customers. The team utilized established procedures and algorithms for combining this information into an overall freeridership score. The NTG questionnaire included consistency checks and open-ended questions. To estimate spillover as well as any potential influence of participation on subsequent projects that received incentive funding, the interviewers asked about influenced projects, the degree of program influence, the project size, and whether they received program support. Both completed and planned projects were considered with a discounted presumed effect for planned projects.

EcoMetric's evaluation of LIP not only focuses on verifying gross and net impacts of the program but also assessing the program's progress towards its goal of addressing system needs at the local level. This includes an in-depth review of the measures offered, incentive levels, program delivery processes, and assessment components to ensure the unique DSM needs of each region are being addressed to maximize peak demand savings.

Savings Impacts

A total of 167 measures have been installed through the BizEnergySaver and CoolSaver programs in Program Year (PY) 2023. Tables 1 through 3 below summarize measures and reported savings by region. The BizEnergySaver initiative focused on the Richview South region and included LED lighting, lighting controls, and VFDs on fan and pump motors. The CoolSaver initiative was active across Richview South, York, and Ottawa regions and included AC tune-ups. These programs will be delivered through the end of 2024, so EcoMetric expects savings to increase as the program matures.

Table 1: PY2023 LIP Evaluation Measures

Initiative	Number of Projects in PY2023 Sample		
	Richview South	York	Ottawa
BizEnergySaver	135	-	-
CoolSaver	19	2	11
Total	**154**	**2**	**11**

Table 2: PY2023 LIP Reported kWh Savings

Initiative	Reported Savings (kWh)		
	Richview South	York	Ottawa
BizEnergySaver	6,051,802	-	-
CoolSaver	11,778	925	9,924
Total	**6,063,580**	**925**	**9,924**

Table 3: PY2023 LIP Reported Summer Peak Demand Savings (kW)

Initiative	Reported Summer Peak Demand Savings (kW)		
	Richview South	York	Ottawa
BizEnergySaver	807.07	-	-
CoolSaver	12.81	1.00	9.64
Total	**819.88**	**1.00**	**9.64**

EcoMetric's engineering reviews revealed very accurate reported savings estimates and technical references. This was expected from the prescriptive programs focused on lighting, VFDs, and AC Tune-ups. The realization rates are defined as the ratio of verified gross savings to reported gross savings and are summarized in Table 4. For CoolSaver, EcoMetric updated the Hours of Use (HOU) variable in the AC Tune-Up for several measures that used the HOU for the wrong region. EcoMetric also adjusted the Efficiency Loss factor for a project which received a refrigerant charge adjustment from 0.175 to 0.243 which led to an increase in savings.

Table 4: PY2023 LIP Realization Rates

Initiative	Realization rate (kWh; %)	Realization Rate (kW; %)
CoolSaver	96%	121%
BizEnergySaver	100%	100%

Due to lower than expected response rates, EcoMetric, through a contracted survey house, was only able to complete 7 surveys with CoolSaver participants and 10 surveys with BizEnergySaver participants. The surveys found very little freeridership and no spillover. EcoMetric calculated a gross-savings weighted program-level NTGR for both initiatives, detailed in Table 5.

Table 5: PY2023 LIP Net-to-Gross Results

Initiative	Number of Survey Responses	NTG Ratio	Standard Error	Lower Confidence Interval	Upper Confidence Interval
CoolSaver	7	98%	2%	94%	102%
BizEnergySaver	10	96%	0.5%	96%	97%

GHG Reductions

Understanding and maximizing the Greenhouse Gas (GHG) reductions of DSM programs is increasingly important to support the collective effort to combat climate change. While the GHG impacts of natural gas-focused DSM programs are clear and easily quantifiable, the GHG impacts of electric DSM programs can often be overlooked. Electric savings result in avoided generation of electricity, which is often produced by burning GHG emitting fossil fuels. The emissions from electricity generated by fossil fuels are commonly referred to as Scope 2 emissions[1]. It is important to quantify and report Scope 2 emissions reductions from DSM programs so that participating residents, businesses, and their communities can understand the impact their energy efficiency decisions have on addressing climate change.

As part of EcoMetric's evaluation of LIP and IESO's other DSM programs, EcoMetric quantifies GHG reductions of the programs in tonnes of CO_2 equivalent. The benefits from DSM externalities, such as GHG reductions, are included in the Societal Cost effectiveness test. This test aims to answer the key question: is the province of Ontario better off as a whole when weighing the benefits against the costs of the LIP.

[1] The US Environmental Protection Agency defines Scope 2 emissions as indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling. Although scope 2 emissions physically occur at the facility where they are generated, they are accounted for in an organization's GHG inventory because they are a result of the organization's energy use.

The IESO's grid in Ontario has one of the lowest emissions factors in the world due to its heavy reliance on hydroelectric and nuclear generation. As depicted in Figure 2, fossil fuels accounted for just 12.8% of Ontario's electric energy generation in 2023.[2]

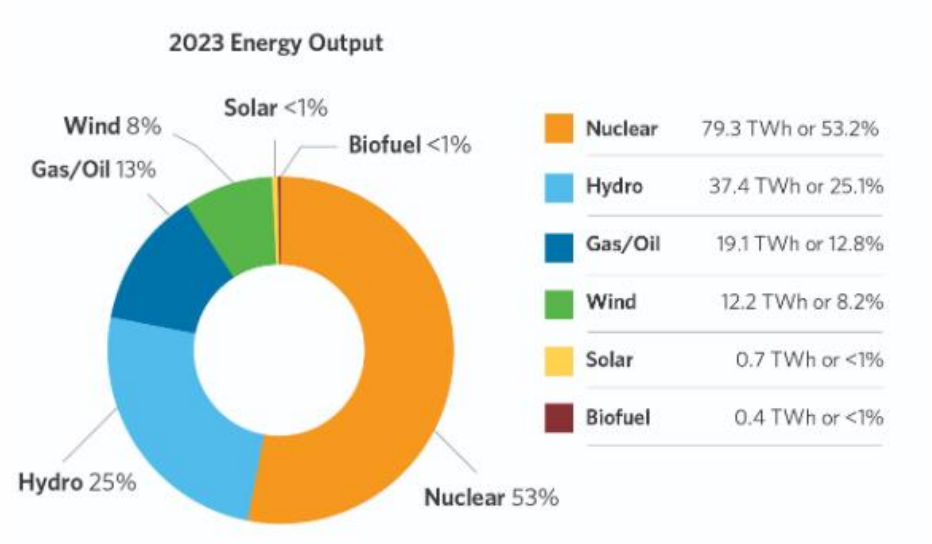

Figure 2. IESO Yearly Energy Output by Fuel (2023). *Source*: The IESO 2024.

Peak loads in Ontario are often met by natural gas plants that increase the IESO's emissions rate. As such, electric savings achieved during peak periods result in greater reductions of GHGs from the avoided generation in the province than savings achieved during off peak. From the GHG perspective, LIP's goal to reduce demand and address regional system constraints aligns with Ontario's decarbonization goals and should maximize the program's societal benefits.

To estimate GHG reductions of the IESO's DSM programs, EcoMetric relies on the IESO's CDM Energy Efficiency Cost-Effectiveness Tool (CE Tool) [3]. In this tool, the IESO uses its hourly electricity generation data to calculate seasonal average emissions factors (tonnes/MWh) across eight time-of-use periods. The emissions factors currently used are based on the 2021 IESO Annual Planning Outlook and detailed in Table 6. The emission factors can be found within the CE Tool mentioned above. As discussed above, the IESO's emissions factors are highest in the summer peak and summer mid peak when natural gas is used to meet peak demand.

[2] These figures do not include embedded generation. Embedded generation, also known as distribution-connected generation, is small-scale generation located within Ontario utilities' territories.

Table 6. IESO Average Emissions Factors - Electricity

	Winter Peak	Winter Mid-Peak	Winter Off Peak	Summer Peak	Summer Mid-Peak	Summer Off Peak	Shoulder Mid-Peak	Shoulder Off Peak
Average Emissions Factor (tonnes/ MWh)	0.179	0.168	0.196	0.254	0.267	0.235	0.201	0.163

Using the CE Tool, EcoMetric applies the emissions factors to the net verified electric savings of LIP to calculate the program's GHG reductions. EcoMetric conducts this analysis at the individual measure level and rolls up the results to the regional and total program levels. For prescriptive measures, EcoMetric references formatted load profiles developed by end-use and building type to bucket the kWh savings across the same eight time-of-use periods used for the average emissions factors. These formatted load profiles are developed and frequently updated by the IESO in their Measures and Assumptions Lists (MALs). For more complicated custom measures, EcoMetric collects project-specific hourly electricity consumption data to develop 8,760 load shapes that reflect the unique consumption and savings pattern of the projects. The estimation of GHG reductions from natural gas savings is more straightforward, where EcoMetric applies the emissions factor of the fuel to the net verified annual savings for each measure.

Table 7 details the GHG Reductions achieved by LIP in 2023. As the program continues to expand its reach and participation, EcoMetric expects the GHG reductions achieved by LIP to increase.

Table 7. PY2023 LIP GHG Reductions

Initiative	First Year GHG Emissions Reduction (tonnes CO2e)	Lifetime GHG Emissions Reduction (tonnes CO2e)
CoolSaver	5.63	16.74
BizEnergySaver	473,191	3,293,486

Process Evaluation

EcoMetric is carrying out a comprehensive process evaluation in which data is collected from a broad range of market actors through detailed and in-depth surveys, including questions on a broad range of program issues. The process evaluation is designed to collect data that provides insights on the successes and challenges of supporting LIP's market-driven solutions tailored to the four geotargeted communities.

The evaluation team is evaluating responses to the following research questions:

1. Is the IESO on track to meet savings goals for this program within the current framework?

2. What processes are in place for Quality Control? For project tracking?

3. What are challenges related to open procurement?

4. What are the customer motivations and barriers to participating in the LIP?

5. How is the customer program experience?

6. What are the qualified contractors' motivations and barriers for participating in the program?

7. How is the qualified contractor program experience?

8. Where are the opportunities to improve the delivery of LIP?

9. How can the IESO increase the participation of customers? Are there significant current program delivery inefficiencies?

EcoMetric is reviewing documents on LIP, such as the open procurement design, communication with potential participants, project implementation plans and any marketing and application materials relating to the request for proposals (RFPs). The program material review task will work in conjunction with any customer feedback received through survey tasks.

The team is conducting in-depth surveys with three key market actors:

1. **IESO and program delivery vendor staff**: These interviews will document findings related to program design, such as procedures to determine targeted areas for local initiatives, marketing and outreach, the RFP process, tracking and reporting proposals, QA/QC practices, and challenges and barriers for customers to participate in LIP.

2. **Participants**: Phone surveys, combined with Net-to-Gross (NTG) surveys, will leverage the impact and gather information on customer motivations to participate in programs, how easy was it for them to navigate the application process, usability of program resources, motivations behind energy reduction behaviors and investment, future investment plans and how well program activities are addressing their needs and the needs of their communities.

3. **Contractors**: Phone interviews will gather information on working with participants and their motivation to participate, how easy it was for them to become a qualified contractor, usability of resources, motivations behind energy efficiency behaviors and investment, future upgrade plans, and how well program activities are addressing their needs and the needs of their communities.

As EcoMetric collects more data from the key market actors, the process evaluation findings will be detailed in this paper and the eventual conference presentation.

Regional Cost Effectiveness Results

EcoMetric leverages the CE Tool to analyze the cost effectiveness of the IESO's DSM programs using the industry's common tests including Total Resource Cost (TRC), Program Administrator Cost (PAC), Societal Cost (SC), Ratepayer Impact Measure (RIM), and Participant Cost (PC) tests.

As shown in Table 8, the BizEnergySaver initiative of LIP is cost effective from the Program Administrator Cost (PAC) test perspective, while the CoolSaver initiative of LIP is not cost effective from the PAC test perspective, using a benefit/cost threshold of 1.0. For BizEnergySaver initiative, PAC benefits totaled $2,260,797, while costs totaled $1,125,332, and for Cool Saver initiative, PAC benefits totaled $8,195, while costs totaled $217,310. The levelized cost (LC) of electricity was $0.03/kWh for the BizEnergySaver initiative, and $3.39/kWh for the CoolSaver initiative.

The cost effectiveness of the CoolSaver initiative should increase in coming years, as more homeowners and tenants participate and contribute benefits from avoided energy and demand.

Table 8. PY2023 LIP Cost Effectiveness Results

Initiative	PAC Costs	PAC Benefits	PAC Ratio	LC ($/kWh)
BizEnergySaver	$1,125,332	$2,260,797	2.01	0.03
CoolSaver	$217,310	$8,195	0.04	3.39
Total	**$1,342,641**	**$2,268,992**	**1.69**	**0.03**

Future of LIP

LIP continues to evolve over time and additional programs may be considered depending on the needs of each region. This may include a variety of new technologies such as cold climate air source heat pumps, DR, DERs, and more.

As of Q1 2024, the IESO is working on launching a program to incentive solar photovoltaic (PV) measures in the Ottawa region. These measures will be for DERs for

businesses in Ottawa. The incentive is for the installation of large solar PV systems and is $860 per kW AC (minimum generation capacity of 50 kW and maximum incentive is capped at 1,000 kW). The solar systems are intended for load displacement so the size of the solar panel array cannot exceed the maximum load of the facility.

The IESO will look to implement a cold climate air source heat pump program for grid constrained regions in the coming months specifically for electrically heated homes with the potential expansion to oil heated homes. As energy efficiency continues to evolve, the IESO is committed to reducing greenhouse gas emissions by reducing metered energy consumption in the electricity grid. For the future of our local program initiatives, the IESO will continue to monitor grid constrained regions and potentially increase the number of additional programs in the coming years. Finally, as new technology continues to advance and become implemented in different sectors and facilities, the IESO will aim to adapt and improve our evaluation processes to adhere to DR, DER and beneficial electrification.

Lessons Learned

EcoMetric intends to complete its evaluation activities and generate early insights to update this paper and the conference presentation. The authors will leverage the results from EcoMetric's in-depth engineering reviews and interviews and surveys with key program actors to derive key insights into the successes and challenges of supporting market-driven DSM solutions tailored to geotargeted communities. By highlighting best practices that lead to the successes and providing actionable recommendations to address challenges, readers will have the resources they need to consider market-driven DSM solutions tailored to geotargeted communities in the jurisdictions they work in.

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