IMPACT AND PROCESS EVALUATION REPORT

INTERIM FRAMEWORK PROCESS & SYSTEMS UPGRADES PROGRAM PY2021

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Prepared for: Independent Electricity System Operator (IESO)

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E.1 PROGRAM DESCRIPTION

The Process & Systems Upgrades program (PSUP) provides financial support for implementing energy efficiency projects and system-optimization projects in intrinsically complex and capital-intensive facilities. In response to prior customer feedback, the IESO made several changes to the program in the Interim Framework (IF) to streamline and simplify the offering. Those changes include the following:

- The program application now contains a single point for customer sign-off.
- Incentives are now based on actual savings.
- The measurement and verification (M&V) period is shorter: one year for smaller projects and four years for larger projects.
- The total incentive available for the project includes engineering study funding (as opposed to full study funding as a separate incentive). Studies are still fully funded (50% upfront and 50% upon project application).

Furthermore, PSUP no longer incentivizes gas-driven Combined Heat and Power (CHP) following a Ministerial Directive in 2019.

E.2 EVALUATION GOALS AND OBJECTIVES

This report documents the impact and process evaluation results conducted for PSUP in Program Year (PY) 2021. PSUP provides incentives to industrial facilities to implement energy efficiency or system optimization projects that are complex and capital-intensive.

In April 2019, the IESO began to centrally deliver all energy efficiency programs in Ontario by implementing a new Interim Framework (IF) following a directive from the Ministry of Energy, Northern Development and Mines. The IF replaced the Conservation First Framework (CFF) with an updated Save on Energy Programs portfolio that was in effect from April 1, 2019, through December 31, 2020.

The goals of the PY2021 evaluation were to:

- Verify annual energy and summer peak demand savings.
- Assess program attribution (net-to-gross or NTG), including free-ridership.

- Conduct annual cost-effectiveness analyses and report on key indicators of cost-effectiveness, including the Total Resource Cost (TRC) test, Program Administrator Cost (PAC) test, and the Levelized Unit Energy Cost (LUEC) metric.
- Annually estimate the net greenhouse gas impacts in tonnes of CO_2 equivalent using the IESO's Cost-Effectiveness Tool.
- Estimate annual job impacts of the program.
- Monitor the overall effectiveness and comprehensiveness of key program elements.
- Analyze and make recommendations to improve the program.

E.3 EVALUATION RESULTS

This section summarizes the results of the PY2021 PSUP impact and process evaluation.

E.3.1 IMPACT EVALUATION RESULTS

The PY2021 PSUP gross verified savings results are summarized in Table 1 and Table 2. In total, 14 PSUP projects were evaluated and ready for reporting in the PY2021 evaluation frame. The total gross verified energy savings for PSUP in PY2021 are 15,901 MWh, including PY2020 and PY2019 true ups, representing 103% of reported savings. Total gross verified summer peak demand savings for PSUP are 1.30 MW, 149% of reported savings. Peak demand savings were not reported for projects that did not have data that spanned the summer period in their Q1 technical review reports. EcoMetric estimated summer peak demand savings for all projects.

Total net first-year energy savings for PSUP projects evaluated in PY2021 are 14,053 MWh, 88% of gross verified savings. Net demand savings for PSUP in PY2021 are 1.18 MW. Free-ridership was 12% for the program, and there was no spillover attributed to the program. One hundred percent of net verified energy savings persist through 2022.

Table 1: PY2020 PSUP Energy Savings Summary

Program Year	Projects Evaluated & Reported	Energy Realization Rate	Gross Verified Energy Savings (MWh)	NTG Ratio	Net Verified Energy Savings (MWh)	Net Verified 2022 Energy Savings (MWh)
2021	10	103%	11,575	87%	10,063	10,063
2020 True Ups	3	106%	3,207	100%	3,207	3,207
2019 True Ups	1	100%	1,119	70%	783	783
TOTAL	**14**	**103%**	**15,901**	**88%**	**14,053**	**14,053**

Table 2: PY2020 PSUP Summer Peak Demand Savings Summary

Program Year	Projects Evaluated & Reported	Demand Realization Rate	Gross Verified Summer Peak Demand Savings (MW)	NTG Ratio	Net Verified Summer Peak Demand Savings (MW)	Net Verified 2022 Summer Peak Demand Savings (MW)
2021	10	147%	0.81	90%	0.73	0.73
2020 True Ups	3	190%	0.36	100%	0.36	0.36
2019 True Ups	1	100%	0.13	70%	0.09	0.09
TOTAL	**14**	**149%**	**1.30**	**91%**	**1.18**	**1.18**

As shown in Table 3, PSUP is not cost effective from the TRC test perspective using a benefit/cost threshold of 1.0[1]. However, PSUP is cost effective from the PAC test perspective. The cost effectiveness of the program has improved significantly from PY2020, when fewer than 10% of projects approved in PSUP were completed and reported. The robust project pipeline for the program is expected to continue to improve the program's cost effectiveness throughout the remainder of the framework.

[1] PSUP cost effectiveness analysis for PY2021 only includes projects implemented in the calendar year 2021.

Table 3: PY2021 Cost Effectiveness Results

TRC Costs (CAD)	TRC Benefits (CAD)	TRC Ratio	PAC Costs (CAD)	PAC Benefits (CAD)	PAC Ratio	LC CAD/kWh
$6,683,095	$3,406,150	**0.51**	$2,052,723	$2,970,566	**1.45**	0.03

Over the lifetime of the PY2021 sample frame projects, including PY2019 and PY2020 true up projects, net GHG reductions totaled 18,024 tonnes of CO_2e.

E.4 KEY FINDINGS AND RECOMMENDATIONS

Finding 1: Peak demand reductions were not calculated by the technical reviewers in the Q1 Measurement and Verification (M&V) Reports for projects that did not have data from the summer. This affected eight out of 14 PSUP projects in the PY2021 sample frame. With no attempts at estimating reported summer peak demand savings, the technical reviews underestimate the total reported peak demand savings for the program by 0.36 MW, contributing to the realization rate of 149%.

As part of PSUP, projects are technically reviewed after one quarter of performance and then reviewed again after one year. In the Q1 M&V reports, the technical reviewers annualized energy savings for reporting. As designed in the evaluation, EcoMetric can begin to evaluate a PSUP project after its Q1 M&V Report. This is a common issue that EcoMetric has seen throughout the evaluation of PSUP in the IF. EcoMetric included a similar finding and recommendation in the PY2020 report, but the issue remains.

Recommendation 1a: The technical reviewer should always strive to calculate demand savings for the summer peak period defined by the IESO, regardless of the time of year from which the performance data comes. If there is no data from the peak summer period, various methods could be employed to estimate peak summer demand savings, including:

- Weather variable-based (i.e., outside air temperature) or production-based regression
- If the measure is not weather-dependent, assume the peak summer demand savings are the same as the peak demand savings from the period that the performance data comes from.

Recommendation 1b: The IESO should develop a peak demand calculation tool that leverages the hourly measurement and verification data required by the PSUP program. This tool would be used by both technical reviewers and applicants when calculating peak demand to ensure accurate and consistent estimates. The IESO's custom and formatted load profile macros in its Cost Effectiveness Tool could be leveraged to develop this tool. The macro leverages 8,760 annual hourly data to build custom load shapes for a facility or project that can be used to calculate savings in the summer and winter peak periods. Such a tool would be beneficial for industrial programs in the 2021-2024 CDM Framework, which focuses on achieving peak demand savings.

Additional project-specific findings and recommendations can be found in Appendix A.

1 INTRODUCTION

1.1 EVALUATION GOALS AND OBJECTIVES

The Independent Electricity System Operator (IESO) retained EcoMetric Consulting, LLC, to evaluate the 2019-2020 Interim Framework (IF) Industrial Programs administered in Ontario. The industrial programs incentivize equipment measures, engineering studies, and energy management services for commercial and industrial facilities in Ontario.

The goals of the PY2021 evaluation were to:

- Annually verify energy and summer peak demand savings.
- Assess program attribution (NTG), including free-ridership.
- Annually estimate the net greenhouse gas impacts in tonnes of CO_2 equivalent using IESO's Cost-Effectiveness Tool.
- Monitor the overall effectiveness and comprehensiveness of key program elements.
- Conduct annual cost-effectiveness analyses and report on key indicators of cost-effectiveness, including the Total Resource Cost (TRC) test, Program Administrator Cost (PAC) test, and the Levelized Unit Energy Cost (LUEC) metric.
- Estimate job impacts
- Analyze and make recommendations to improve the program.
- Determine customer satisfaction.

This report contains the findings from the impact and process evaluation conducted for the Process & Systems Upgrades program (PSUP) in Program Year (PY) 2021.

1.2 PROGRAM DESCRIPTION

PSUP provides financial support for implementing energy efficiency projects and system-optimization projects in intrinsically complex and capital-intensive facilities. In response to prior customer feedback, the IESO made several changes to the program in the IF to streamline and simplify the offering. Those changes include the following:

- The program application now contains a single point for customer sign-off.
- Incentives are now based on actual savings.
- The measurement and verification (M&V) period is shorter: one year for smaller projects and four years for larger projects.

- The total incentive available for the project includes engineering study funding (as opposed to full study funding as a separate incentive). Studies are still fully funded (50% upfront and 50% upon project application).

Furthermore, PSUP no longer incentivizes gas-driven Combined Heat and Power (CHP) following a Ministerial Directive in 2019.

2 METHODOLOGY

This section of the report outlines the methodologies used in the PY2021 evaluation of PSUP.

2.1 EVALUATION APPROACH

Methods used to conduct this evaluation include virtual inspections and measurement, engineering analysis, interval billing analysis, telephone surveys, documentation review, best practice review, and interviews with program participants and contractors. This section explains the evaluation approach in more detail, including the overall sample design and basic descriptions of the methods applied.

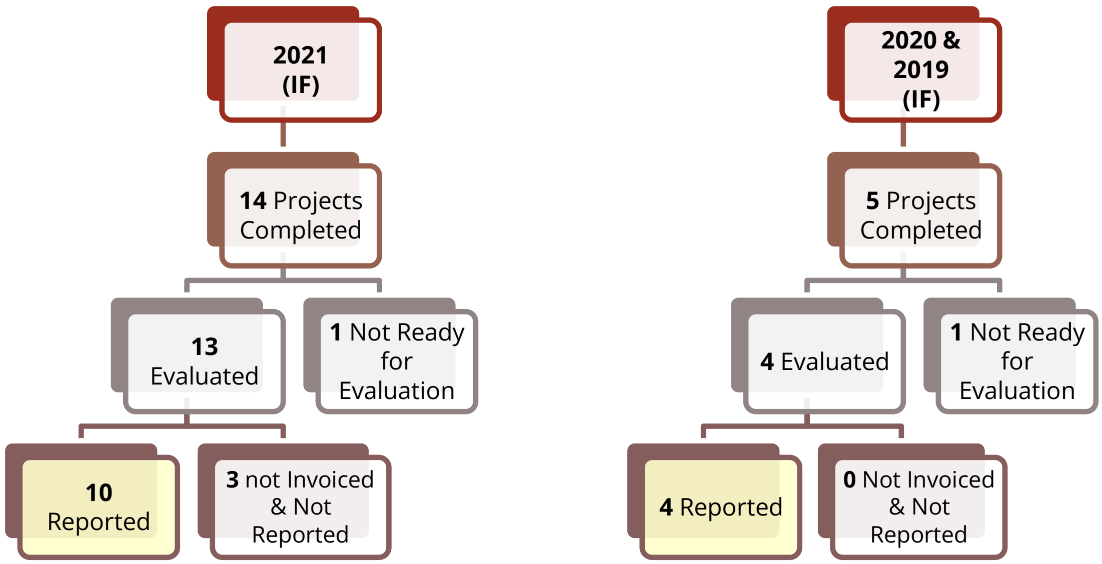
Fourteen industrial customers completed PSUP projects in PY2021. Thirteen of the six projects had undergone technical review and were ready for evaluation when the sample frame for this evaluation was established on April 1, 2022. Of these 14 projects, ten were invoiced to the IESO. Completing the invoicing process for a project is a requirement for savings to be reported. Another three projects from PY2020 were included in this year's sample frame. EcoMetric also included one project from PY2019 in this year's evaluation. This project began during the CFF but was transferred to the IF due to project delays.[2] These projects were not technically reviewed or invoiced in time for evaluation and reporting in the PY2019 and PY2020 evaluation reports.

The 14 projects from PY2019 – PY2021 evaluated and reported in this PY2021 evaluation report are collectively referred to as the PY2021 sample frame. EcoMetric will report projects completed and evaluated in the IF that have not yet been invoiced in the PY2022 results once invoiced. Figure 1 shows how the PSUP sample frame comprises projects from PY2019 – PY2021.

Measures evaluated and reported in the PY2021 PSUP sample frame include major upgrades to systems such as chillers, aeration blowers, fans, pumps, HVAC, and process-specific machinery.

[2] EcoMetric evaluated this project in PY2019, but an invoicing database error resulted in its exclusion from the PY2019 and PY2020 evaluation reports.

Figure 1: PY2021 PSUP Sample Frame



2.1.1 SAMPLING APPROACH

EcoMetric conducted a census review of all PSUP projects. This program warrants the census approach because of the relatively small number of projects, each with a high reported contribution to overall industrial portfolio savings.

2.2 IMPACT METHODOLOGY

2.2.1 DATA COLLECTION

The primary data source for PSUP projects was measurement and verification (M&V) reports, equipment logs, analysis workbooks, and other data and documentation submitted by the technical reviewer in support of reported savings estimates. EcoMetric carefully reviewed the application and annual and/or quarterly M&V reports prepared for each project and facility. Every project contained at least one-quarter of baseline operational data and one-quarter of post-retrofit operational data. This review of project documentation provided an initial understanding of the efficiency upgrades implemented and, just as importantly, how savings from these upgrades have been estimated.

2.2.2 GROSS SAVINGS VERIFICATION

A thorough review of the M&V completed by the IESO's technical reviewer enabled EcoMetric to assess the key assumptions and potential areas of uncertainty for each PSUP project. In the rare instances where assumptions were undocumented or appeared inconsistent, EcoMetric flagged them for further investigation. Similarly, if key parameters that would affect the observed savings of the project were not included in established savings estimates, EcoMetric gathered these values and incorporated them into the gross verified savings calculation.

For specific projects, further investigation involved a virtual onsite inspection. The virtual onsite inspections, which were deemed appropriate (as opposed to onsite inspections) due to COVID-19 restrictions, involved connecting with a facility representative via a video call application. The facility representative then walked around the facility in spaces affected by the energy efficiency project, holding a phone or tablet with the camera ON and facing forward. An EcoMetric member on the other end guided the facility representative to spaces and equipment of interest. Where relevant, screenshot images were captured.

EcoMetric performed energy and peak demand savings analyses for all projects. Energy savings were annualized, regardless of the time-of-year or duration of measured data available.

More detailed descriptions of the gross savings verification methodology are included in Appendix B.

2.2.3 NET SAVINGS ANALYSIS

Net savings and net-to-gross (NTG) ratios were calculated to incorporate free-ridership factors for the projects evaluated. NTG is the process of determining what portion of project savings is attributable to the influence of the IESO programs versus what the customer would have done in the absence of incentive programs. The calculation of NTG factors typically includes both free-ridership, defined as the savings customers would have achieved in the absence of the program's influence (commonly called the counterfactual condition), and spillover, defined as savings influenced by the program but not formally incentivized or claimed by the program.

The approach for PY2021 continued to utilize the enhancements made to the NTG questionnaire for the CFF evaluation. Results from the prior NTG spillover assessments from PY2013 through PY2019 sites did not identify any spillover attributable to any of the programs in the industrial portfolio, so the team did not assess participant spillover for PY2021. As in the past, the basis of free-ridership analysis for IESO's industrial programs was direct query (interviews with past participants) about the theoretical counterfactual condition. This method is considered best practice for programs with large savings per project, unique applications, and low participant counts.

A more detailed net savings analysis methodology is provided in Appendix B.

2.3 COST EFFECTIVENESS ANALYSIS

EcoMetric used the IESO Conservation and Demand Management (CDM) Cost-Effectiveness tool to estimate measure-level costs and benefits, then aggregated to program- and portfolio-level cost effectiveness. Program administrative costs were provided to EcoMetric by the IESO. Other key inputs for the cost effectiveness analysis include lifetime electric energy and demand savings, measure lives, energy savings load shapes, and incremental project costs.

EcoMetric states benefits and costs in present value terms, using the appropriate discount and inflation rates conforming to the IESO's requirements outlined in the IESO CDM Cost-Effectiveness Guide.

2.4 OTHER ENERGY EFFICIENCY BENEFITS

2.4.1 AVOIDED GREENHOUSE GAS EMISSIONS ESTIMATION

EcoMetric estimated net greenhouse gas (GHG) impacts for each project by utilizing measure-level energy savings load shapes based on metered data and emissions factors (EFs) provided by the IESO at the annual and hourly level and aggregated to the eight IESO peak periods as defined in the Conservation and Demand Management Energy Efficiency Cos- Effectiveness Tool.

2.4.2 JOB IMPACTS ESTIMATION

EcoMetric leveraged the Statistics Canada (StatCan) custom input/output (I/O) economic model to estimate the job impacts of PSUP. The StatCan I/O model simulates the economic and employment impacts of economic activity related to PSUP. The economic activity related to PSUP was leveraged as "shocks," which act as inputs into the model to show the direct, indirect, and induced impacts on the number of jobs created by the program. The I/O model uses regional and national multipliers to estimate the economy-wide effects of the economic activity induced by the program. The I/O model used three shocks to determine the job impacts of PSUP:

- Demand for goods and services related to PSUP
- Business reinvestment
- Program funding

EcoMetric and StatCan developed the shocks using the net verified savings for the sample frame summarized in Section 3.2. The output of the model expresses job impacts in "person-years"—representing a job for one person for one year.

3 IMPACT EVALUATION RESULTS

This section details the results from the impact evaluation of PSUP in PY2021.

3.1 GROSS VERIFIED SAVINGS RESULTS

The PY2021 PSUP gross verified savings results are summarized in Table 4. The total gross verified energy savings for PSUP in PY2021 are 11,575 MWh, representing 103% of reported savings. True up projects from PY2019 and PY2020 totaled 4,326 MWh of gross verified energy savings, representing 105% of reported savings. When combined, the total gross verified energy savings for PY2021 and true up projects are 15,901 MWh—103% of reported energy savings. Total gross verified summer peak demand savings for PSUP are 1.30 MW, representing 149% of reported demand savings.

Table 4: PY2021 PSUP Gross Verified Savings Results

Program Year	Projects Evaluated	Energy Realization Rate (%)	Gross Energy Savings (MWh)	Peak Demand Realization Rate (%)	Gross Summer Peak Demand Savings (MW)
2021	10	103%	11,575	147%	0.81
2020 True Ups	3	106%	3,207	190%	0.36
2019 True Ups	1	100%	1,119	100%	0.13
TOTAL	14	103%	15,901	149%	1.30

Project-level realization rates – the ratio of gross verified savings to reported savings - ranged between 91% and 162% for energy savings and 0% and 120% for peak demand savings.

Finding 1: Peak demand reductions were not calculated by the technical reviewers in the Q1 Measurement and Verification (M&V) Reports for projects that did not have data from the summer. This affected eight out of 14 PSUP projects in the PY2021 sample frame. With no attempts at estimating reported summer peak demand savings, the technical reviews underestimate the total reported peak demand savings for the program by 0.36 MW, contributing to the realization rate of 149%.

As part of PSUP, projects are technically reviewed after one-quarter of performance and then reviewed again after one year. In the Q1 M&V reports, the technical reviewers annualized energy savings for reporting. As designed in the evaluation, EcoMetric can begin to evaluate a PSUP project after its Q1 M&V Report. This is a common issue that EcoMetric has seen throughout the evaluation of PSUP in the IF. EcoMetric included a similar finding and recommendation in the PY2020 report, but the issue remains.

Recommendation 1a: The technical reviewer should always strive to calculate demand savings for the summer peak period defined by the IESO, regardless of the time of year that the performance data comes from. If there is no data from the peak summer period, various methods could be employed to estimate peak summer demand savings, including:

- Weather variable-based (i.e., outside air temperature) or production-based regression
- If the measure is not weather-dependent, assume the peak summer demand savings are the same as the peak demand savings from other periods.

Recommendation 1b: The IESO should develop a peak demand calculation tool that leverages the hourly measurement and verification data required by the PSUP program. This tool would be used by both technical reviewers and applicants when calculating peak demand to ensure accurate and consistent estimates. The IESO's custom and formatted load profile macros in its Cost Effectiveness Tool could be leveraged to develop this tool. The macro leverages 8,760 annual hourly data to build custom load shapes for a facility or project that can be used to calculate savings in the summer and winter peak periods. Such a tool would be beneficial for industrial programs in the 2021-2024 CDM Framework which focuses on achieving peak demand savings.

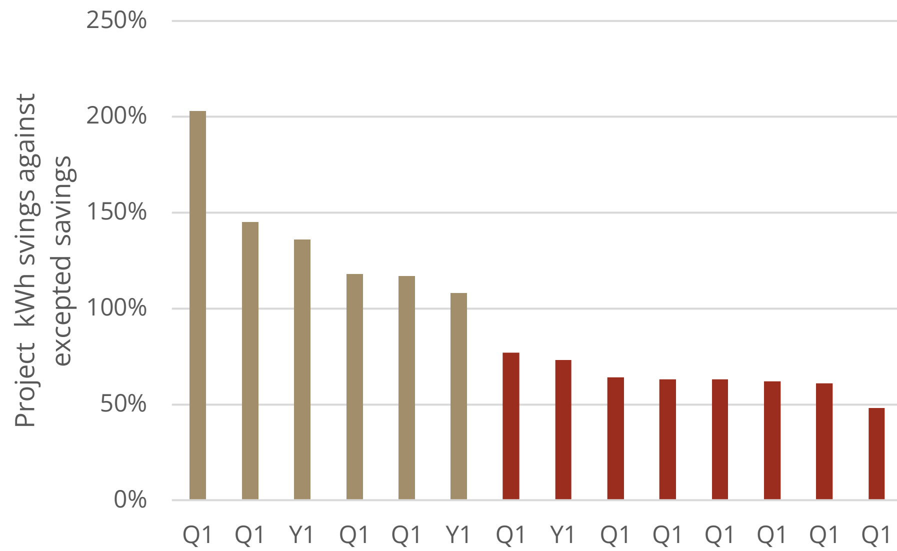
More detailed project-specific findings and recommendations are included in Appendix A.

3.1.1 PROJECT PERFORMANCE AGAINST ANTICIPATED SAVINGS

PSUP program rules specify that project incentives are recalculated following the project's actual performance after one year of M&V against anticipated savings calculated before the project is installed. As shown in Figure 2, six out of the fourteen PSUP projects evaluated exceeded their anticipated savings.

Seven of the eight PSUP projects that did not meet anticipated savings have not yet completed their first-year M&V technical review, so they still have an opportunity to improve savings and reach their first-year anticipated savings.

Figure 2: PSUP Savings Performance Results



The most common reason for projects to fail to meet expected savings was lower than expected run times of efficient equipment. The lower than expected run time reduced the opportunity for the efficient equipment to cumulate savings compared to the baseline. The opposite is true for projects that exceeded expectations. Overperformance was caused by the efficient equipment running more than expected. Future operations and equipment run time can be difficult to estimate in complex industrial facilities when calculating estimated savings. In the evaluation of these projects, EcoMetric did not find any of these operational differences rose to the level of a non-routine event (NRE) that required adjustments.

3.2 NET VERIFIED SAVINGS RESULTS

Total net first-year energy savings for PSUP projects evaluated in PY2021 are 14,053 MWh, 88% of gross verified savings, as summarized in Table 5. Net demand savings for PSUP in PY2021 are 1.18 MW. Free-ridership was 12% for the program, and there was no spillover attributed to the program. One hundred percent of net verified energy savings persist through 2022. The large, complex projects that PSUP incentives often have longer Effective Useful Lives (EULs). The average EUL of PSUP projects in the PY2021 sample frame was 12.1 years.

For the PY2021 sample frame, participants expressed favorable opinions of the PSUP program and indicated that the program provided needed support to enable them to implement their projects.

Table 5: PY2020 PSUP Net Verified Savings Results

Program Year	Projects Evaluated	NTG Ratio (%)[3]	Net Energy Savings (MWh)	Net 2022 Energy Savings (MWh)	Net Summer Peak Demand Savings (MW)	Net 2022 Summer Peak Demand Savings (MW)
2021	10	87%	10,063	10,063	0.73	0.73
2020 True Ups	3	100%	3,207	3,207	0.36	0.36
2019 True Ups	1	70%	783	783	0.09	0.09
Total	**14**	**88%**	**14,053**	**14,053**	**1.18**	**1.18**

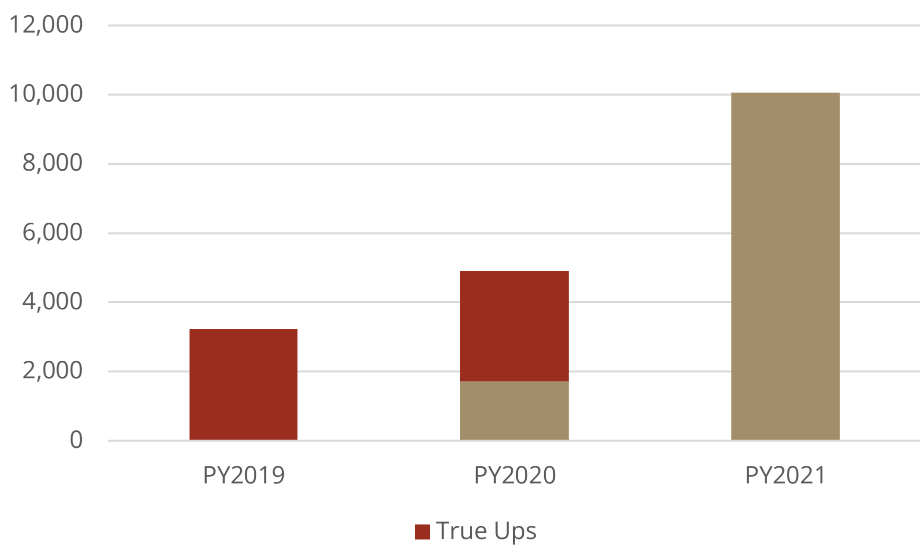
3.2.1 TOTAL IF PSUP NET SAVINGS

Figure 3 summarizes the net energy savings achieved in PSUP throughout the IF. Each year throughout the framework, net verified savings have increased for PSUP. EcoMetric expects this trend to continue as an increasing number of true up projects in the PSUP pipeline are completed and reported. As part of the Interim Framework, PSUP has achieved 18,215 MWh of net first-year energy savings, representing 82% of gross verified energy savings. One hundred percent of these savings persist through 2022.

In PY2019, PSUP achieved 3,233 net kWh, increasing to 4,919 MWh in PY2020. As thirteen more projects were completed in PY2021, PSUP net savings increased to 10,063 MWh—the highest annual savings for PSUP in the IF.

[3] NTG Ratios in this table are illustrative only, representing total net verified savings divided by total gross verified savings for each program year. EcoMetric applied a unique NTG ratio to each individual project, calculated from our primary NTG research.

Figure 3: Total IF PSUP Net Verified First Year Energy Savings (MWh)



4 COST EFFECTIVENESS EVALUATION

As shown in Table 6, PSUP is not cost effective from the TRC test perspective using a benefit/cost threshold of 1.0[4]. However, PSUP is cost effective from the PAC test perspective. The cost effectiveness of the program has improved significantly from PY2020, when fewer than 10% of projects approved in PSUP were completed and reported. The robust project pipeline for the program is expected to continue to improve the program's cost effectiveness throughout the remainder of the framework.

Table 6: PY2021 PSUP Cost Effectiveness Results

TRC Costs (CAD)	TRC Benefits (CAD)	TRC Ratio	PAC Costs (CAD)	PAC Benefits (CAD)	PAC Ratio	LC CAD/kWh
$6,683,095	$3,406,150	**0.51**	$2,052,723	$2,970,566	**1.45**	0.03

Finding 2: As each year of the IF PSUP evaluation progresses, the program’s cost effectiveness has improved. This is due to more projects in the pipeline being completed and generating substantial benefits from avoided energy and demand. Administrative costs and project delays from the transition from CFF to IF negatively affected cost effectiveness, results in the early evaluation of the program in the IF.

Recommendation 2: While it is important to track programs’ cost effectiveness each year when new projects and costs are available, the most complete assessment of cost effectiveness for PSUP is a cumulative evaluation that compares the costs incurred and benefits incentivized by the program throughout the entire framework. EcoMetric recommends that the cumulative evaluation be used to measure the cost effectiveness of PSUP.

[4] PSUP cost effectiveness analysis for PY2021 only includes projects implemented in the calendar year 2021.

5 OTHER ENERGY EFFICIENCY BENEFITS

The projects and savings incentivized by PSUP have benefits that go beyond kWh and peak kW savings, including but not limited to greenhouse gas emissions reductions and economic impacts such as job creation. This section summarizes those other energy efficiency benefits.

5.1 AVOIDED GREENHOUSE GAS EMISSIONS

Net first-year greenhouse gas (GHG) reductions total 1,591 metric tonnes of CO_2 equivalent (CO_2e) for the PY2021 sample frame, as summarized in Table 7. As PSUP projects focus on electric savings, these GHG reductions are derived from the avoided generation of electricity. Over the lifetime of the PY2021 sample frame projects, net GHG reductions total 20,024 tonnes of CO_2e.

For the PY2021 sample frame, the cost of first-year GHG emissions reductions is $5,120 per tonne of CO_2e from the total resource cost perspective. Reduction costs were much improved compared to the PY2020 PSUP projects due to the higher NTG ratio in PY2021, which increased the amount of net reductions compared to full total resource costs.

Table 7: PY2021 PSUP Greenhouse Gas Emissions Impacts

Program Year	First Year GHG Impacts (tonnes CO_2e)	First Year GHG Reduction Costs ($/tonne CO_2e) (Total Resource Costs)
2021	1,149	$5,816
2020 True Ups	341	$2,460
2019 True Ups	101	$6,220
Total	**1,591**	**$5,120**

Finding 3: Considering the size of the projects and their savings, PSUP has major potential to achieve GHG reductions through reduced electric energy use and summer peak demand reductions. However, GHG impacts are only calculated by the evaluation contractor well after project commissioning and performance. Many of the industrial participants in PSUP have decarbonization goals and requirements.

Recommendation 3: Provide PSUP participants with an emissions tool to calculate their reduction of greenhouse gas emissions associated with the purchase of electricity.[5] For simple emissions reductions calculations based on annual kWh and peak kW savings, the GHG module of the IESO CE Tool would be a good framework to leverage for the tool.

5.2 JOB IMPACTS SUMMARY RESULTS

As summarized in Table 8, PSUP projects in the PY2021 sample frame created an estimated 93 jobs. Of these 93 jobs, 54 were direct jobs, 12 were indirect jobs, and 27 were induced jobs. Nearly all the jobs created by the program were local, with 86 of the 93 total jobs created in Ontario. In terms of full-time equivalents (FTEs), PSUP created an estimated 86 total jobs.

Jobs and FTEs are expressed in person-years, meaning each job or FTE represents one job for one person for one year.

Direct jobs include all jobs created by PSUP activity, such as administrative jobs, contractors hired to complete projects, engineers, and inspectors, among many others. Indirect jobs include the additional jobs created from economic activity related to PSUP participation, such as equipment and supply distribution centers, delivery drivers, and manufacturing, among many others. Induced jobs include the jobs supported by the "ripple effects" of economic activity from PSUP participation (i.e., the re-spending of income and benefits resulting from PSUP activity).

[5] Emissions associated with the purchase of electricity are commonly referred to as Scope 2 emissions.

Table 8: PY2021 PSUP Job Impacts

Job Impact Type	Ontario FTE	Canada Total FTE	Ontario Jobs	Canada Total Jobs
PY2021				
Direct	44	45	45	46
Indirect	8	11	9	12
Induced	14	17	20	23
PY2021 Total	**66**	**73**	**74**	**81**
PY2020 True Ups				
Direct	6	7	6	6
Indirect	0	0	0	0
Induced	2	3	3	3
PY2020 Total	**8**	**10**	**9**	**9**
PY2019 True Ups				
Direct	2	2	2	2
Indirect	0	0	0	0
Induced	1	1	1	1
PY2019 Total	**3**	**3**	**3**	**3**
Grand Total	**77**	**86**	**86**	**93**

Including true up projects from PY2019 and PY2020, PSUP in PY2021 created 93 jobs throughout Canada. Direct jobs in Ontario's construction and engineering industry accounted for 54 of these jobs.

Table 9 summarizes the cumulative job impacts of PSUP in the IF, including the job impacts from the PY2020 evaluation that covered PY2019 and PY2020. In total, PSUP in the IF has created 117 jobs across Canada, 108 of which are in Ontario.

Table 9: Cumulative IF PSUP Job Impacts

Program Year	Ontario FTE	Canada Total FTE	Ontario Jobs	Canada Total Jobs
PY2021	66	73	74	81
PY2020	23	27	25	26
PY2019	10	9	9	10
Grand Total	**99**	**109**	**108**	**117**

5.2.1 PSUP JOB IMPACTS BY INDUSTRY

Table 10 summarizes the job impacts by the industry for PSUP in PY2021. As PSUP targets the industrial sector, the top three industries where the program created jobs were: engineering construction, wholesale trade, and manufacturing. Due to the size and complex nature of the projects implemented in PSUP, over half of the jobs created by the program were in engineering construction in Ontario. PSUP also created jobs in wholesale and retail trade, finance, insurance, real estate, transportation, warehousing, administrative, and waste management. The program funding shock, represented by the portion of PSUP funding covered by Ontario's residential sector, resulted in job losses in services sector. These are some of the largest industries in the province in terms of the number of workers, so the program funding shock impacted them the most. Moreover, the industrial focus of the PSUP program resulted in very little job creation for this sector.

Table 10: PSUP Job Impacts by Industry

Industry	Ontario FTE	Canada Total FTE	Ontario Jobs	Canada Total Jobs
Engineering construction	49	50	54	52
Wholesale trade	8	8	8	9
Manufacturing	5	6	6	8
Retail trade	5	7	5	5
Professional, scientific and technical services	4	4	3	4
Transportation and warehousing	2	2	2	3
Finance, insurance, real estate, rental and leasing and holding companies	1	2	2	2
Accommodation and food services	-1	1	1	2
Repair construction	1	2	1	2
Government education services	1	1	1	2
Administrative and support, waste management and remediation services	0	1	0	1
Information and cultural industries	1	1	1	1
Health care and social assistance	1	1	1	1
Arts, entertainment and recreation	1	1	1	1
Other services (except public administration)	-1	-1	0	0
Total	**77**	**86**	**86**	**93**

5.2.2 PSUP JOB IMPACTS BY MODEL SHOCK

As described in Section 2.4.2, job impacts of PSUP were estimated leveraging three shocks in the StatCan I/O model: demand for goods and services related to PSUP, business reinvestment, and program funding. The shock that resulted in the largest number of jobs created was the demand for goods and services associated with PSUP. As summarized in Table 11, the demand shock resulted in 85 jobs created in Ontario and 91 total jobs throughout Canada. The majority of these jobs are direct job impacts in Ontario, primarily representing construction and engineering jobs created to complete the complex industrial projects the PSUP incentivizes. The complex value chain of equipment and relatively high incremental cost of these complex projects also resulted in 38 indirect and induced jobs created throughout Canada.

Table 11: PSUP Job Impacts from Demand for Goods and Services Shock

Job Impact Type	Ontario FTE	Canada Total FTE	Ontario Jobs	Canada Total Jobs
Direct	52	52	53	53
Indirect	9	11	9	12
Induced	17	20	23	26
Total	**78**	**83**	**85**	**91**

The job impacts of the business reinvestment shock are summarized in Table 12. This shock represents the amount of bill savings the participating organizations reinvest in their company to spur further economic activity. The business reinvestment shock resulted in one total job being created.

In the process and NTG interviews with PSUP participants, EcoMetric asked participants directly what percentage of bill savings they planned to reinvest. EcoMetric then applied this percentage to each participant's bill savings calculated based on net energy savings multiplied by IESO's retail electricity rate. Overall, the rate of reinvestment averaged 98%, with most organizations claiming they planned on reinvesting 100% of their bill savings from the projects. This represents a sign of improvement in the investment environment coming out of the COVID-19 pandemic, as the average reinvestment rate from the PY2020 PSUP evaluation was just 60%.

Table 12: PSUP Job Impacts from Business Reinvestment Shock

Job Impact Type	Ontario FTE	Canada Total FTE	Ontario Jobs	Canada Total Jobs
Direct	5	5	5	6
Indirect	2	2	2	3
Induced	2	2	2	3
Total	**9**	**9**	**9**	**12**

The final shock, program funding represents the increase in Ontario residents' hydro bills from funding PSUP. The IESO estimates that 35% of the portfolio's funding is supplied by the residential sector. EcoMetric applied this 35% to the total $4.9M PSUP budget across PY2019 to PY2021, resulting in a shock of $1.7M. As this shock represents less money available to the residential sector for spending throughout the economy, the job impacts are negative.

The job impacts of the program funding shock are summarized in Table 13. Overall, the program funding shock resulted in -10 total jobs across Canada. These estimated job losses occurred in the largest industries in terms of employment, including accommodation and food services, retail trade, transportation and warehousing, and other services. Compared to the jobs created by PSUP through the demand shock, the jobs eliminated through program funding are relatively minor. In fact, per $1M in program funding, PSUP created 18 net FTEs throughout Canada.

Table 13: PSUP Job Impacts from Program Funding Shock

Job Impact Type	Ontario FTE	Canada Total FTE	Ontario Jobs	Canada Total Jobs
Direct	-4	-4	-5	-5
Indirect	-2	-2	-2	-3
Induced	-1	-1	-1	-2
Total	**-7**	**-7**	**-8**	**-10**

6 FINDINGS AND RECOMMENDATIONS

Table 14 presents the conclusions and recommendations from the PY2021 evaluation findings for PSUP.

Since the first evaluation of PSUP in the IF in PY2019, EcoMetric has seen the project documentation provided by the technical reviewers improve, allowing for the evaluation team to better determine how reported savings were calculated and the drivers of realization rates for specific projects. The IESO worked with its technical reviewers to ensure that the project documentation provided to EcoMetric was sufficient to verify savings. In the PY2021 evaluation, EcoMetric saw the results of this effort through improved documentation and explanation of the reported savings calculations methodology.

The key findings and recommendations from the impact evaluation of PSUP in PY2021 mainly involve reported summer peak demand savings. In the PY2020 evaluation report, EcoMetric had similar findings and recommendations regarding the lack of summer peak demand estimates by technical reviewers in PSUP projects' Q1 M&V Reports. As noted in Finding and Recommendation 1, this problem persists in PY2021, with eight of the 14 PSUP projects in the sample frame having no reported summer peak demand savings calculated. Following the PY2020 report, the IESO noted that the IF version of PSUP was focused on energy (kWh) savings and that improving documentation and calculations of reported peak demand will grow in importance for the demand-focused 2021-2024 CDM Framework. EcoMetric agrees with the IESO's assessment. Recommendations 1 and 2 should be applied to any industrial offerings in the 2021-2024 CDM Framework to ensure accurate reported peak demand calculations.

On the energy (kWh) savings side, the calculations for reported savings were generally accurate and well documented, resulting in the overall energy realization rate of 103%. Some key project-specific findings and recommendations are included in Appendix A to help improve savings calculations in future industrial offerings.

Table 14: PSUP Evaluation Findings and Recommendations

Findings and Conclusions		Recommendations	
PSUP Impact Evaluation Results (Section 3)			
1	Peak demand reductions were not calculated by the technical reviewers in the Q1 Measurement and Verification (M&V) Reports for projects that did not have data from the summer. This affected eight out of 14 PSUP projects in the PY2021 sample frame. With no attempts at estimating reported summer peak demand savings, the technical reviews underestimate the total reported peak demand savings for the program by 0.36 MW, contributing to the realization rate of 149%. As part of PSUP, projects are technically reviewed after one quarter of performance and then reviewed again after one year. In the Q1 M&V reports, the technical reviewers annualized energy savings for reporting. As designed in the evaluation, EcoMetric can begin to evaluate a PSUP project after its Q1 M&V Report. This is a common issue that EcoMetric has seen throughout the evaluation of PSUP in the IF. EcoMetric included a similar finding and recommendation in the PY2020 report, but the issue remains.	1a	The technical reviewer should always strive to calculate demand savings for the summer peak period defined by the IESO, regardless of the time of year from which the performance data comes. If there is no data from the peak summer period, various methods could be employed to estimate peak summer demand savings, including: - Weather variable-based (i.e., outside air temperature) or production-based regression - If the measure is not weather-dependent, assume the peak summer demand savings are the same as the peak demand savings from the period that the performance data comes from.

	Findings and Conclusions		Recommendations
	See Finding 1	1b	The IESO should develop a peak demand calculation tool that leverages the hourly measurement and verification data required by the PSUP program. This tool would be used by both technical reviewers and applicants when calculating peak demand to ensure accurate and consistent estimates. The IESO's custom and formatted load profile macros in its Cost Effectiveness Tool could be leveraged to develop this tool. The macro leverages 8,760 annual hourly data to build custom load shapes for a facility or project that can be used to calculate savings in the summer and winter peak periods. Such a tool would be beneficial for industrial programs in the 2021-2024 CDM Framework, which focuses on achieving peak demand savings.
	PSUP Cost Effectiveness Evaluation Results (Section 4)		
2	As each year of the IF PSUP evaluation progresses, the program's cost effectiveness has improved. This is due to more projects in the pipeline being completed and generating substantial benefits from avoided energy and demand. Administrative costs and project delays from the transition from CFF to IF negatively affected cost effectiveness, results in the early evaluation of the program in the IF.	2	While it is important to track programs' cost effectiveness each year when new projects and costs are available, the most effective cost-effectiveness evaluation for PSUP is a cumulative evaluation that compares the costs incurred and benefits incentivized by the program throughout the entire framework. EcoMetric recommends that the cumulative evaluation be used to measure the cost effectiveness of PSUP.
	PSUP Other Energy Efficiency Benefits (Section 5)		
3	Considering the size of the projects and their savings, PSUP has major potential to achieve GHG reductions through reduced electric energy use and summer peak demand reductions. However, GHG impacts are only calculated by the evaluation contractor well after project commissioning and performance. Many of the industrial participants in PSUP have decarbonization goals and requirements.	3	Provide PSUP participants with an emissions tool to calculate their reduction of greenhouse gas emissions associated with the purchase of electricity. For simple emissions reductions calculations based on annual kWh and peak kW savings, the GHG module of the IESO CE Tool would be a good framework to leverage for the tool.

Findings and Conclusions		Recommendations	
	Project-Specific (Appendix A)		
A1	Reported savings calculations for an optimization project included a major non-routine adjustment to account for 121 days of shutdown due to COVID-19. EcoMetric leveraged a full production calendar from 2018 (pre-pandemic) to develop the production, non-production, and shutdown days from a typical year of operations while also using the measured data from the reporting period. Using the 2018 schedule resulted in higher savings as the exclusion of the 121 days of shutdown resulted in an underestimation of annual savings.	A1	If available, use operations schedules and data from a typical, pre-pandemic year to estimate savings for a COVID-impacted facility as opposed to employing a major non-routine adjustment.
A2	Reported peak summer demand savings for two projects were calculated by averaging the kW savings that occurred during peak hours in the Q1 reporting period, which were a small number of hours. EcoMetric calculated peak summer demand savings by extrapolating average demand by the hour and day of the week during the Q1 reporting period to a full year and taking the average kW savings over the peak period.	A2	To calculate peak demand, use an hourly 8,760 load shape analysis. If a full year of baseline data (8,760 hours) is not available, extrapolate the existing data to model a full year.
A3	The reported baseline calculated for two projects underestimated baseline energy consumption for a hydraulic injection molding machine being replaced in each by only considering the unit's production up-time (85%) instead of the total hours of operation (98%). The hydraulic equipment draws substantial power even when production is not occurring (i.e., during idle periods). The energy savings analysis for this project is based on the average power of the baseline system, which includes both production and idle periods, so the hours of use should include both periods.	A3	When calculating baseline energy consumption, consider all hours of operation. This reflects the true consumption of the baseline equipment or system.

Appendix A Key Project Specific Findings and Recommendations

This appendix includes key project-specific findings and recommendations from the PY2021 impact evaluation.

Finding A1: Reported savings calculations for an optimization project included a major non-routine adjustment to account for 121 days of shutdown due to COVID-19. EcoMetric leveraged a full production calendar from 2018 (pre-pandemic) to develop the production, non-production, and shutdown days from a typical year of operations while also using the measured data from the reporting period. Using the 2018 schedule resulted in higher savings as the exclusion of the 121 days of shutdown resulted in an underestimation of annual savings.

Recommendation A1: If available, use operations schedules and data from a typical, pre-pandemic year to estimate savings for a COVID-impacted facility as opposed to employing a major non-routine adjustment.

Finding A2: Reported peak summer demand savings for two projects were calculated by averaging the kW savings that occurred during peak hours in the Q1 reporting period, which were a small number of hours. EcoMetric calculated peak summer demand savings by extrapolating average demand by the hour and day of the week during the Q1 reporting period to a full year and taking the average kW savings over the peak period.

Recommendation A2: To calculate peak demand, use an hourly 8,760 load shape analysis. If a full year of baseline data (8,760 hours) is not available, extrapolate the existing data to model a full year.

Finding A3: The reported baseline calculated for two projects underestimated baseline energy consumption for a hydraulic injection molding machine being replaced in each by only considering the unit's production up-time (85%) instead of the total hours of operation (98%). The hydraulic equipment draws substantial power even when production is not occurring (i.e., during idle periods). The energy savings analysis for this project is based on the average power of the baseline system, which includes both production and idle periods, so the hours of use should include both periods as well.

Recommendation A3: When calculating baseline energy consumption, consider all hours of operation. This reflects the true consumption of the baseline equipment or system.

Appendix B Select Methodology Details

B.1 GROSS SAVINGS ANALYSIS

B.1.1 Data Sources

Table 15 contains a list of the data sources used for verifying gross savings.

Table 15: Data & Information Sources Used for Impact Evaluation

Item	Description	Source
Reported participation & savings	Savings by program, project, & measure	Technical Reviewer
Participant contact information	For project-specific interviews and site visit coordination	Technical Reviewer & IESO
Project files	Including M&V data & documentation	Technical Reviewer & IESO
Reporting template(s)	For impact reporting	IESO
Cost-effectiveness parameters	Avoided costs, admin costs, discount rate	IESO

EcoMetric used several distinct data-collection techniques to fulfill evaluation objectives, explained below.

B.1.2 Gross Savings Verification Methods

Project Documentation Review

Project documentation was provided mainly by the IESO's technical reviewer, and in some cases, by the customer or IESO program staff. Project files utilized for the review and analysis include project incentive applications, engineering workbooks, equipment cut sheets, invoices, email exchanges, technical drawings, M&V plans and reports, and digital photos.

Project Audits

Project audits verify the accuracy of savings calculations, assumptions, and M&V conducted by the technical reviewer, contractors, customers, and any other parties involved in the application, implementation, and technical review process. EcoMetric performed audits for each project in the sample, utilizing technology-specific methods and tools and testing the calculations and assumptions used to estimate reported savings for each project.

Level 1 audits consist of a desk review of project documentation and supporting calculations, including applications, savings worksheets, M&V plans, M&V reports, engineering studies, metered data, invoices, and any other documents made available.

Level 2 audits expand upon the work conducted in the Level 1 audits and as stated above, in many cases, include a virtual review of the equipment installation and operating parameters.

Data collected from the Level 1 and Level 2 audit activities enabled EcoMetric to verify energy and demand savings for each PSUP project.

Ratios of gross verified to reported savings are realization rates. EcoMetric analyzed a census of PSUP projects in PY2020, resulting in a unique realization rate, or adjustment factor, for each project. In these cases, program-level realization rates are equal to total verified savings divided by total reported savings. Program-level realization rates can be found in detail in Section 3.1.

B.1.3 Summer Peak Demand Analysis

EcoMetric verified summer coincident peak demand impacts for each project based on the IESO-defined peak periods summarized in Table 16. High-resolution energy savings load shapes, vital for calculating on-peak demand savings, were developed for each project where possible and used to account for the seasonal, daily, and hourly variations in operating schedules and energy consumption.

Table 16: IESO EM&V Protocol Peak Period Definitions

Definition Source	Months	Days and Hours	Calculation of Demand Savings
EM&V Protocols: Standard Peak Calculation	Summer: Jun-Aug	Weekdays 1pm-7pm	Average over entire peak period
EM&V Protocols: Standard Peak Calculation	Winter: Jan-Dec	Weekdays 6pm-8pm	Average over entire peak period
EM&V Protocols: Alternative Peak Protocols for Weather-Dependent Measures	Summer: Jun-Aug	Weekdays 1pm-7pm	Weighted average of the top hour in each of 3 months per IESO weights
EM&V Protocols: Alternative Peak Protocols for Weather-Dependent Measures	Winter: Jan-Dec	Weekdays 6pm-8pm	Weighted average of the top hour in each of 3 months per IESO weights

B.2 NET SAVINGS ANALYSIS

B.2.1 Net Savings Data Collection

For PY2021 projects, EcoMetric implemented the NTG questionnaire originally developed for the Conservation First Framework to provide consistency in the evaluation approach across program frameworks. The traditional free-ridership approach first establishes a gross baseline (e.g., industry standard practice) and conducts a free-ridership interview to determine the degree of influence the program had in moving the customers from the gross baseline to the high-efficiency alternative that was installed. This is an excellent approach for straightforward measures, for those with only two efficiency options available (the binary choice of the high or low-efficiency options), and when the questionnaire must be written to cover diverse technologies. All measures in the IESO program fit this approach.

The primary data collection method for NTG data was through in-depth self-report interviews. This approach was consistent with the CFF approach and is allowed by the IESO's Evaluation, Measurement, and Verification Protocol v4.0. The general NTG process is as follows:

- The NTG surveys addressed the free-ridership component of net savings analysis, calculating both a direct free-ridership score and an indirect score that incorporates questions about program influence and any other factors that possibly influenced the decision to implement the project. Spillover was not assessed during the PY2021 evaluation.
- Prior to the roll-out of the NTG survey instruments, EcoMetric conducted training exercises to ensure that the team had the appropriate training and expertise to conduct the interviews. This included a refresher session on interviewing tone, follow-up questions, time management, avoiding leading questions, and pre-tests of interview scripts and pilot testing with initial recruited participants.
- EcoMetric takes considerable steps to ensure that interviews are conducted with the primary decision-maker(s) involved in the decision-making, or at the very least, aware of the decision-making criteria for the project. EcoMetric works with the IESO to identify the primary decision-makers for each project by first reviewing the project files and customer contact information.
- Once likely decision-makers are identified, the IESO sends personalized recruitment emails to these contacts, notifying them of the upcoming interview. EcoMetric then contacts the customers directly, screening them prior to starting the interview to confirm that they were the decision-maker or involved/aware of the decision-making process. EcoMetric leverages a combination of email and phone messages to customers at different times of day and week and logs each contact attempt (time, date, target, result) in a contact tracking system.

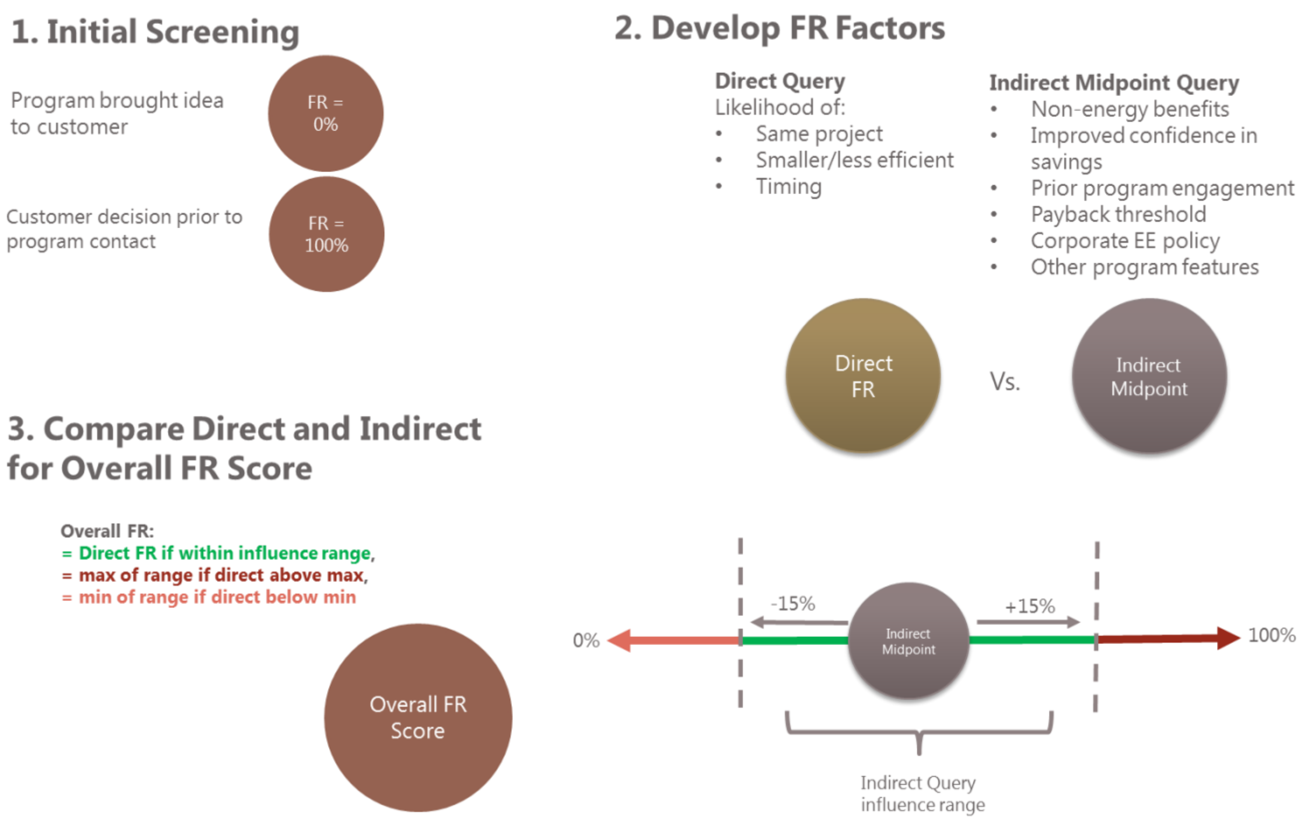
EcoMetric worked with the IESO to conduct another contact attempt for any sites that were not responsive to initial recruitment efforts.

- In preparation for the interviews, the EcoMetric staff reviewed the project files for each customer to understand the projects completed, timelines, and any other unique characteristics of each customer. For customers that implemented multiple projects during the study year, EcoMetric investigated the two projects with the largest electricity savings to capture the most savings without creating an excessive burden on the interviewee.
- After completing each interview, the interviewer reviewed and clarified notes and submitted the interview results for quality control (QC). During the QC, results were reviewed for completeness and consistency.

B.2.2 Net Savings Data Analysis

The collected free-ridership data was analyzed first by computing a direct query-based free-ridership from responses on the likelihood of implementing the project absent the program, and likely size, efficiency, and timing of implementation. After estimating free-ridership using this direct method, EcoMetric analysts calculated a probable free-ridership range based on a series of questions about program influence and other factors that possibly influenced the decision to implement the project. The final project free-ridership was then computed by considering the direct query and the range. Figure 4 presents a graphical representation of the calculation approach.

Figure 4: Free-ridership Methodology



EcoMetric computed the free-rider (FR) factors to estimate net savings as shown in the following formula:

*Net savings = verified gross savings * (1 – FR)*

For example, an individual project with 1,000,000 kWh/year of tracking savings, a 95% realization rate, and 10% free-ridership would have verified gross savings of 950,000 kWh/year, an NTG ratio of 0.90 (1-FR = 1 - 0.10), and verified net savings of 855,000 kWh/yr.

B.3 COST EFFECTIVENESS ASSUMPTIONS

- Project costs and benefits are included for projects in-service starting in 2021 and included in PY2021 verified impact results.
- Engineering study costs are included for all 2021 studies listed in the IF I&A Database.
- Engineering Study costs are the sum of “Project Incentive ($)” from the IF I&A Database where Program equals Process & Systems Upgrades and IESO Reporting Period equals 2021.
- Program admin costs (CE Tool Budget Inputs) were provided by the IESO Evaluation Team for PY2021.

- EcoMetric sourced PSUP incremental project costs from technical reviewer's M&V reports and verified costs using supporting project documentation when available.
- Per-unit incentive amounts are the actual incentive amounts paid for each project in the IF I&A Database. Each project is entered as a custom measure in the CE tool; therefore, each measured quantity is equal to 1, and the incentive is only included once.
- EcoMetric developed and utilized custom measure-specific load shapes for PSUP cost effectiveness analysis to improve the accuracy of the avoided cost calculations.

B.4 JOB IMPACTS METHODOLOGY

EcoMetric leveraged the StatCan custom input/output (I/O) economic model to estimate the job impacts of PSUP. The StatCan I/O model simulates the economic and employment impacts of economic activity related to the program. The economic activity related to PSUP was leveraged as "shocks", which act as inputs into the model to show the direct, indirect, and induced impacts on the number of jobs created by the program. The I/O model uses regional and national multipliers to estimate the economy-wide effects of the economic activity induced by the program. The I/O model used three shocks to determine the job impacts of PSUP:

- Demand for goods and services related to the program
- Business reinvestment
- Program funding

The demand for goods and services related to PSUP shock represents the spending on goods and services to participate in the program. This includes spending on capital measures, hiring contractors and consultants, all labor costs related to program participation, and the administrative costs for the IESO. EcoMetric derived the value of this shock from the estimated project costs for each project.

The business reinvestment shock represents the amount of savings from reduced energy bills that the participants reinvest in the local economy. The portion of project costs not covered by IESO incentives was deducted from the total bill savings for each facility. EcoMetric calculated the energy bill savings using the net energy savings from the impact evaluation and the IESO's electricity retail rates. As for the amount of reinvestment, the team collected primary data from the participants through the process and NTG interviews. EcoMetric asked participants what percentage of their bill savings they plan on reinvesting.

Finally, the program funding shock represents the incremental increase in electricity bills in Ontario's residential sector used to fund the program. EcoMetric sourced the PSUP program budget data from the IESO and the assumption of the share of the residential sector's funding portion of the program.

The I/O model generates three types of job impacts: direct, indirect, and induced. Direct jobs include all jobs created by PSUP activity, such as administrative jobs, contractors hired to complete projects, engineers, and inspectors, among many others. Indirect jobs include the additional jobs created from economic activity related to PSUP participation, such as equipment and supply distribution centers, delivery drivers, and manufacturing, among many others. Induced jobs include the jobs supported by the "ripple effects" of economic activity from PSUP participation (i.e., the re-spending of income and benefits resulting from PSUP activity).

The model outputs job impacts in the total number of jobs and full-time equivalent (FTE). The total number of jobs does not take into account the number of hours worked. Total jobs are represented by full-time, part-time, and temporary jobs. FTEs, on the other hand, are total jobs converted to represent only full-time jobs. This is determined by the average full-time hours worked in the business or government sectors. Both total jobs and FTEs are measured in person-years, meaning one job for one person for one year.