Interim Framework: First Nations Conservation Program Evaluation Report

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SUBMITTED TO:
Independent Electricity System Operator

SUBMITTED BY:
NMR Group, Inc. in partnership with Resource Innovations, Inc.

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Acknowledgements

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Acronyms

Acronym	Definition
AC	Air Conditioner
AFT	Affordability Fund Trust
AV	Audiovisual
CDM	Conservation and Demand Management
CE Tool	Cost-Effectiveness Tool
CEF	Combined Energy Factor
CF	Correction Factor
CFF	Conservation First Framework
CI	Confidence Interval
DHW	Domestic Hot Water
DSM	Demand Side Management
EM&V	Evaluation Measurement and Verification
ES QPL	ENERGY STAR Qualified Product List
EUL	Effective Useful Life
FAST	Field Audit Support Tool
FNCP	First Nations Conservation Program
FTE	Full-time equivalent
HOU	Hours of Use
IDI	In-depth Interview
IESO	Independent Electricity System Operator
IF	Interim Framework
IO	Input-Output
ISR	In-Service Rate
kW	Kilowatt
kWh	Kilowatt-hours
LDC	Local Distribution Company
LEAP	Low-Income Energy Assistance Program
LED	Light-emitting Diode
LPM	Liters Per Minute
LUEC	Levelized Unit Electricity Costs
MAL	Measures and Assumptions List
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTG	Net-to-Gross
OESP	Ontario Electricity Support Program
PAC	Program Administrator Cost Test
PIA	Prescriptive Input Assumption
PPS	Probability Proportional to Size
PY	Program Year
RR	Realization Rate
StatCan	Statistics Canada

Acronym	Definition
SUPC	Supply and Use Product Classification
SUT	Supply and Use Table
TRC	Total Resource Cost Test
TRM	Technical Reference Manual

Executive Summary

NMR Group, Inc. (NMR), in partnership with subcontractor, Resource Innovations, Inc., (collectively, "the NMR team") and under contract to the Independent Electricity System Operator (IESO), performed an evaluation of the First Nations Conservation Program (FNCP) for program years 2019, 2020, and 2021 (PY2019, PY2020 and PY2021) as part of the Interim Framework (IF).

Program Description

FNCP helps qualified on-reserve First Nations customers improve the energy efficiency of their homes and manage their energy use more effectively. It offers free in-home audits, health and safety upgrades, and energy-efficiency measures at no cost to participants. Measures installed during the home audit or as part of a follow-up visit may include ENERGY STAR® light-emitting diodes (LEDs), smart power bars, programmable thermostats, block heater timers, high-efficiency showerheads and faucet aerators, hot water tank and pipe insulation, energy-efficient freezers, refrigerators and window air conditioners, attic/basement insulation, and weather-stripping around doors and windows.

Evaluation Objectives

The FNCP evaluation sought to address several research objectives, including the following:

- Verify gross energy and demand savings;
- Estimate realization rates (RRs). FNCP has a deemed value of 1 for Net-to-Gross (NTG) since it is a low income program;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions;
- Perform a limited process evaluation; and
- Analyze job impacts for the program.

SUMMARY OF RESULTS

The impact evaluation results for FNCP are displayed in Table 1. These results cover the entire Interim Framework. The overall RR for FNCP is 63% for energy savings and 83% for demand savings.

Table 1: FNCP Interim Framework Results

Metric	Units	Evaluated
Participation	Projects	784
Participation	Homes	718
Reported Energy Savings	MWh	964
Reported Demand Savings	MW	0.07
Gross Energy RR		0.63
Gross Demand RR		0.83
Gross Verified Energy Savings	MWh	607
Gross Verified Demand Savings	MW	0.06
Net-to-Gross (NTG) Ratio	--	1.00
Net Verified Annual Energy Savings (First Year)	MWh	607
Net Verified Annual Demand Savings (First Year)	MW	0.06
Net Verified Persisting Energy Savings to PY2022	MWh	607
Net Verified Persisting Demand Savings to PY2022	MW	0.06
Program Administrator Cost (PAC) Test Ratio	--	0.13
Levelized Delivery Cost (Energy)	$/kWh	0.36
Levelized Delivery Cost (Demand)	$/kW	3,739

KEY FINDINGS AND RECOMMENDATIONS

The following section summarizes the evaluation key findings and recommendations. Section 7 presents these key findings and recommendations in greater detail.

***Finding 1:* The number of projects completed under FNCP during the Interim Framework (2019-2021) was 784.** The size of the FNCP program population suggests that this is a relatively small program and participants are likely hard-to-reach.

> **Recommendation 1.** Conduct an analysis to understand the potential size of the remaining First Nations population that could be supported by program activities. This could include a postal code analysis based on income levels and estimated housing counts to understand both the potential for the program and whether any of the First Nation communities remain underserved by IESO programming.

Finding 2: The FNCP measure offerings are limited compared to other income eligible direct-install programs in IESO territory. While some measures may not be appropriate for all homes, these measures can help reduce the energy burden of FNCP participants and provide additional savings opportunities for FNCP. These measures are represented in the Measures and Assumptions List (MAL) already and are actively distributed to participants in similar income-

eligible direct install programs.

Recommendation 2a. Weatherization upgrades can provide important savings opportunities and health upgrades for participants. The FNCP could emphasize and implement weatherization upgrades to both auditors and participants if the program is made available in the future.

Recommendation 2b. Consider offering smart power bar products to eligible FNCP participants in the future. These are typically the tier-2 smart power bars and are installed with audiovisual (AV) equipment. If included in the FNCP offering, ensure that the location of these power bars is documented if not installed with AV equipment.

Recommendation 2c. Consider offering eligible participants indoor clothes drying racks. These products provide the participants with dryers an opportunity to reduce energy through passive means.

Recommendation 2d. Consider offering either programmable or smart thermostats for eligible participants. Removing old, manual thermostats with smart or programmable thermostats offer both energy savings and increased thermal controls for FNCP participants.

Recommendation 2e. Further consider the relative cost effectiveness (CE) of these potential new measures. Referencing the PY2021 HAP evaluation, the above recommended measures typically were near to or above the median measure-level TRC ratio of 0.81 in the HAP. Specifically, the measure-level TRC ratios from HAP were: weatherization (0.83-0.98), smart power bar (0.72), indoor drying rack (2.02), and programmable thermostats – low voltage (1.66-2.11). The exception to the high measure-level CE performance were line voltage thermostats, having a TRC ratio range of 0.26 to 0.28.

Finding 3: **FNCP program tracking data includes completed projects and installed measures along with unique identifiers for each. However, the tracking data does not typically include key characteristics that are collected during audits such as building or equipment type.** This information can be used to better estimate savings impacts and to provide insights for future program offerings. These data points are often collected and included in the data collection forms that are used during in-home audits. However, only in some cases is this information captured in the program tracking data. The program tracking data did include completed projects and installed measures, including variables to identify unique projects and measures. These unique identifying variables are critical for impact accounting over multiple years in a framework.

Recommendation 3a. Continue to include variables that can be used to identify unique projects and measures within the tracking data. If possible, limit the annual program tracking data to projects that are fully completed.

Recommendation 3b. Work with program staff and implementation contractors to incorporate additional details into the tracking data such as building type and mechanical equipment (e.g., type and fuel) and any additional data that are collected on-site (e.g., efficiency, capacity). This could include revising the IESO's Field Audit Support (Fast) Tool program or supporting the development of a new uniform electronic data collection form for auditors to fill out on-site

which can then be uploaded directly into the tracking data.

Finding 4: Participants, contractors, IESO staff, and delivery vendor staff recommended offering additional equipment if the program is offered in the future. Nearly two-thirds (62%) of surveyed participants provided recommendations for additional energy-efficiency equipment or services for inclusion. These participants most often recommended windows and door (21%), stoves (20%), and water heating (15%). The surveyed contractor was least satisfied with the number and types of equipment incentivized through the program, and recommended several new measures for inclusion, including clothes washers and dryers, and dishwashers. IESO staff and delivery vendor staff noted the importance of properly ventilated homes, with staff suggesting that ventilation improvement support be considered. Staff also recommended identifying potential ways to offer heat pumps to customers in the future, potentially in partnership with other programs or funding streams.

Recommendation 4a. Consider offering additional types of equipment, such as windows and door, water heating, clothes washers and dryers, dishwashers, and heat pumps. Refer to Recommendation 2 for additional measure recommendations.

Recommendation 4b. Consider the feasibility of offering ventilation improvement support in the future, especially for homes receiving weatherization or heating upgrades.

Recommendation 4c. Look for opportunities to offer heat pumps to customers, potentially in partnership with other programs or funding streams.

Recommendation 4d. Further consider the relative cost effectiveness (CE) of these potential new measures. Household appliances have yielded the lowest measure-level TRC ratios (0.02 to 0.20). Space heating and cooling measure-level TRC ratios fared better (TRC ratios 0.14 to 0.43) but are still well below 1.0. Conversely, as stated in Key Finding #2 above, using the HAP as a reference, weatherization measures tended to pull up program-level CE, having measure-level TRC ratios above the program's median measure-level TRC ratio.

Finding 5: Directly engaging with community members is critical to the success of the program. Distrust of government agencies and outside organizations or individuals was a barrier to participation mentioned by both IESO staff and delivery vendor staff. To help address this, the program hired and trained local community members and a First Nations-affiliated delivery vendor. The surveyed program contractor stressed the importance of having First Nation community members involved in participant recruitment, noting that it is critical to generating leads and alleviating skepticism about the program. IESO staff and delivery vendor staff stressed this as well, and indicated that the community-based enrollment events the vendor held prior to the pandemic were well-received by community members and helped to build relationships and trust.

Recommendation 5. If the program is offered in the future, continue to hire and train local community members as canvassers, auditors, and contractors and continue to engage with the community through in-person enrollment events.

Section 1 Introduction

The Independent Electricity System Operator (IESO) retained NMR Group, Inc. (NMR), in partnership with subcontractor, Resource Innovations, Inc., (collectively, "the NMR team") to conduct an evaluation of its Low Income, First Nations, and Residential Local programs and pilots offered under the Interim Framework (IF). This report includes results, findings, and recommendations for program years 2019, 2020, and 2021 (PY2019, PY2020 and PY2021) evaluation and is specific to the First Nations Conservation Program (FNCP).

1.1 Program Description

FNCP helped qualified on-reserve First Nations customers improve the energy efficiency of their homes and manage their energy use more effectively. It offered free in-home audits, health and safety upgrades, and energy-efficiency measures at no cost to participants. The program provided the opportunity to install energy-efficient solutions that will help communities reduce energy consumption and costs while improving comfort.

1.1.1 Delivery

Under the Interim Framework, FNCP was a centrally managed program designed and administered by the IESO. The delivery vendor under contract with the IESO was responsible for managing the program's delivery, including program promotion and outreach, managing and training an energy auditor and installation contractor network that performed in-home energy audits and installations of program-eligible equipment, and other daily program management activities. The program emphasized hiring auditors and contractors within First Nation communities to develop a local workforce. The program educated participants about electricity conservation and efficiency through an education module delivered by program auditors.

1.1.2 Eligibility

Residential on-reserve customers from selected First Nations were eligible to participate in the program. The program predetermined eligible communities based on a review of past participation from communities in prior frameworks.

1.1.3 Measures

The measures offered by FNCP included the basic track measures track, extended track measures, and weatherization track measures. The program also provided health and safety improvements when applicable.

Basic measures included block heater timers, smart power bars, high efficiency showerheads, aerators, and ENERGY STAR® light-emitting (LEDs). Measures that conserved water usage and insulated water heater piping and storage tanks were only provided to customers with electric water heaters.

Extended measures were those that required additional follow-up actions, such as confirmation of appliance delivery, and were not completed in the duration of the initial audit. Extended measures included refrigerator replacements, freezer replacements, window air conditioner replacements, dehumidifiers, and programmable thermostats.

The weatherization track offered building shell weatherization improvements, such as attic/basement insulation and weatherstripping round doors and windows, to homes that were electrically heated.

1.2 EVALUATION OBJECTIVES

The evaluation sought to address several research objectives, including the following:

- Verify energy and demand savings with a 90% level of confidence at 10% precision for the program;
- Estimate realization rates (RRs). FNCP has a deemed value of 1 for Net-to-Gross (NTG) ratio since it is a low income program;
- Conduct cost-effectiveness analyses;
- Estimate the avoided greenhouse gas (GHG) emissions from electricity savings using the IESO Cost Effectiveness Tool;
- Conduct a process evaluation by addressing key research questions of interest to the program; and
- Conduct a jobs impact analysis to estimate the number of direct and indirect jobs attributable to the program

Section 2 Methodology

This section presents a summary of the impact, cost-effectiveness, process evaluation, and jobs impact analysis methodologies in this section. Detailed descriptions of these methodologies are provided in Appendix A.

2.1 Impact Evaluation Methodology

To complete the FNCP impact evaluation, the NMR team performed various evaluation activities, including a review of the program tracking data, an analysis of in-service rates (ISRs) and hours of use (HOU) using data from participant surveys, and engineering desk reviews. The NMR team also incorporated results from the PY2019 review of technical reference manuals (TRMs) from other jurisdictions[1] to calculate RRs.[2] These are standard practices to compare evaluated savings with reported savings. IESO Evaluation Measurement and Verification (EM&V) staff and the NMR team agreed to use the entire FNCP population, from both the Interim Framework and the 2021-2024 Conservation and Demand Management (CDM) Framework, to determine the desk review sample. This was done because the program design and delivery were the same between the two frameworks. However, only the impact results from the Interim Framework are presented in this report (PY2019, PY2020, and PY2021 projects).

A detailed description of the impact sampling methodology, activities, and process to calculated gross verified savings are provided in Appendix A.1.

2.1.1 Net Verified Energy and Demand Savings

The NMR team applied a net-to-gross (NTG) ratio value of 1.0 to maintain consistency with other low-income, direct installation programs in IESO territory and other jurisdictions. The NTG ratio of 1.0 indicates that participants would not have installed the energy-efficiency measures without program intervention. The 1.0 NTG value also indicates that the installation of these measures were 100% influenced by the program. Note that due to a NTG ratio of 1.0, the gross verified savings are equivalent to the net first year savings for the program. In addition, the net persisting savings for 2022 are a key metric for the FNCP program, which signifies the amount of savings that persist to the end of the interim Framework.

[1] See “Secondary Data Review of TRMs” (Section 2.1.2) in Methodology section of PY2019 HAP Evaluation. Appendix A of the same report contains additional details on adjusted measure-level inputs and savings parameters.
[2] Note that PY2019 adjustments also included measure-level updates to effective useful life (EUL) and incremental costs, which are presented in the Appendix B.3 of the PY2019 HAP evaluation report. The evaluation applied the updated EULs and incremental costs that resulted from the PY2019 evaluation activity.

2.2 COST-EFFECTIVENESS EVALUATION

The NMR team completed the cost-effectiveness analysis in accordance with the IESO requirements as set forth in the IESO *Cost-Effectiveness Guide for Energy Efficiency*[3] and using IESO's *Cost-Effectiveness Tool*. The energy and demand savings results from the impact evaluation were inputs into the IESO *Cost-Effectiveness Tool*, as was administrative cost and incentive information supplied from IESO. A more detailed description of the cost-effectiveness methodology is provided in Appendix A.2.

2.3 PROCESS EVALUATION METHODOLOGY

The process evaluation focused on program design and delivery. The NMR team evaluated program processes through interviews and surveys with relevant program actors, including the IESO staff, program delivery vendor staff, contractors, and participants. For each respondent type, the NMR team developed a customized interview guide or survey instrument to ensure responses produced comparable data and to allow the NMR team to draw meaningful conclusions. IESO EM&V staff and the NMR team agreed to use the entire FNCP population, from both the Interim Framework and the 2021-2024 CDM Framework, to determine the process evaluation sample. Given the similarities in program design, participant feedback from both frameworks are provided together.

For each respondent type, Table 2 shows the survey methodology, the total population that the NMR team invited to participate in the survey or interviews, the total number of completed surveys, and the sampling error at the 90% confidence interval (CI). A detailed description of the process evaluation methodology is provided in Appendix A.3.

Table 2: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Completed	Population	90% CI Error Margin
FNCP IESO Staff and Delivery Vendor Staff	Phone In-depth Interviews (IDIs)	2	2	0%
FNCP Contractors	Web	1	2	N/A*
FNCP Participants	Web	131	1,403	6.9%

*Error margin not displayed if the respondent count is below 30 unless census is achieved.

2.4 JOBS IMPACT ANALYSIS METHODOLOGY

The analysis of job impacts utilized the Statistics Canada[4] (StatCan) Input-Output (IO) model to estimate direct and indirect job impacts. IO models are used to analyze the propagation of exogenous economic shocks throughout an economy. The models represent relationships, or flows, of inputs and outputs between industries. When an energy-efficiency program such as FNCP is funded and implemented it creates a set of "shocks" to the economy, such as demand

[3] *Cost Effectiveness Guide for Energy Efficiency Version 4*, Independent Electricity System Operator, January 20, 2021. https://www.ieso.ca/-/media/Files/IESO/Document-Library/EMV/CDM_CE-TestGuide.ashx

[4] Statistics Canada is the Canadian government agency commissioned with producing statistics to help better understand Canada, its population, resources, economy, society, and culture.

for specific products and services, and additional household expenditures from energy bill savings. The shocks propagate throughout the economy and their impacts can be measured in terms of variables such as economic output and employment. A detailed description of the job impact analysis methodology is provided in Appendix A.4.

The model output generated three types of job impact estimates:

Direct impacts: jobs created during the initial round of spending from the exogenous shock. For the demand shock for energy-efficient products and services, direct impacts would be from firms adding employees to perform audits, install measures, and handle administrative duties. For the household expenditure shock, direct impacts would be from jobs created due to additional household spending.

Indirect impacts: job impacts due to inter-industry purchases as firms respond to the new demands of the directly affected industries. These include jobs created up supply chains due to the demand created by the energy-efficiency program—such as in the manufacturing of goods or the supply of inputs.

Induced impacts: job impacts due to changes in the production of goods and services in response to consumer expenditures induced by households' incomes (i.e., wages) generated by the production of the direct and indirect requirements.

The IO model provides estimates for each type of job impact in the unit of *person-years*, or a job for one person for one year. It further distinguishes between two types of job impacts:

- **Total number of jobs:** this covers both employee jobs and self-employed jobs (including persons working in a family business without pay). The total number of jobs includes full-time, part-time, temporary jobs and self-employed jobs. It does not take into account the number of hours worked per employee.
- **Full-time equivalent (FTE) number of jobs:** this includes only employee jobs that are converted to full-time equivalence based on the overall average full-time hours worked in either the business or government sectors.

Model run results are presented in terms of the above job impact types (direct, indirect, and induced) and also the type of job (total jobs vs. FTEs). These results—along with the model input shock values—are presented and discussed in Section 6.2.

Section 3 Impact Evaluation

The following subsections outline the impact evaluation results. Details regarding the impact methodology can be found in Section 2.1 and Appendix A.1. Additional impact-related results, rationale and drivers of realization rates (RR), and general insights from the impact evaluation activities by measure category can be found in Appendix B.

3.1 High-Level Results

The gross verified savings for FNCP have a net-to-gross (NTG) ratio of 1.0 applied to them, meaning gross verified and net verified savings are equal (Section 2.1.1). The results presented in this section refer to the gross verified savings and can be considered equivalent to net verified first year savings. It should also be noted that all measure lifetimes and the savings that are associated with those measures persist beyond 2022. This is a key metric to assess FNCP performance compared to the savings targets established for the Interim Framework.

In addition, the results presented in these subsections represent the FNCP impacts for the entire Interim Framework.

3.1.1 Gross Verified Energy Savings Key Results

- FNCP achieved 607 MWh of net energy savings persisting to 2022.
- The overall program RR is 63% for energy savings.
- Lighting measures achieved an RR of 69%and accounted for most of FNCP savings (60.3%).
- Domestic hot water measures had a RR of 65%but only accounted for 16.9% of gross verified savings.
- Power bars with timers had verified savings roughly equal to reported savings (RR of 98.8%) due to an in-service rate (ISR) adjustment.
- The appliance end-use category had an RR of 105% and attributed 19.2% to total program savings. The RR was driven by the use of model-specific energy consumption values and occasional replacements that were not the same size as the existing equipment.
- Block heater timers had a low RR of 12% and only accounted for 3.2% of gross verified savings. The low RR was a result of ISR and hour-of-use (HOU) adjustments.

3.1.2 Gross Verified Demand Savings Key Results

- FNCP achieved 0.06 MW of net demand savings persisting to 2022.
- The overall program RR is 83% for demand savings.

- Lighting measures had an RR of 73% for demand savings and these represented about 41% of total program demand savings. Specifically, 11W LED A-line bulbs accounted for the largest portion of demand savings (39.2%).
- After 11W LED bulbs, refrigerator replacements between 17-18.4 cubic feet (12.6%), and kitchen aerators (6.2%) provided the highest proportion of demand savings.
- Appliances had a 109% RR and accounted for 42.3% of program savings. The RR was driven by the use of model-specific energy consumption and occasional replacements that were not the same size as the existing equipment.
- Power bars with timers had no demand savings reported in the tracking data (a total of 673 power bars), therefore a measure-level RR could not be calculated for these measures.[5]

3.2 Gross Verified and Reported Savings Assessment

The gross verified energy savings for FNCP were dominated by lighting end-use measures, which covered three-fifths (60%) of total program savings of 607 MWh from PY2019 to PY2021. (Figure 1). Appliances, domestic hot water, and miscellaneous measures were the next largest end-use categories for FNCP. Appliances, including dehumidifiers, freezers, and air conditioners, accounted for 19% of gross verified savings for FNCP. Refrigerator replacements, of all sizes offered, contributed the highest savings within appliances by comprising 10.3% of the gross verified savings.

Figure 1: Gross Verified Energy Savings by End-Use (kWh/year)

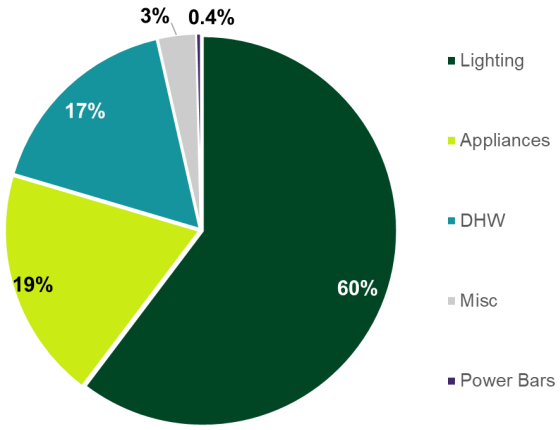
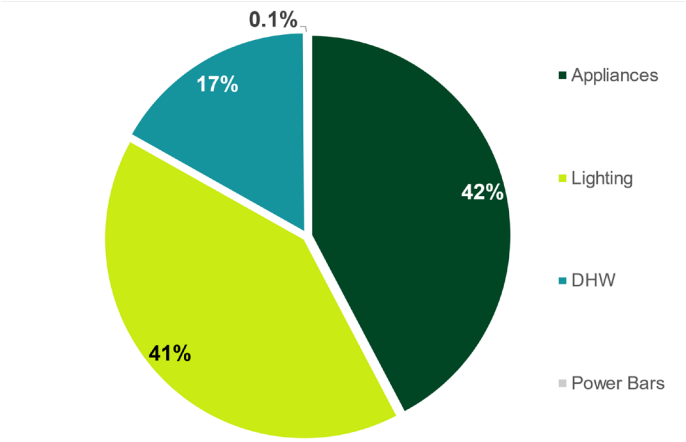


Figure 2 displays the proportion of gross verified demand savings by end-use category for FNCP. Appliances and lighting end-uses covered the majority of total demand savings of 60 kW for FNCP from PY2019 to PY2021. The other primary end-use categories that attributed to gross verified demand savings were domestic hot water measures and power bars with timers. Domestic hot

[5] While a measure-specific RR was not able to be calculated, the overall program realization rate considers the gross (reported) savings and the gross verified demand savings values.

water measures consisted of almost 17% of gross verified demand savings specifically the efficient kitchen aerator and efficient showerhead categories (6.3% and 5.9%, respectively). The power bars with timers contributed to less than 1% of gross verified demand savings for FNCP.

Figure 2: Gross Verified Demand Savings by End-Use (kW/year)



3.2.1 Program Level Savings

Table 3 presents reported, gross verified, and net first year energy and demand savings for the entire Interim Framework FNCP program population covering PY2019 to PY2021. The program gross verified RR is 63% for energy savings and 83% for demand savings. As described above, the NTG ratio is assumed 1.0 for the FNCP. Measure level impacts for both energy and demand savings are detailed in Appendix B.

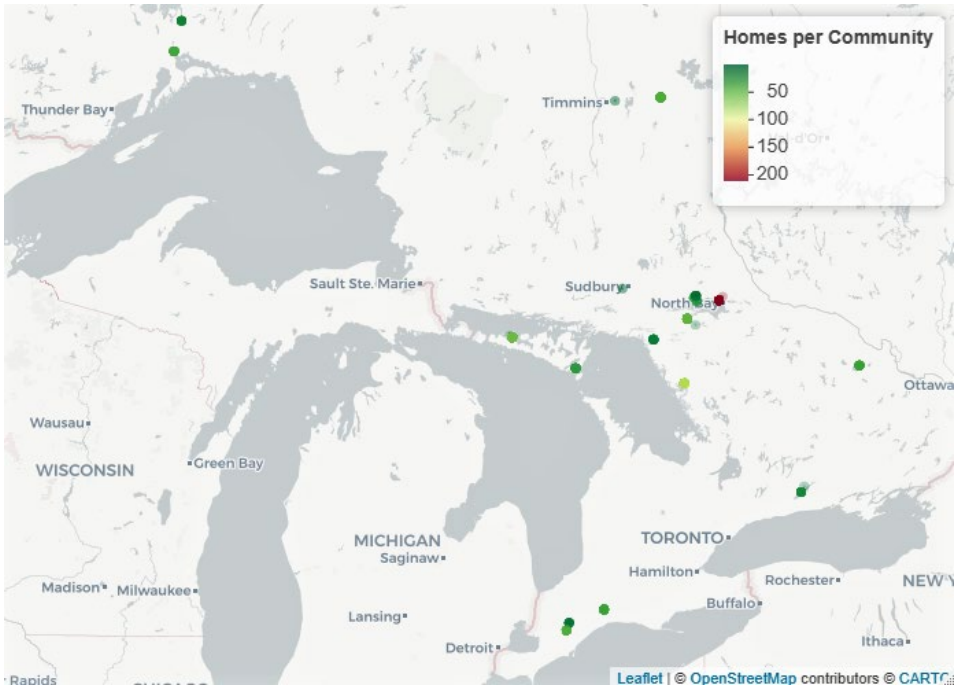
Table 3: FNCP Program Level Reported, Gross Verified, and Net First Year Savings for the Interim Framework

Metric	Units	PY2019	PY2020	PY2021	Program Total
Reported Energy Savings	MWh	278	143	544	**964**
Reported Demand Savings	MW	0.02	0.01	0.04	**0.07**
Gross Energy RR	MWh	0.60	0.65	0.64	**0.63**
Gross Demand RR	MW	0.81	0.83	0.83	**0.83**
Gross Verified Energy Savings	MWh	168	93	347	**607**
Gross Verified Demand Savings	MW	0.02	0.01	0.03	**0.06**
Net-to-Gross (NTG) Ratio	--	1.00	1.00	1.00	**1.00**
Net Verified Annual Energy Savings (First Year)	MWh	168	93	347	**607**
Net Verified Annual Demand Savings (First Year)	MW	0.02	0.01	0.03	**0.06**
Net Verified Persisting Energy Savings to PY2022	MWh	168	93	347	**607**
Net Verified Persisting Demand Savings toPY2022	MW	0.02	0.01	0.03	**0.06**

Figure 3 shows the geographic distribution of evaluated FNCP project homes across Ontario.[6] Green dots represent buildings where there are few other FNCP participant projects within the same community, while red dots represent higher densities of participant homes. North Bay was most represented among FNCP participants, indicated by the red dot in the map below. North Bay was also the only community with a building count surpassing two hundred. Three others--Shawanaga, Sheshegwaning and Dokis First Nations—had building counts surpassing 50, indicated by the lighter green dots in the map below. These four First Nations accounted for roughly one-half (51%) of the projects mapped in Figure 3.

[6] There were 718 unique building addresses for the 784 IF projects. This value represents the physical addresses in the tracking data and is referred to as the FNCP participant program home count.

Figure 3: Interim Framework FNCP Participant Home Distribution Across Ontario



Section 4 Cost-Effectiveness Evaluation

This section presents the cost-effectiveness evaluation results. Details regarding the cost-effectiveness methodology can be found in Section 2.2 and Appendix A.1.

The cost-effectiveness results for each program year and a total for the Interim Framework are presented in Table 4. The program did not pass the Total Resource Cost (TRC) test or the Program Administrator Cost (PAC) test in any year because benefits were less than their respective costs. This is consistent with findings for low income programs in other jurisdictions. Additionally, regulations in other jurisdictions commonly do not require low income programs to meet cost effectiveness.[7]

Table 4: Program Level Cost-Effectiveness Key Metrics

Cost-Effectiveness Test	PY2019	PY2020	PY2021	Total
TRC				
TRC Costs ($)	690,993	620,112	693,247	2,004,351
TRC Benefits ($)	76,635	47,357	185,588	309,581
TRC Net Benefits ($)	-614,358	-572,755	-507,658	-1,694,771
TRC Net Benefit (Ratio)	0.11	0.08	0.27	0.15
PAC				
PAC Costs ($)	690,993	620,112	693,247	2,004,351
PAC Benefits ($)	66,639	41,180	161,381	269,200
PAC Net Benefits ($)	-624,354	-578,932	-531,865	-1,735,151
PAC Net Benefit (Ratio)	0.10	0.07	0.23	0.13
Levelized Delivery Cost				
$/kWh	0.43	0.74	0.22	0.36
$/kW	5,014	6,618	2,276	3,739

The program's TRC, PAC, and levelized delivery cost (LC) metrics indicate that the program's cost effectiveness dropped slightly from PY2019 to PY2020 but improved substantially in PY2021.

To understand why the ratios changed year to year, one can look at the corresponding costs and benefits that comprise these CE ratios. Since FNCP is a direct install program that covers the full cost of implementing measures, both the TRC and PAC tests present similar results. Therefore, the following analysis only focuses on only PAC.

The PAC costs did not fluctuate much year to year, only deviating between three to seven percent from the average cost of $668,117 among the three years. However, the composition of that cost was drastically different in PY2021, where the IESO's administrative cost dropped from over $400,000 in each of PY2019 and PY2020 to only $80,500 in PY2021. The balance of the cost in

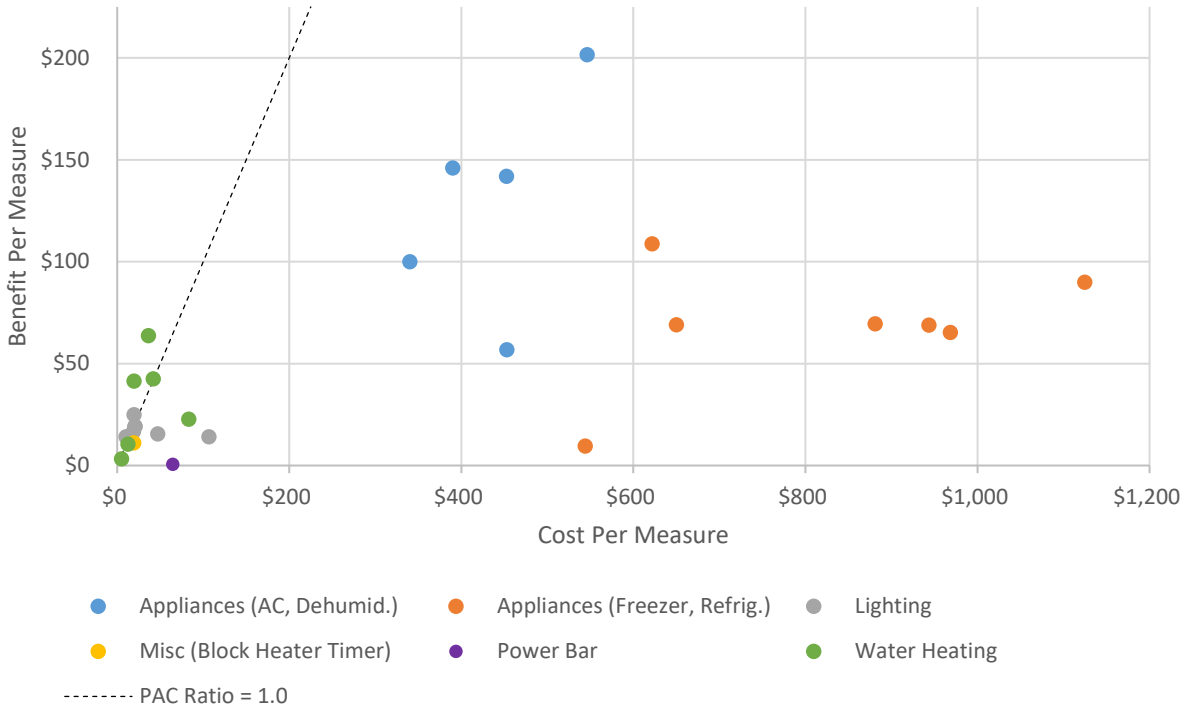
[7] *Guidelines for Low-Income Energy Efficiency Programs,* American Council for an Energy-Efficient Economy, https://database.aceee.org/state/guidelines-low-income-programs

PY2021, which brought the total PAC cost shown in Table 4 more in line with previous years, was due to an increased quantity of measures implemented. In fact, every measure but one saw an increase in quantity implemented between PY2020 and PY201, and most of these increases in measure quantity were substantial. Of the 23 measures implemented in both PY2020 and PY2021, 16 were implemented at least twice as many times in PY2021 as they were in PY2020. This observation is supported by the program's total verified net energy savings, which saw a 44% drop between PY2019 and PY2020, but saw a 272% increase between PY2020 and PY2021. At the measure level, the measures with the highest PAC ratio (i.e., were the most cost effective) tended to be measures with low cost and that served lighting, hot water heating, and plug load end uses. These included, 11W LED light bulbs, hot water pipe wrap, low water flow devices (bath and kitchen faucet aerators and showerheads), and engine block heater timers.

The measures with the lowest PAC ratio (i.e., were the least cost effective) were exclusively comprised all the various sizes of window air conditioner, refrigerator, freezer, and dehumidifier measures. Correspondingly, these measures also make up the highest cost measures offered in the program.

Figure 4 below more generally presents the relative costs and benefits by end use. We observe that while household appliances (freezers and refrigerators) offer the good benefits, their costs are by far the highest. Clustered below approximately $100 in cost each are water heating, plug loads, and lighting measures. While these measures are low cost and generally have the best measure-level PAC ratios, they provide relatively smaller benefits per measure.

Figure 4: PAC Benefits vs. Costs by End Use



Section 5 Process Evaluation

This section presents the process evaluation results. Details regarding the process methodology can be found in Section 2.2 and Appendix A.3.

5.1 IESO and Delivery Vendor Staff Perspectives

The following subsections highlight the feedback received from the IESO and delivery vendor staff about the design and delivery of FNCP.

5.1.1 High-Level Results

High-level results from the IESO and delivery vendor staff in-depth interviews (IDIs) include the following:

- Both IESO staff and delivery vendor staff reported the greatest strength the program provided is the collection of benefits it offers to communities that live on reserve.
- The program and the communities that it served were greatly impacted by COVID-19. IESO staff noted that they were pleased with the number of enrollments they were able to achieve under difficult circumstances.
- Distrust of government agencies and outside organizations or individuals was a barrier to participation mentioned by both IESO staff and delivery vendor staff. To help address this, the program hired local staff and a First Nations-affiliated delivery vendor.
- Other common program barriers identified were a reluctance to replace appliances that had been reliable, to accept new appliance warranty terms, to learn new technologies, or to change the aesthetics of the home. Additionally, some customers' homes would have required repairs before they could accommodate certain upgrades.
- IESO staff stressed that installing as many efficiency improvements as possible while onsite was critical given the hard-to-reach nature of these communities.
- The benefits of providing a more holistic approach to home improvements was mentioned by both IESO staff and delivery vendor staff. Identifying opportunities to partner with other programs or funding streams to offer non-eligible measures (e.g., heat pumps, non-electric measures) was recommended.
- Both IESO staff and delivery vendor staff noted the importance of properly ventilated homes, with staff suggesting that ventilation improvement support be considered in any future iterations of the program, especially for homes receiving weatherization or heating upgrades.

5.1.2 Design and Delivery

IESO staff reported that they had a good working relationship with the delivery vendor, a First Nations-owned organization that focuses on First Nations energy-engineering programs and projects.

One of the main goals of the program under the Interim Framework was to encourage all communities that had not participated in previous years to participate. IESO staff reported that they have targeted most of these communities during this period, but some did not either because of the pandemic or other reasons.

Prior to the pandemic, community-based events were the main way that the delivery vendor engaged customers and enrolled them in the program. These events were good opportunities to build trust with the community, share information about the program, and enroll many individuals at once in a process. In addition, the delivery vendor also assigned canvassers to communities to promote the program through direct engagement, and they worked closely with contractors and suppliers to get measures into communities quickly and efficiently. During the pandemic, the program outreach moved online, which was generally less effective, and during the height of the pandemic, all in-person outreach activities were halted.

IESO staff and delivery vendor staff affirmed that the pandemic also significantly impacted the program's delivery. Enrollment dropped off during the period when in-person activities could not be held. Program auditors and contractors stopped all projects during this time and many projects could not be completed. Supply chain disruptions forced up measure costs; however, the delivery vendor staff reported that they were locked into pre-pandemic supply cost agreements.

5.1.3 Strengths

IESO staff and delivery vendor staff indicated that the program's main strength was the provision of benefits to communities that live on-reserve which include direct installs, new appliances, weatherization, improved home comfort, and reduced energy bills. IESO staff also noted that some additional appliances sizes that better aligned with community needs were added to the program as well. Delivery vendor staff noted that participants are largely satisfied with the program and indicated that it has made a difference to the communities it has served. Both IESO staff and delivery vendor staff cited the in-person community engagement events and hiring and training local community members to deliver the program as other key strengths as they were well-received by community members and helped to build relationships and trust.

5.1.4 Barriers and Opportunities

COVID-19 had a major impact on the program as well as the communities that it served in both PY2019 and PY2020. For over a year and a half, no in-person program-related activities occurred. Because of this, the program was not able to meet its participation and energy saving targets, but IESO staff indicated that the program was able to serve many customers prior to the onset of the pandemic and after it was re-launched. While they fell short of their enrollment goals, they were pleased with the enrollments they were able to achieve under such difficult circumstances.

IESO staff and delivery vendor staff both reported that First Nation communities can be distrustful of government agencies and hesitant to work with outside organizations or individuals. The program lowered this barrier by hiring local staff and a First Nations-affiliated delivery vendor.

IESO staff noted that in the PY2019 and PY2020 periods, the extent of the upgrades completed were often basic, with not many opportunities for weatherization or deeper retrofits. They indicated that this was often due to the electric heating program requirement. IESO staff also reported that with cost increases and supply chain issues, the weatherization cost caps often did not cover the cost of these installations.

Other program barriers staff identified included the remoteness of many communities, old building stock, a reluctance to replace appliances that had been reliable, to learn new technologies that accompany equipment, or to change the aesthetics of the home. Some customers felt the warranty on new equipment was not long enough. Other customers' homes required repairs or renovations before they could accommodate high-efficiency HVAC equipment.

IESO staff stressed making as many efficiency improvements as possible to customer homes while onsite given the hard-to-reach nature of these communities. Both IESO staff and delivery vendor staff noted that offering a more holistic approach to home improvements would serve customers well (including non-eligible measures, such as heat pumps or non-electric measures); doing so could require partnerships with other programs or funding streams. Both IESO staff and delivery vendor staff noted that ensuring a home is properly ventilated is important to health and safety, with staff recommending that any future iterations of the program consider offering ventilation support, especially for homes receiving weatherization or heating upgrades.

5.2 CONTRACTOR PERSPECTIVES

One contractor completed the FNCP auditor and contractor survey. The following subsections highlight the feedback received from this respondent.

5.2.1 High-Level Results

High-level results from the contractor survey include the following:

- The respondent was highly satisfied with the program application process, training, and the value provided to customers.
- Having First Nation community members involved in participant recruitment is critical to generating leads and alleviating skepticism about the program as reported by the respondent.
- The respondent was least satisfied with was the number and types of equipment incentivized through the program and recommended several equipment types (e.g., clothes washers and dryers, dishwashers, and programmable pool pumps).
- Decreasing the time it takes for contractors to receive payment was recommended by the respondent.
- COVID-19 impacted the respondent's company and their related participation in the program in many ways, with sales and revenues decreasing while measure costs and operating costs increasing.

5.2.2 Program Experience

The sole respondent to the FNCP contractor survey worked as a contractor on approximately 30 single-family and 20 multi-family FNCP projects in 2019 and 2020. The respondent received training in health and safety and "[recognizing] communities with [unique] needs" from the delivery vendor. The respondent frequently informed customers about the availability of FNCP and was highly satisfied with the program application process, training provided to them by the delivery vendor, and the value that the program provided to customers. The contractor said the program had increased company revenue and allowed for the hiring of additional employees.

5.2.3 Program Barriers

The respondent identified an array of barriers to FNCP participation including lack of program awareness, low importance of energy-efficiency upgrades relative to other priorities, disbelief over the financial return of upgrades, skepticism of the legitimacy of the program, distaste for the aesthetics of upgrades, and distrust towards those not part of the First Nation community. The respondent asserted the need to have First Nation community members involved in participant recruitment, explaining that this partnership generates leads and alleviates skepticism about the program.

5.2.4 Recommendations for Program Improvement

The one aspect of the program the respondent was less satisfied with was the number and types of equipment incentivized through the program. The respondent recommended several new measures for inclusion, including clothes washers and dryers, dishwashers, and programmable pool pumps. Another aspect for which the respondent indicated there was room for improvement was the time it took for contractors to receive payment from IESO. The respondent said it could take 60 to 90 days to receive payment and recommended that this duration be shortened.

5.2.5 COVID-19 and Health/Safety

The respondent's company experienced many impacts from the COVID-19 crisis during 2020 and 2021. The company increased cleaning and safety measures, changed its operating hours, increased remote work, and closed part of the business. It experienced supply chain delays and workforce issues such as layoffs and difficulty in hiring. Sales and revenues decreased, while measure costs and operating costs increased. Frequent cancellations and delays in booking appointments drove operating costs in the form of extensive storage fees and financing expenses. The contractor noted it was somewhat difficult to adhere to the relevant health and safety standards when installing equipment at customer sites but offered no insight on how to overcome that challenge.

COVID-19 Impacts	
Increased cleaning and safety measures	✓
Changes in operating hours	✓
More remote work	✓
Closed part of business	✓
Supply chain delays or shortages	✓
Workforce issues such as layoffs or difficulty hiring	✓
Lower sales or revenues	✓
Increased measure costs	✓
Increased operating costs	✓

5.3 PARTICIPANT PERSPECTIVES

The following subsections highlight the feedback received from the FNCP participant survey. Results are presented either as percentages or counts, depending on sample size.

5.3.1 High-Level Results

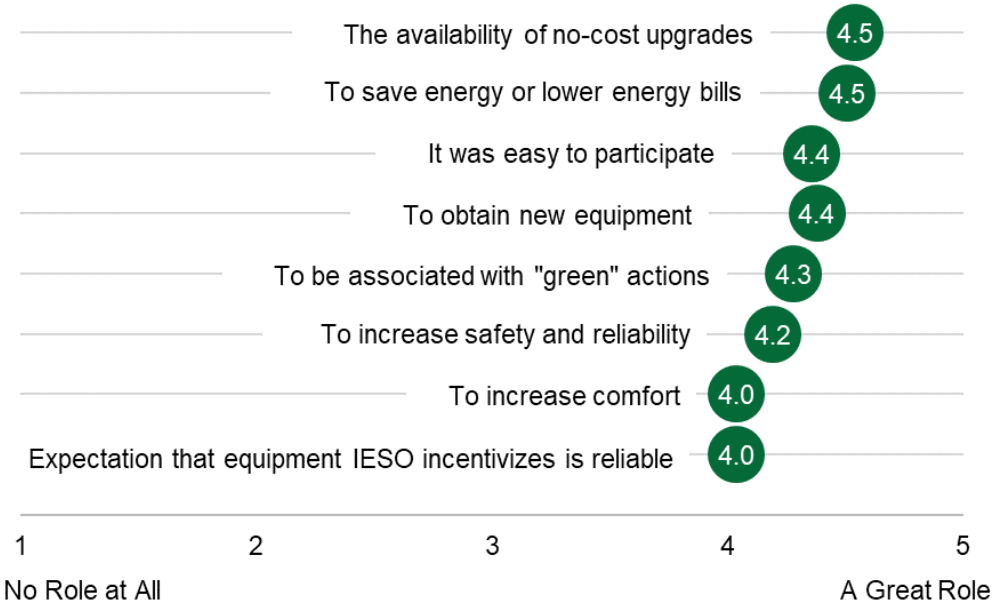
High-level results from the participant survey include the following:

- Most participants heard about the program from a community resource (52%) and applied through a community organization (36%).
- Their primary motivation for applying to the program was the availability of no-cost upgrades and to save energy or lower energy bills (average rating of 4.5 on a scale from 1 to 5, where 1 meant the factor played “no role at all” and 5 meant it played “a great role”).
- Just over one-half (56%) of respondents said their energy auditor discussed additional ways to save energy at the time of the audit. Of these respondents, nearly three-quarters (74%) had tried at least one of them since having the audit performed.
- Respondents were largely satisfied with the program overall (average rating of 4.5 on a scale from 1 to 5, where 1 meant “not at all satisfied” and 5 meant “completely satisfied”). They were especially satisfied with the professionalism of the auditor (average rating of 4.6). Over nine-tenths (95%) of respondents would recommend the program to others.
- Nearly two-thirds (62%) of respondents provided recommendations for additional energy-efficiency-equipment or services for inclusion in FNCP. Participants often recommended windows, doors, stoves, water heaters, clothes washers, and dryers.

5.3.2 Program Awareness and Motivation

Over one-half (52%) of respondents heard about the program from a community resource, such as a community organization (37%), community energy champion (9%), or a community event (6%). The most common method for applying to the program was through a community organization: over one-third (36%) of respondents applied that way. Additional feedback on how participants heard about and applied to the program can be found in Figure 29 and Figure 30 in Appendix C.1.2. Figure 5 displays respondents’ average ratings for the level of influence various factors had on their decision to participate in the program. Respondents rated the influence of each factor using a scale from 1 to 5, where 1 meant “no role at all” and 5 meant “a great role.” The most influential factors were (1) the availability of the no-cost upgrades and (2) to save energy or lower energy bills, each with an average rating of 4.5.

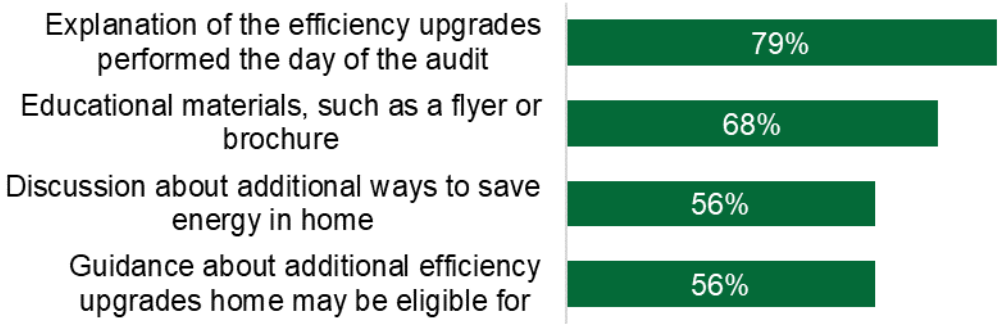
Figure 5: Factors Influencing FNCP Participation (n=131)



5.3.3 Program Education and Behavioral Changes

Energy auditors provided various resources to participants at the time of the audit. As shown in Figure 6, almost four-fifths (79%) of respondents said the auditor explained the efficiency upgrades performed the day of the audit. Additionally, just over two-thirds (68%) of respondents said the auditor provided educational materials, such as flyers or brochures. Over one-half (56%) of respondents said the auditor discussed additional ways to save energy in their home or offered guidance about additional upgrades for which they may be eligible. Respondents found these resources useful: the average rating was 4.0 on a scale from 1 to 5, where 1 meant "not at all useful" and 5 meant "very useful."

Figure 6: Resources Provided by Energy Auditor (n=131; Multiple Response)*



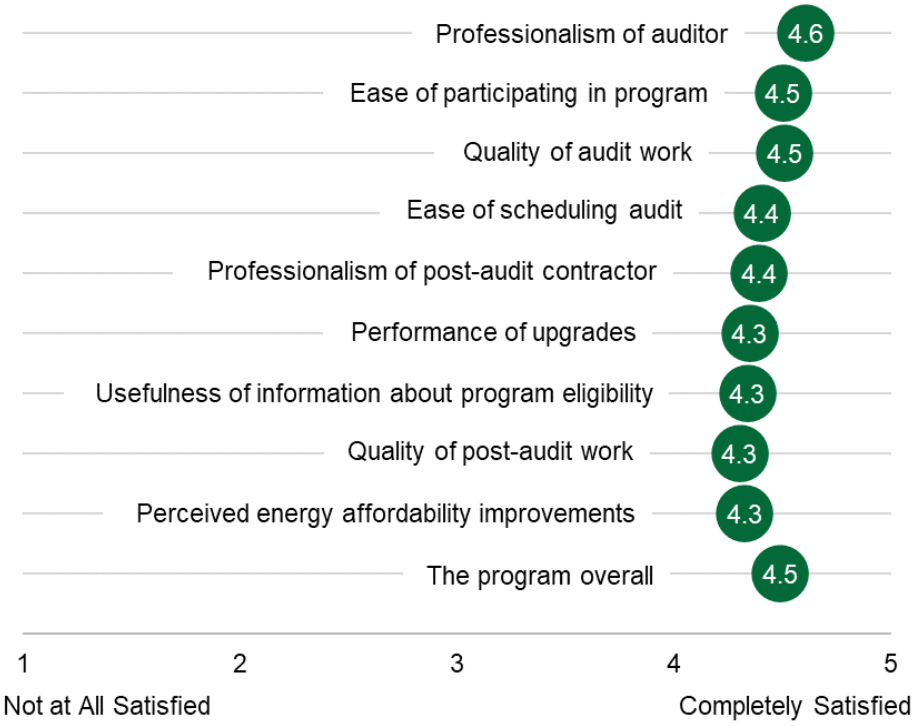
*Does not sum to 100% due to multiple response.

Participants provided feedback about the additional energy-saving methods that their auditor suggested. The most frequently suggested method was to purchase ENERGY STAR appliances: close to one-half (46%) of respondents said their auditor suggested this. Between one-fifth and one-third of respondents said their auditor suggested washing laundry with cold water (30%), cleaning or replacing air filters (27%), installing programmable thermostats (27%), turning off appliances and electronics (26%), and opening shades in the winter and closing them in the summer (20%). Nearly three-fourths (74%) of respondents whose auditor discussed additional ways to save energy had tried at least one of them since having the audit performed. The most common energy saving actions respondents mentioned trying included buying ENERGY STAR appliances (24%), washing laundry with cold water (24%), and turning off appliances and electronics (20%). Additional feedback on other energy-saving methods suggested and tried can be found in Figure 31 in Appendix C.1.3.

5.3.4 Program Satisfaction

Most respondents were satisfied with the program. Figure 7 displays respondents' average satisfaction ratings with various aspects of the program and the program overall on a scale from 1 to 5, where 1 meant "not at all satisfied" and 5 meant "completely satisfied." The average rating for the program overall was 4.5. The program aspect that respondents were most satisfied with was the professionalism of the auditor: the average rating was 4.6. None of the program aspects respondents were asked about had an average rating below 4.3. Over nine-tenths (95%) of respondents said they were likely to recommend the program to others.

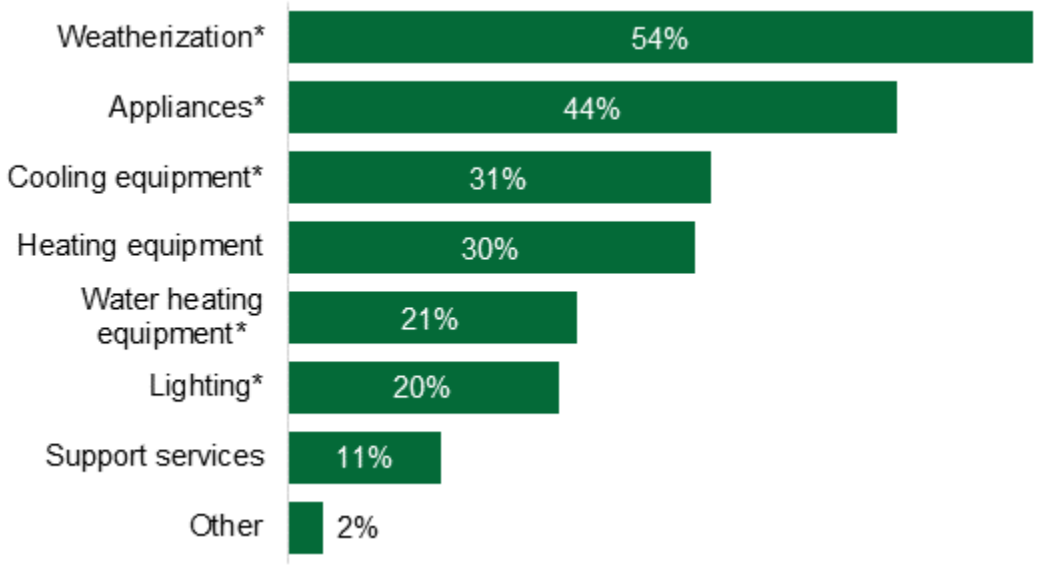
Figure 7: Satisfaction with Program Aspects (n=131)



5.3.5 Recommendations for Program Improvement

Nearly two-thirds (62%) of respondents provided a total of 168 recommendations for additional energy-efficiency equipment or services for inclusion in FNCP. Figure 8 displays the categories of additional equipment or services respondents recommended; asterisks denote whether some or all the upgrades in the category are already included in the program. One-third of the recommended upgrades are already included in the program, such as refrigerators, freezers, insulation, window ACs, weather stripping, dehumidifiers, faucet aerators, low-flow showerheads, water heater insulation, and block heater timers. This suggests that respondents who recommended these measures were unaware of their inclusion, potentially because they were ineligible for them. The most frequently recommended types of equipment not already offered by the program include windows and doors (included within weatherization, 21%), stoves (included in appliances, 20%), water heaters (included in water heating equipment, 15%), clothes washers and dryers (10%), central air conditioning (included in appliances, 5%), and fans (included in appliances, 4%).

Figure 8: Additional Equipment or Services (n=81; Multiple Response)**



*Some or all the upgrades in this category are already offered by the program.
**Does not sum to 100% due to multiple response.

Only two respondents (less than two percent) offered recommendations for improving the program beyond additional equipment or services. Both respondents were disappointed because they did not receive all equipment and services they expected, suggesting the program could have done a better job of accurately setting their expectations.

5.3.6 COVID-19 and Health/Safety

Respondents rated the program energy auditors and contractors highly in terms of how they adhered to the relevant health and safety standards associated with the COVID-19 pandemic. Most respondents (78%) assigned a rating of 4 or 5 on a scale from 1 to 5, where 1 meant "did not adhere at all" and 5 meant "adhered completely" (Table 5). The average rating was 4.6.

Table 5: Adherence to Health and Safety Standards Associated with Covid-19 Pandemic (n=131)

Adherence to Health and Safety Standards	Percent of Respondents
5- Adhered completely	63%
4	15%
3	6%
2	2%
1- Did not adhere at all	1%
Don't know/Refused	14%
Average Rating	**4.6**

*Does not sum to 100% due to rounding.

Section 6 Other Energy-Efficiency Benefits

This section presents results related to the program's other energy efficiency benefits including avoided greenhouse gas emissions and the jobs impact analysis.

6.1 Avoided Greenhouse Gas Emissions

The NMR team used the IESO's *Cost Effectiveness Tool* to calculate avoided GHG emissions. The NMR team calculated avoided GHG emissions for the first year and for the lifetime of the measures. Table 6 presents the results of these calculations for each program year and the total for the framework.

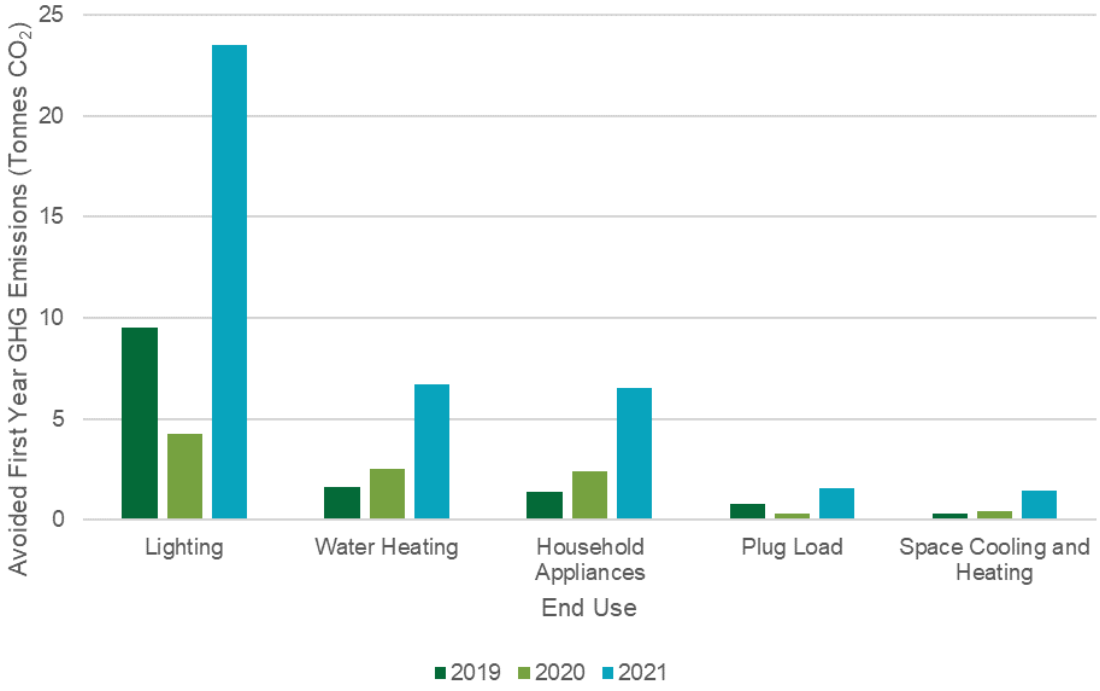
Table 6: Avoided GHG Emissions by Program Year and Total Framework

Avoided (Tons CO_2 equivalent)	PY2019	PY2020	PY 2021	Total
First Year	14	10	40	64
Lifetime	318	172	683	1,173

Figure 9 compares avoided cost emissions by end use and program year. Correspondingly to energy and demand savings performance, each end use produced an increase in GHG emissions reductions in PY2021 when compared to previous years.

Each end use at least doubled in avoided GHG emissions between PY2020 and PY2021. The largest of which, by both percentage and magnitude, was lighting. Water heating and household appliances each showed similar growth in both magnitude (approximately 4.2 tons each) and percentage (164% and 173%, respectively) between PY2020 and PY2021. Plug loads and space heating and cooling yielded the smallest emissions reductions each year, but grew substantially between PY2020 and PY2021, at 355% and 224%, respectively.

Figure 9: Comparison of Avoided GHG Emissions by End Use and Program Year



6.2 JOBS IMPACT ANALYSIS

This section outlines the jobs impact analysis results. Details regarding the jobs impact analysis methodology can be found in Section 2.4 and Appendix A.4. Additional jobs impact results can be found in Appendix D.

6.2.1 High-Level Results

- The analysis used an input-output model which estimated that FNCP will create 17 total jobs in Canada, of which 15 will be in Ontario.
- Most of the jobs stem from the demand created for energy-efficient products and services related to program delivery.
- The FNCP program is estimated to create approximately 8.7 jobs per $1M of program spend.

Section 6.2.2 details the values of the inputs used as shock values for the model runs. Section 6.2.3 presents the analysis, including details of job impacts and assumptions.

6.2.2 Input Values

The model was used to estimate the impacts of two economic shocks – one representing the demand for energy-efficient products and services from FNCP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 7 shows the input values for the demand shock representing the products and services related to FNCP. Each

measure installed as part of FNCP was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

Table 7: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor (S Thousands)	Total Demand Shock ($ Thousands)
Major appliances	551	70	621
Electric light bulbs and tubes	128	0	128
Small electric appliances	46	46	92
Other miscellaneous manufactured products	20	0	20
Other professional, scientific and technical services	-	-	211
Office administrative services	-	-	932
Total			**2,004**

Table 8 shows the calculations and input value for the household expenditure shock.[8] This shock represents the net additional amount that households would inject back into the economy through spending. Additional background and details about the shock inputs can be found in Appendix D.1.

Table 8: Summary of Input Values for Household Expenditure Shock

Description	Demand Shock *($ Thousands)*
NPV of energy bill savings	985
Residential portion of program funding	(702)
Net bill savings to residential sector	**283**
Percent spent on consumption (vs. saved)	47%
Total Shock	**132**

[8] The model is actually run with a normalized value of $1 million in extra household expenditures and the job results can be scaled by the actual demand shock.

6.2.3 Model Results

Impacts from the StatCan I-O model are generated separately for each shock and added together to calculate overall program job impacts. In the case of FNCP, this means that two different sets of job impacts are combined into the overall jobs impacts. Table 9 shows the total estimated job impacts by type – combining the impacts from the demand and household expenditure shocks. The majority (15 out of the 17 estimated total jobs) were in Ontario. All the direct and indirect jobs created were created in Ontario. A slightly smaller number of induced jobs was in Ontario, 3 out of 4 induced total jobs created within the province. The FTE estimates are slightly less, with a total of 12 FTEs (of all types) created in Ontario and 13 FTEs added throughout Canada. Calculating relative program performance as a function of jobs created per $1M of program budget is helpful in comparing different program years. The FNCP program was estimated to create 8.7 total jobs per $1M of investment in 2021.

Table 9: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)* - Ontario	FTE *(in person-years)* - Total	Total Jobs *(in person-years)* - Ontario	Total Jobs *(in person-years)* - Total	Total Jobs per $1M Investment *(in person-years)*
Direct	6	6	8	8	3.9
Indirect	3	4	5	5	2.6
Induced	2	3	3	4	2.2
Total	**12**	**13**	**15**	**17**	**8.7**

Section 7 Key Findings and Recommendations

The following section presents detailed key findings and recommendations for the evaluation. Please note that given the nature of findings 9 and 10, the team does not provide related recommendations.

Finding 1: **The number of projects completed under FNCP during the Interim Framework (2019-2021) was 784.** The size of the FNCP program population suggests that this is a relatively small program and participants are likely hard-to-reach.

Recommendation 1. Conduct an analysis to understand the remaining potential size of the First Nations population that could be supported by program activities. This could include a postal code analysis based on income levels and estimated housing counts to understand both the potential for the program and whether any of the First Nation communities remain underserved by IESO programming.

Finding 2: The FNCP measure offerings are limited compared to other income eligible direct-install programs in IESO territory. There were no weatherization projects completed in FNCP participant homes during the Interim Framework. The FNCP program still distributes power bars with timers rather than smart power bars to participants. In addition, measures such as indoor clothes drying racks, programmable thermostats, and smart thermostats were not provided to participants. While some measures may not be appropriate for all homes, these measures can help reduce the energy burden of FNCP participants and provide additional savings opportunities for FNCP. These measures are represented in the Measures and Assumptions List (MAL) already and are actively distributed to participants in similar income-eligible direct install programs.

Recommendation 2a. Weatherization upgrades can provide important savings opportunities and health upgrades for participants. Including weatherization upgrades as an offer for participants may be an important measure to help deepen energy savings on a per-unit basis. The FNCP could emphasize and implement weatherization upgrades to both auditors and participants if the program is made available in the future.

Recommendation 2b. Consider offering smart power bar products to eligible FNCP participants in the future. These are typically the tier-2 smart power bars and are installed with audiovisual (AV) equipment. These measures may provide greater savings to FNCP participants. If included in the FNCP offering, ensure that the location of these power bars is documented if not installed with AV equipment.

Recommendation 2c. Consider offering eligible participants indoor clothes drying racks. These products provide the participants with dryers an opportunity to reduce energy through passive means.

Recommendation 2d. Consider offering either programmable or smart thermostats for eligible participants. Removing old, manual thermostats with smart or programmable thermostats offer both energy savings and increased thermal controls for FNCP participants.

Recommendation 2e. Further consider the relative cost effectiveness (CE) of these potential new measures. Referencing the PY2021 HAP evaluation, the above recommended measures typically were near to or above the median measure-level TRC ratio of 0.81 in the HAP. Specifically, the measure-level TRC ratios from HAP were: weatherization (0.83-0.98), smart power bar (0.72), indoor drying rack (2.02), and programmable thermostats – low voltage (1.66-2.11). The exception to the high measure-level CE performance were line voltage thermostats, having a TRC ratio range of 0.26 to 0.28.

Finding 3: FNCP program tracking data includes completed projects and installed measures along with unique identifiers for each. However, the tracking data does not typically include key characteristics that are collected during audits such as building or equipment type. This information can be used to better estimate savings impacts and to provide insights for future program offerings. These data points are often collected and included in the data collection forms that are used during in-home audits. However, only in some cases is this information captured in the program tracking data. For example, 94% of FNCP participant records were missing building type information and no mechanical equipment details are included in the data. If additional programming for First Nations Communities is offered in the future, additional measures such as cold-climate heat pumps or heat pump water heaters may be offered through the program. Having these additional data points will be valuable for program staff, vendors, and the evaluation team to assess the impacts of any new measures. The program tracking data did include completed projects and installed measures, including variables to identify unique projects and measures. These unique identifying variables are critical for impact accounting over multiple years in a framework.

Recommendation 3a. Continue to include variables that can be used to identify unique projects and measures within the tracking data. If possible, limit the annual program tracking data to projects that are fully completed.

Recommendation 3b. Work with program staff and implementation contractors to incorporate additional details into the tracking data such as building type and mechanical equipment (e.g., type and fuel) and any additional data that are collected on-site (e.g., efficiency, capacity). This could include revising the IESO's Field Audit Support (Fast) Tool program or supporting the development of a new uniform electronic data collection form for auditors to fill out on-site which can then be uploaded directly into the tracking data.

Finding 4: Participants, contractors, IESO staff, and delivery vendor staff recommended offering additional equipment if the program is offered in the future. Nearly two-thirds (62%) of surveyed participants provided recommendations for additional energy-efficiency equipment or services for inclusion. These participants most often recommended windows and door (21%), stoves (20%), and water heating (15%). The surveyed contractor was least satisfied with the number and types of equipment incentivized through the program, and recommended several new measures for inclusion, including clothes washers and dryers, and dishwashers. IESO staff and delivery vendor staff noted the importance of properly ventilated homes, with staff suggesting that ventilation improvement support be considered. Staff also recommended identifying potential

ways to offer heat pumps to customers in the future, potentially in partnership with other programs or funding streams.

Recommendation 4a. Consider offering additional types of equipment, such as windows and door, water heating, clothes washers and dryers, dishwashers, and heat pumps. Refer to Recommendation 2 for additional measure recommendations.

Recommendation 4b. Consider the feasibility of offering ventilation improvement support in the future, especially for homes receiving weatherization or heating upgrades.

Recommendation 4c. Look for opportunities offer heat pumps to customers, potentially in partnership with other programs or funding streams.

Recommendation 4d. Further consider the relative cost effectiveness (CE) of these potential new measures. Household appliances have yielded the lowest measure-level TRC ratios (0.02 to 0.20). Space heating and cooling measure-level TRC ratios fared better (TRC ratios 0.14 to 0.43) but are still well below 1.0. Conversely, as stated in Key Finding #2 above, using the HAP as a reference, weatherization measures tended to pull up program-level CE, having measure-level TRC ratios above the program's median measure-level TRC ratio.

Finding 5: Directly engaging with community members is critical to the success of the program. Distrust of government agencies and outside organizations or individuals was a barrier to participation mentioned by both IESO staff and delivery vendor staff. To help address this, the program hired and trained local community members and a First Nations-affiliated delivery vendor. The surveyed program contractor stressed the importance of having First Nation community members involved in participant recruitment, noting that it is critical to generating leads and alleviating skepticism about the program. IESO staff and delivery vendor staff stressed this as well, and indicated that the community-based enrollment events the vendor held prior to the pandemic were well-received by community members and helped to build relationships and trust.

Recommendation 5. If the program is offered in the future, continue to hire and train local community members as canvassers, auditors, and contractors and continue to engage with the community through in-person enrollment events.

Finding 6: Appliances and weatherization were impacted by supply chain disruptions and rising costs. As a result of COVID-19 and other economic conditions, supply chain disruptions and rising costs have had major impacts on program measure costs in recent years. IESO staff reported that these cost increases and supply chain issues have meant that the weatherization cost caps often did not cover the cost of the installations. The delivery vendor staff indicated that they were locked into pre-pandemic supply cost agreements which were difficult for suppliers to meet given increasing costs and availability constraints. The interviewed contractor cited rising measure costs and increasing operating costs as having impacts on their bottom line.

Recommendation 6. If the program is made available in the future, perform measure-related cost caps reviews, including additional market research and cost evaluations of relevant program measures (e.g., appliances, weatherization).

Finding 7: Energy-efficiency education activities are likely resulting in savings. Just over one-half (56%) of participants said the auditor discussed additional ways to save energy in the home, and of these participants, nearly three-fourths (74%) said they had tried at least one of the additional ways to save energy since having the audit performed.

Recommendation 7. Encourage more auditors to discuss additional ways to save energy with participants.

Appendix A Detailed Methodology

This appendix presents the methodology applied for various components of the FNCP evaluation: impact, cost-effectiveness, avoided GHG emissions, process, and jobs impacts.

A.1 IMPACT METHODOLOGY

This appendix presents additional details about the impact evaluation methodology. A summary of the methodology was provided in Section 2. As noted above, IESO EM&V staff and the NMR team agreed to use the entire FNCP population, from both the Interim Framework and CDM Framework, to determine the desk review sample. However, only the impact results from the Interim Framework are presented in this report (PY2019, PY2020, and PY2021 projects).

A.1.1 Impact Sampling

The NMR team sampled FNCP at the project level to generate data for the desk reviews (Table 7). Initially, the projects were examined to determine what measures and combination of measures were most common across projects to ensure that strata could be created without excluding any measure categories. Projects were then binned based on the level of deemed gross savings for the entire project. These bins were the high-savers (projects whose summed measure savings were in the top 20% of savings), medium-savers (projects whose summed measure savings were in-between 33% and 80% of total distributed savings) and low-savers (projects whose summed measure savings were in the lowest 33% of total distributed savings). The NMR team used the projects that resulted in the top 20% of program savings to sample from for the desk review. Initial allocations did not yield enough sample points to obtain the desired confidence levels for some of the critical measures of interest. To address these deficiencies, the NMR team re-ran the allocation, oversampling low-incidence projects with dehumidifiers, freezers, and window air conditioners. These steps resulted in a final sample size of 105. This approach balanced competing needs, that the desk review sample include the most program savings possible while covering as many low-incidence measures as possible.

Table 10: Desk Review Sample Summary

n	105
Avg. # of Measures per Project	8
Avg. kWh Deemed Savings per Project	2,231

A.1.2 Program Tracking Database Review

The NMR team analyzed the participant database and conducted a cross-cutting assessment to identify the evaluation priorities and to develop a sampling plan. The NMR team assigned priorities based on the following metrics:

- Measures that accounted for the largest share of savings
- Measures that have the most uncertainty around their estimated savings

- The amount of evaluation work done for each measure in previous evaluations

The NMR team also conducted a comprehensive review of the FNCP tracking database to identify key measures, savings discrepancies, and other issues that impact the accuracy of reported savings. The review checked for consistency between measures and the Measures and Assumptions List (MAL) values and verified the accuracy of reported savings calculations based on the IESO substantiation sheet algorithms for prescriptive measures that were updated as a part of the PY2019 impact evaluation activities. The NMR team also leveraged the database to calculate gross and verified net savings for the entire population. Equation 1 shows the program tracking data correction factor calculation, which aligned reported savings with the updated PY2019 evaluation substantiation sheet savings values. Note that if there were no errors or inconsistencies in the reported savings calculations, the correction factor would equal one.

Equation 1: Program Tracking Data Correction Factor

$$Tracking\ Data\ Correction\ Factor\ (CF) = Deemed\ savings\ value\ (PY2019\ Updated\ Substantiation\ Sheet\ Savings) \div Reported\ Saving$$

A.1.3 In Service Rate (ISR) and Hours of Use (HOU) Analysis

The NMR team surveyed FNCP participants to verify the number of measures installed and in use on their premises. The NMR team applied the ISR findings to verified savings calculations for all measures that achieved the desired sampling error (10%) at the 90% confidence interval (CI) based on the participant survey. Due to multiple measures not achieving these thresholds, the evaluation team determined a minimum of 10 responses were needed to apply an ISR result. The only measures that did not have an ISR adjustment applied due to lack of responses were the dehumidifier and window air conditioner (AC) measure categories.

The NMR team also surveyed participants to determine HOU for measures more directly impacted by occupant usage. Unlike the ISR analysis, only select measures received HOU adjustments, detailed below:

Lighting. The NMR team determined that further evaluation would be necessary to consider the self-reported lighting usage values as valid for substituting into substantiation sheets and/or calculating verified lighting savings. The substantiation sheets source values from studies that logged actual lighting usage in residential settings. Self-reported HOU did not align with values in the substantiation sheets, survey respondents reported using lighting twice as much as metered results from various other evaluations.

Aerators. The NMR team determined that further evaluation would be necessary to consider the self-reported aerator usage values as valid for substituting into substantiation sheets and/or calculating verified aerator savings. Survey respondents reported aerator HOU over five times greater than those documented in IESO substantiation sheets.

Block heater timers. The NMR team updated block heater timer HOU based on PY2021 survey results after comparing them with the block heater substantiation sheet values, which established HOU based on self-reported survey responses from the PY2017 block heater timer pilot evaluation. Survey respondents reported less usage than the levels documented in IESO

substantiation sheets, including fewer days per year, fewer baseline operating hours (before timer), and more efficient operating hours (after timer).

Dehumidifiers. The NMR evaluation team defaulted to the substantiation sheet values for dehumidifiers due to the limited number of survey responses for dehumidifier end-uses.

Showerhead. The NMR evaluation team used default substantiation sheet values for showerheads due to the limited number of survey responses regarding shower usage and the uncertainty in applying self-reported water usage data from a small population of participants to the broader program population.

The results for the ISR and HOU aspects of the participant surveys are discussed in Appendix B.2 and Appendix B.3, respectively.

A.1.4 Engineering Desk Reviews

The engineering desk reviews consisted of a review of a sample of 105 projects that the NMR team selected as part of the program tracking database review process. The program delivery vendor provided the NMR team with documentation for the sampled projects. The NMR team conducted a thorough review of the detailed project documents, which consisted of application forms, invoices, appliance shipment confirmation, photos, and auditor data collection forms. Note that no weatherization measures were included in the FNCP program tracking data.

A.1.5 Prescriptive Measures

The NMR team assessed prescriptive measure quantities and measure descriptions based on the documentation provided for the sampled projects. The NMR team conducted additional research to determine the actual nominal energy usage for appliance measures based on existing and new equipment model numbers (when available) to reflect savings estimates more accurately from these measures. The NMR team used the program tracking data review, the PY2019 review of other TRM's, and the desk review to calculate measure-specific RRs, which the NMR team then applied to the population. The NMR team generated measure specific ISR values from participant survey results and then applied them to gross savings calculations. In addition, some measures received HOU adjustments because of the participant surveys. Equation 2 shows the gross verified savings calculation for prescriptive measures. Note that if there were no corrections as a result of the program tracking data review nor adjustments made during the PY2019 substantiation sheet savings review (Equation 1), the RR would only reflect any discrepancies found during the desk review (i.e., quantity discrepancies or installed measure inconsistencies).

The inputs for the equation are described below:

- **Gross verified savings:** The evaluated savings after all evaluation activities—outside of net-to-gross—are conducted.
- **Desk review RR:** This is determined based on the project file documentation. For example, some measures have discrepancies in quantities or types and are included in the tracking data but not verified in the project file documentation.
- **Adjusted TRM Correction Factor (CF):** A general evaluation process to ensure the reported savings align with deemed savings values that are defined in the substantiation sheets (outlined in Equation 1).
- **ISR:** measure specific in-service rates are determined from the participant surveys and are applied to savings to account for some measures that are distributed to participants that are not used. For example, 94% of lightbulbs that were distributed by the program are still in use which is then applied to the savings value for the measure.
- **HOU adjustment:** Hours of use adjustments impact the amount of savings for a given measure. The HOU influence the degree of savings that are calculated. This is generally one or two variables within the algorithm defined by the measure's substantiation sheet.
- **Measure quantity:** The number of measures that a participant received. For example, a participant received 20 lightbulbs would have the per-unit savings value multiplied by 20.

Equation 2: Gross Verified Savings – Prescriptive Measures

$$Gross\ Verified\ Savings = Desk\ Review\ RR \times Adjusted\ TRM\ CF \times ISR \times HOU\ adjustment\ X\ Measure\ Quantity$$

A.2 COST-EFFECTIVENESS METHODOLOGY

This appendix presents additional details about the cost-effectiveness methodology. A summary of the methodology was provided in Section 2.2.

The cost-effectiveness analysis was completed using IESO's *Cost Effectiveness Tool* and in accordance with the IESO *Cost Effectiveness Guide for Energy Efficiency.*[9] The tool was populated with the following key information from the evaluation:

- First year energy and demand savings
- EUL
- End use load profile
- Incremental equipment and installation cost
- Net to gross ratios for energy savings and demand savings

[9] *Cost Effectiveness Guide for Energy Efficiency Version 4*, Independent Electricity System Operator, January 20 2021, https://www.ieso.ca/-/media/Files/IESO/Document-Library/EMV/CDM_CE-TestGuide.ashx

- Adjustments in savings over the life of the program

Additionally, the IESO provided the following information for use in the cost-effectiveness calculation:

- Program administrative costs
- Incentive amounts

The IESO Cost Effectiveness Tool provides many outputs and varying levels of granularity. While the NMR team leveraged various outputs to develop findings and recommendations, the key outputs the team selected to directly present in this report are as follows:

- TRC test costs, benefits, and ratio
- PAC test costs, benefits, and ratio
- Levelized delivery cost by kWh and kW

A.3 PROCESS METHODOLOGY

This appendix presents additional details about the process evaluation methodology. A summary of the methodology was provided in Section 2.2. During the process evaluation, the NMR team collected primary data from key program actors, including the IESO staff, the delivery vendor staff, participants, and contractors. (Table 8). The NMR team collected the data using different methods, depending on what was most suitable for a particular respondent group (e.g., web surveys or telephone-based-IDIs). This data, when collected and synthesized, provides a comprehensive understanding of the delivery of the program.

The NMR team directly carried out or managed all process evaluation data collection activities and developed all survey instruments, interview guides, and sample files for use in the interviews and surveys. The survey instruments and interview guides were approved by the IESO EM&V staff, and the data used to develop the sample files came from program records supplied either by the IESO EM&V staff or the delivery vendor. IESO EM&V staff and the NMR team agreed to use the entire FNCP population, from both the Interim Framework and the CDM Framework, to determine the process evaluation sample. Given the similarities in program design, participant feedback from both frameworks are provided together.

The NMR team conducted the in-depth telephone interviews with the IESO staff and the delivery vendor staff using in-house staff (rather than through a survey lab). The NMR team fielded FNCP participant as both web and phone-based surveys and fielded the FNCP contractor survey as a phone-based survey. The surveys were fielded in partnership with the Resource Innovations survey lab based in Toronto. The NMR team designed the survey instruments and developed the sample lists. The Resource Innovations survey lab then programmed and distributed the surveys using Qualtrics survey software. The NMR team worked closely with the Resource Innovations survey lab to test the programming of each survey and to perform quality checks on all data collected.

Table 11: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Fielding Firm	Completed	Population	90% CI Error Margin
FNCP IESO Staff and Delivery Vendor Staff	Phone IDIs	NMR Staff	2	2	0%
FNCP Contractors	Phone	Nexant Survey Lab	1	2	N/A*
FNCP Participants	Web	Nexant Survey Lab	131	1,403	6.9%

*Error margin not displayed if the respondent count is below 30 unless census is achieved.

A.3.1 IESO Staff and Delivery Vendor Staff Interviews

The NMR team completed one interview with one IESO staff member and one interview with one delivery vendor staff members to gain a detailed understanding of FNCP (Table 9). The purpose of the interviews was to better understand program design, delivery, and barriers, and solicit suggestions for improvement.

The interview topics included program roles and responsibilities, program design and delivery, marketing and outreach, market actor engagement, program strengths and weaknesses, and suggestions for improvement.

The NMR team identified the appropriate staff to interview in consultation with the IESO EM&V staff. Each interview took approximately sixty minutes to complete. The NMR team conducted IDIs via phone with the IESO staff and the delivery vendor staff from March 10 to May 20 of 2022.

Table 12: FNCP IESO Staff and Delivery Vendor Staff Interview Disposition

Disposition Report	Count
Completes	2
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	-
Screened Out	-
No Response	-
Total Invited to Participate	2

A.3.2 Contractor Survey

The NMR team surveyed one FNCP contractor from a sample of two and contractors (Table 10). The purpose of the survey was to better understand FNCP auditor and contractor perspectives related to program delivery.

The interview topics included role in the program, firmographics, the application process, training, and education received, outreach and marketing to customers, program barriers, suggestions for program improvement, including additional equipment or services to consider, and job impacts.

The NMR team developed the survey sample with support from the delivery vendor, who provided a contact list of two contractors. The NMR team employed a census-based approach to reach the largest number of respondents possible given the small number of unique contacts.

The NMR team delivered the survey over the phone in partnership with the Resource Innovations survey lab using Qualtrics survey software. Survey implementation was conducted between April 6 and June 13 of 2022. The survey took an average of 20 minutes to complete.

Table 13: FNCP Auditor and Contractor Survey Disposition

Disposition Report	Count
Completes	1
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	-
Screened Out	-
No Response	1
Total Invited to Participate	2

A.3.3 Participant Survey

The NMR team surveyed 174 FNCP participants from a sample of 1,051 unique contacts (Table 11). The purpose of the survey was to better understand FNCP participant perspectives related to program experience.

The survey topics included ISRs; HOU; how participants learned about and applied to the program; motivations for doing the upgrades; education and materials provided by the energy auditor; suggested energy-saving methods that participants implemented; satisfaction with various aspects of the program process; suggestions for program improvement, including additional equipment or services to consider; job impacts; and demographics.

The NMR team developed the sample from program records provided by the IESO EM&V staff. Given the large number of program participants, the NMR team randomly selected a subset of participants for inclusion in the survey sample.

The NMR team delivered the survey over the web and phone in partnership with the Resource Innovations survey lab using Qualtrics survey software. The NMR team conducted survey implementation between March 17 and April 19 of 2022. The survey took an average of 14 minutes to complete after removing outliers.[10] The NMR team sent weekly e-mail reminders to non-responsive contacts over the course of web survey fielding.

[10] Note that the survey was designed to allow the respondent to come back to the survey at a later time to complete it if they preferred. The average survey time was calculated with this in mind and assumed that any survey that took 40 minutes or more to complete was likely completed by a respondent who took a break before completing the survey.

Table 14: FNCP Participant Survey Disposition

Disposition Report	Web	Phone	Total
Completes	101	30	131
Emails bounced	94	-	94
Bad Contact Info (No Replacement Found)	1	-	1
Unsubscribed	-	-	0
Partial Complete	50	-	50
Screened Out	14	-	14
Busy	-	5	5
Callback	-	40	40
Hard Refusal	4	26	30
No answer	-	226	226
No Eligible Respondent	-	5	5
Non-working #	-	47	47
Voicemail	-	91	91
Agreed to Complete Online	-	9	9
Wrong Number	-	3	3
Language Barriers	-	-	0
No Response	452	0	452
Total Invited to Participate	716	482	1,198

A.4 JOBS IMPACT METHODOLOGY

This appendix presents additional details about the job impact methodology. A summary of the methodology was provided in Section 2.4.

The analysis of job impacts utilized the StatCan IO model to estimate direct and indirect job impacts. IO models are used to analyze the propagation of exogenous economic shocks throughout an economy. The models represent relationships, or flows, of inputs and outputs between industries. A system of linear equations represents how certain industries' outputs become the inputs for other industries, while other outputs become consumer goods. When an energy-efficiency program such as FNCP is funded and implemented it creates a set of "shocks" to the economy, such as demand for specific products and services, and additional household expenditures from energy bill savings. The shocks propagate throughout the economy and their impacts can be measured in terms of variables such as economic output and employment.

A.4.1 Statistics Canada IO Model

The Industry Accounts Division of StatCan maintains two versions of a Canadian IO model: a national, and an interprovincial model [11]. The models are classical Leontief-type open-IO models [12], where some production is consumed internally by industries, while the rest is consumed externally. The models provide detailed information on the impact of exogenous demands for

[11] Statistics Canada - Industry Accounts Division System of National Accounts; (2009). User's Guide to the Canadian Input-Output Model. Statistics Canada. Ret

[12] Ghanem, Ziad; (2010). The Canadian and Inter-Provincial Input-Output Models: The Mathematical Framework. Statistics Canada – Industry Accounts Division.

industry outputs. The impacts are quantified in terms of production, value-added components (such as wages and surplus), expenditures, imports, employment, energy use, and pollutant emissions by industry. The StatCan IO Model is composed of input, output, and final demand tables. IO tables are published annually with a lag of approximately three years, so the model used for this analysis represents the Canadian economy from 2018. The model has been used to model employment impacts from a wide range of economic shocks, including structural changes to the Canadian economy[13], the bovine spongiform encephalitis (BSE) crisis in the early-mid 2000's[14], and the construction of hydropower projects[15].

The supply and use tables (SUTs) for the Canadian IO model break the economy down into 240 industries and 500 Supply and Use Product Classification (SUPCs). They represent the economic activity of a specific Canadian province, or of the whole country. The SUTs show the structure of the Canadian economy, with goods and services flowing from production or import (supply tables) to intermediate consumption or final use (use tables). Intermediate consumption refers to domestic industries using goods and services to produce other products and services. Final use includes consumption of products by households, non-profit institutions serving households, and governments; capital formation; changes in inventory; and exports. Provincial SUTs are like national SUTs, but for the addition of interprovincial trade to go along with the international imports and exports.

StatCan offers the IO Model as a service but not as a product. StatCan economists work with researchers to develop the data and inputs to develop and answer specific research questions using the model. The end product is a set of outputs from running the model.

A.4.2 Approach

The process for using the StatCan IO model followed three steps:

1. Developed specific set of research questions to address with the IO model, reflecting the exogenous shocks caused by the program.
2. Developed model inputs, which consisted of exogenous shock values (in dollars) to simulate the effects of FNCP.
3. Ran the model and interpreted the results.

The following sections cover each step in more detail.

A.4.2.1 Developed Specific Research Questions

The first step in modeling the job impacts from FNCP was to determine which specific research questions (RQs) the model would answer. In a scenario without the existence of FNCP, customers receive electricity from IESO and pay for it via the monthly billing process. Delivering FNCP

[13] Gera, S & Masse, P; (1996). Employment Performance in the Knowledge-Based Economy, Gouvernement du Canada - Industrial Organization 14, Gouvernement du Canada - Industry Canada.
[14] Samarajeewa, S. et al.; (2006). Impacts of BSE Crisis on the Canadian Economy: An Input-Output Analysis. Prepared for the Annual Meeting of the Canadian Agricultural Economics Society.
[15] Desrochers, R. et al.; (2011). Job Creation and Economic Development Opportunities in the Canadian Hydropower Market. Canadian Hydropower Association.

introduces a set of economic supply and demand shocks to different sectors of the economy. The four research questions below illustrate these shocks:

1. **What are the job impacts from new demand for energy-efficient measures and related program delivery services?** Funds collected for FNCP generate a demand for efficient equipment and appliances. They also generate a demand for services related to program delivery, such as audits at customer premises, call center operations, and general overhead for program implementation and staffing. This demand creates jobs among firms that supply these products and services.
2. **What are the job impacts from household energy bill savings? Once** energy-efficient equipment is installed in households, the customers realize annual energy savings for the useful life of the measures. Households can choose to put this money into savings or to spend it on goods and services in the economy. This additional money and the decision to save or spend has implications for additional job creation. For instance, additional household spending on goods and services generates demand that can create jobs in other sectors of the economy.
3. **What are the job impacts from funding the energy-efficiency program?** IESO energy-efficiency programs are funded via volumetric bill charges for all customers – both residential and non-residential. This additional charge can reduce the money that households have for savings and for spending on other goods and services. It also impacts non-residential customers. This additional bill charge results in a negative impact on jobs in the Canadian economy.
4. **What are the job impacts from reduced electricity production?** The energy-efficient measures will allow households to receive the same benefit while using less electricity. The program as a whole will reduce the demand for electricity in the residential sector. This reduced demand could have upstream impacts on the utility industry (e.g., generation) and related industries, such as companies in the generator fuel supply chain.

A.4.3 Developed Model Inputs

The second step in modeling job impacts was to gather the data required for the StatCan IO model to answer each of the research questions. Model input data included the dollar values of the exogenous shocks from program delivery. The sources of data for each research question were as follows:

1. **Demand for energy-efficient measures and related program delivery services.** The StatCan IO Model divides the Canadian economy into 240 industry classifications and 500 SUPCs. Each measure installed as part of the program was classified into one of the SUPCs. The dollar value for each product-related demand shock was calculated using the measure cost and quantity data from the impact evaluation (see Section 2.4).

   Services that were part of the delivery process were also classified into SUPCs. The vast majority of these services were either audits or program administrative services. Customer audits had flat fees for calculating the value of the demand shock and the value of administrative services was obtained from program budget actuals.

It was necessary to specify the amount of each demand shock attributed to labor versus non-labor. For the product categories, we used the labor versus non-labor cost estimate proportions from the measure research conducted as part of the cost-effectiveness analysis. For the service categories, the IO model contained underlying estimates that defined the portion of labor versus overhead (non-labor).

2. **Household energy bill savings.** This value was calculated for the model as the net present value (NPV) of the discounted future stream of energy bill savings by participants. It was calculated by multiplying net energy savings[16] (in kWh) in each future year by that future year's retail rate ($/kWh). This calculation was performed for each future year through the end of the measure's expected useful life (EUL). Savings beyond the EUL were assumed to be zero. Measure-level energy saving estimates were obtained from the impact evaluation. The other calculation parameters (discount rate, measure EULs, and retail rate forecast) align with the cost-effectiveness analysis.

   Customers' intentions for whether to spend or save the money saved on energy bills was obtained via a short section on the customer surveys. The percentages that indicated what the customers would do with the bill savings were obtained from the participant surveys through the following two questions:

   J1. What do you anticipate you will do with the money saved on electricity bills from the energy-efficient equipment upgrades?

   1. Pay down debt or put the money into savings
   2. Purchase more goods and/or services
   3. Split – put some money into savings/debt payments and use some money to purchase more goods/services
   4. Other. Please specify.
   98. Don't know
   99. I'd rather not answer

   [BASE: IF RESPONDENT WILL SPLIT MONEY SAVED IN VARIOUS WAYS (J1=3)]

   J2. Approximately what would be the split between savings/debt payments and purchasing more goods/services? [ALLOW MULTIPLE RESPONSE OPTION]

   1. Percent saved or used to pay down debt [NUMERIC RESPONSE BETWEEN 0 and 100]
   2. Percent used to purchase more goods and services [NUMERIC RESPONSE BETWEEN 0 and 100]
   98. Don't know
   99. I'd rather not say

[16] The net-to-gross ratio for HAP is 1, so the net energy savings are the same as gross savings.

For estimating job impacts, the key input value was the amount of bill savings that customers would spend—as opposed to save.

3. **FNCP funding.** IESO energy-efficiency programs are funded by a volumetric charge on electricity bills and, volumetrically, residential customers accounted for 35 percent of consumption and non-residential customers accounted for 65 percent in 2021[17]. The overall program budget was distributed between these two customer classes by these percentages.
4. **Reduced electricity production.** The NPV of retail savings (estimated as part of RQ2) was also the input for examining a potential impact of producing less electricity.

A.4.3.1 Run Model and Interpret Results

Determining the total job impacts from FNCP required considering possible impacts from each the four shocks represented by the research questions. Addressing the four research questions above required only two runs of the StatCan IO model, as certain components of the shocks could be consolidated, and others addressed without full runs of the model. The two shocks that were modeled were as follows:

1. Demand shock as outlined in RQ1, representing the impact of the demand for energy-efficient products and services due to FNCP.

2. Household expenditure shock representing the net amount of additional spending that the residential sector will undertake. This was estimated by taking the NPV of energy bill savings and subtracting the residential contribution to program funding. Thus, the model run combined RQ2 with the residential component of RQ3.

The model output generated three types of job impact estimates: direct, indirect, and induced impacts – as described in Section 2.4.

[17] Annual Planning Outlook – A view of Ontario's electricity system needs; 2020. IESO.

Appendix B Additional Impact Evaluation Results

This appendix includes additional results associated with the impact evaluation activities. Higher-level results were provided in Section 3.

B.1 Detailed Impact Results

Table 12 presents the detailed measure-level results of the FNCP impact evaluation for the entire Interim Framework population. The savings values in the table represent the measure-level savings for the entire population. The quantity of measures installed during the Interim Framework is also included. The proportion of total program savings is also included to show the representative impact of each measure's energy and demand savings on FNCP. RRs for energy and demand are displayed in the table.

Table 15: Aggregate Measure-Level Energy and Demand Savings

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Lighting end-use									
=11W ENERGY STAR® Qualified LED A Shape (60W) (minimum 600 Lumen output) (Formerly: 7W – 11W ENERGY STAR® Qualified LED A Shape)	10,829	516,543	32.49	68%	73%	351,869	23.58	57.9%	39.2%
=14W ENERGY STAR® Qualified LED A Shape (75W) (minimum 800 Lumen output) (Formerly:10W – 14W ENERGY STAR® Qualified LED A Shape)	7	332	0.02	72%	76%	239	0.02	0.0%	0.0%
=16W ENERGY STAR® Qualified LED PAR 20 (minimum 600 Lumen output) (Formerly: 8W – 12W ENERGY STAR® Qualified LED PAR 20)	62	2,846	0.19	84%	86%	2,376	0.16	0.4%	0.3%
=23W ENERGY STAR® Qualified LED A Shape (100W) (minimum 1600 Lumen output) (Formerly: 17W – 23W ENERGY STAR® Qualified LED A Shape)	17	1,042	0.07	94%	96%	976	0.07	0.2%	0.1%
=23W ENERGY STAR® Qualified LED PAR (minimum 1100 Lumen output) (Formerly: 14W – 18W ENERGY STAR® Qualified LED PAR 38)	14	739	0.06	83%	74%	616	0.04	0.1%	0.1%
=6W ENERGY STAR® Qualified LED MR 16 / PAR 16 (minimum 250 Lumen output) (Formerly:7W – 10W ENERGY STAR® Qualified LED MR 16 / PAR 16 - GU 10 Base)	187	7,050	0.56	94%	79%	6,654	0.45	1.1%	0.7%
ENERGY STAR® LED Wet Location Rated PAR lamp = 23 Watt (minimum 1100 Lumen output)	75	3,990	0.30	83%	74%	3,331	0.22	0.5%	0.4%

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
LED Downlight with Light Output >600 and <800 lumens (Retrofit Measure List)	10	617	0.04	53%	54%	325	0.02	0.1%	0.0%
Lighting Total	**11,201**	**533,159**	**33.72**	**69%**	**73%**	**366,386**	**25**	**60.3%**	**40.8%**
Appliances									
Dehumidifier Replacement (ENERGY STAR Qualified 14.2 - 21.2 l/day)	3	728	0.23	59%	59%	428	0.14	0.1%	0.2%
Dehumidifier Replacement (ENERGY STAR Qualified 21.3 - 25.4 l/day)	1	199	0.06	72%	72%	143	0.05	0.0%	0.1%
Dehumidifier Replacement (ENERGY STAR Qualified 25.5 - 35.5 l/day)	55	10,065	3.25	114%	114%	11,466	3.67	1.9%	6.1%
Freezer Replacement (ENERGY STAR Qualified <7.75 cu ft)	59	1,947	0.24	62%	62%	1,204	0.17	0.2%	0.3%
Freezer Replacement (ENERGY STAR Qualified =7.75 - <12 cu ft)	31	1,612	0.22	447%	447%	7,206	0.98	1.2%	1.6%
Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	152	15,945	2.13	141%	141%	22,443	3.05	3.7%	5.1%
Freezer Replacement (ENERGY STAR Qualified 14.5 – 16.0 cu ft)	30	3,090	0.42	136%	136%	4,192	0.57	0.7%	0.9%
Refrigerator Replacement (10.0 – 12.5 cu ft)	5	900	0.12	84%	84%	752	0.10	0.1%	0.2%
Refrigerator Replacement (ENERGY STAR Qualified 15.5 – 16.9 cu ft)	29	5,945	0.78	73%	73%	4,333	0.57	0.7%	0.9%
Refrigerator Replacement (ENERGY STAR Qualified 17.0 – 18.4 cu ft)	295	64,310	8.55	89%	89%	57,443	7.55	9.5%	12.6%
Window Air Conditioner Replacement (ENERGY STAR Qualified 10,000 – 12,000 BTU/hr)	26	1,960	2.31	150%	150%	2,939	3.48	0.5%	5.8%
Window Air Conditioner Replacement (ENERGY STAR Qualified 6,000 – 7,999 BTU/hr)	58	2,378	2.84	78%	78%	1,849	2.19	0.3%	3.6%

Measure	Quantity Installed	Reported Savings - Energy (kWh)	Reported Savings - Demand (kW)	RR - Energy	RR - Demand	Verified Savings - Energy (kWh)	Verified Savings - Demand (kW)	Percent of Program Savings - Energy (kWh)	Percent of Program Savings - Demand (kW)
Window Air Conditioner Replacement (ENERGY STAR Qualified 8,000 – 9,999 BTU/hr)	31	1,798	2.14	137%	137%	2,468	2.92	0.4%	4.9%
Appliance Total	**775**	**110,877**	**23.30**	**105%**	**109%**	**116,865**	**25.42**	**19.2%**	**42.3%**
Domestic hot water (DHW)									
Efficient Aerators (bathroom) < 3.8 liters per minute (Lpm)	245	12,054	1.23	60%	57%	7,195	0.70	1.2%	1.2%
Efficient Aerators (kitchen) < 5.7 Lpm	330	41,415	3.96	92%	94%	38,068	3.71	6.3%	6.2%
Efficient Showerhead (handheld) < 4.8 Lpm	123	28,745	2.83	51%	50%	14,577	1.42	2.4%	2.4%
Efficient Showerheads (standard) < 4.8 Lpm	200	46,740	4.60	76%	75%	35,505	3.46	5.8%	5.8%
Hot Water Tank Insulation - Fiberglass R10	45	4,464	0.45	87%	94%	3,876	0.43	0.6%	0.7%
Hot Water Tank Pipe Insulation - ½" (per foot)	516	24,820	2.58	13%	13%	3,267	0.33	0.5%	0.6%
DHW Total	**1459**	**158,238**	**15.64**	**65%**	**64%**	**102,489**	**10.05**	**16.9%**	**16.7%**
Power Bars									
Power Bar With Integrated Timer	673	2,423	0.00	99%	N/A	2,393	0.08	0.4%	0.1%
Power Bar Total	**673**	**2,423**	**0.00**	**99%**	**N/A**	**2,393**	**0.08**	**0.4%**	**0.1%**
Miscellaneous									
Block Heater Timer (just timer)	666	159,241	0.00	12%	N/A	19,278	0.00	3.2%	0.0%
Miscellaneous Total	**666**	**159,241**	**0.00**	**12%**	**N/A**	**19,278**	**0.00**	**3.2%**	**0.0%**
Program Total	**14,774**	**963,937**	**72.7**	**63%**	**83%**	**607,410**	**60.1**	**100%**	**100%**

B.1.1 Lighting

The NMR team verified the savings for lighting measures using project file data and lighting specific information collected by FNCP auditors. There are various light bulb products that are offered by the program for direct installation based on the replaced bulb type. The overall energy RR for lighting measures was 69%. The lower RR was a result of the 2019 substantiation sheet adjustments, which lowered the delta between baseline wattage and efficient wattage values. In some cases, quantities of light bulbs were misaligned between the project documentation and the tracking data which also impacted the RR. In addition, the NMR team applied the ISR results from the participant survey to the gross verified savings. The impact of adjustments to lighting measures represents a primary driver to the program's overall RR as lighting measures account for over one-half (60%) of total verified savings for the program.

The lighting end-use category is dominated by 11-watt A-line bulbs which represents 58% of the program savings, while the 23-watt A-line bulb contributes only 0.2% of program savings. A-line bulbs are very common bulb shapes in residential settings, often used in both hard-wired and plug-in fixtures. In addition, A-line bulbs are easily swapped out, whereas other bulb shapes that are common in certain fixture types that may not be common in the FNCP participant home (i.e., candelabra shaped bulbs in a chandelier-type fixture or a reflector shaped installed into a recessed fixture).

B.1.2 Appliances

The NMR team verified the savings for appliances using the project file data and equipment-specific information collected by FNCP auditors. The NMR team applied model number lookups to incorporate project-specific values into the desk reviewed savings calculations instead of default reported savings input assumptions – for the installed equipment and, where possible, the existing equipment. This model-specific data typically included the size or capacity of the equipment and its annual energy consumption. During the desk reviews, the NMR team found that 16% of the appliances replaced were not the same size as their replacement. In these cases, the appliance was aligned with the corresponding size category to calculate the proportion of energy savings that are associated with replace on failure (i.e., associated with the verified baseline size rather than the existing equipment's). For example, if an 18 cubic foot refrigerator replaced one that was 15 cubic feet, the baseline energy usage would be calculated using the 15 cubic foot (existing) energy consumption for a portion of the equipment life (typically represents one third of the savings) and using the 18 cubic foot (replace on failure baseline) energy consumption to determine the remaining two-thirds of energy savings.

Energy savings RRs were generally high among appliances (105%), particularly with freezers. Appliances accounted for 19% of total program gross verified energy savings. The RR for appliance demand savings was also high at 109%, and they accounted for 42% of the program gross verified demand savings.

Refrigerators. The NMR team calculated verified savings based on project-specific annual energy consumption derived from model number lookups for the installed refrigerators and the existing equipment, while the reported savings used the minimum requirements for meeting the

ENERGY STAR efficiency specifications. The application of actual annual energy consumption values provides a more accurate savings estimate that does not rely solely on using the minimum ENERGY STAR specifications. Refrigerators accounted for 62,528 kWh in energy savings (88% RR) and 8.2 kW in demand savings (87% RR).

Freezers. The NMR team calculated verified savings for freezers in a similar way to refrigerators, leveraging model numbers to look up annual energy consumption and comparing it against the ENERGY STAR minimum values used in deemed savings.

Freezers accounted for 35,045 kWh in energy savings (155% RR) and 4.8 kW in demand savings (158%). The high RRs for freezers seem to be partially since the specific models offered by the program are on the low end of the size categories that freezers are grouped into, and therefore have lower energy consumption than the midpoint of each category, which is used to calculate the prescribed savings. In addition, the model number look up for specific annual energy consumption of existing appliances attributed to the high RR.

Dehumidifiers. Typically, the NMR team limited the data used to verify savings for dehumidifiers to the project specific capacity of the equipment (liters per day). The efficiency of the dehumidifiers offered by the program was consistent with the minimum ENERGY STAR specifications, so verified savings were relatively consistent with deemed savings. However, during project file reviews, the NMR team identified a recurring issue regarding the reported capacity which seems to be reported in pints as opposed to liters, this discrepancy accounts for the difference between reported and verified savings. There was also a lack of existing dehumidifier model number nameplates captured in project documentation, so reported savings and calculations used midpoint capacity assumptions for the appliance category. Dehumidifiers accounted for 12,037 kWh in gross verified savings (110% RR) and 3.9 kW in gross verified demand savings (109% RR).

Window Air Conditioners. Like other appliances, the NMR team calculated verified savings for window air conditioners by looking up the capacity and efficiency of the installed equipment. These metrics were relatively consistent with the ENERGY STAR minimum specifications used in deemed savings. The RR can be attributed to the use of actual (new and existing) capacity and CEER values rather than default assumptions. Window air conditioners accounted for 7,256 kWh in gross verified energy savings (118% RR) and 8.6 kW in gross verified demand savings (118% RR).

B.1.3 Power Bars with Timers

The high RR (99%) for the power bars with timers is due to the application of the ISR results. There were no adjustments made to the substantiation sheets for this measure. The power bars accounted for 0.4% of the program's gross total verified energy savings. There were no reported demand savings for power bars (673 units) in the tracking data. Due to this issue in the tracking data, the NMR team could not calculate an RR. The NMR team corrected demand savings for power bars in the verification process and they accounted for .01% of the program's gross verified demand savings. The NMR team notes that power bars with timers are no longer offered in other programs with similar measure offerings, such as HAP and EAP, instead smart power bars are offered which associated with significantly higher savings.

B.1.4 Domestic Hot Water

Domestic hot water (DHW) measures are only offered to participants with electric water heating systems. The NMR team primarily verified savings for water heating measures by confirming the water heater fuel-type, the measure types, and quantities in the project files matched the program tracking data. The lower RRs for pipe wrap measures were due to reported savings calculations referencing the total linear feet of insulation installed, which is standard data collection practice by auditors in the field, while the input assumption for reported savings values is in three feet increments. This resulted in an overestimation of reported savings by a multiple of three. The NMR team updated the deemed savings values for pipe wrap, aerators, and showerheads during the PY2019 substantiation sheet review. Additionally, there were some instances of pipe insulation in the data that were not confirmed in the project file documentation or were reported in homes with gas water heaters.

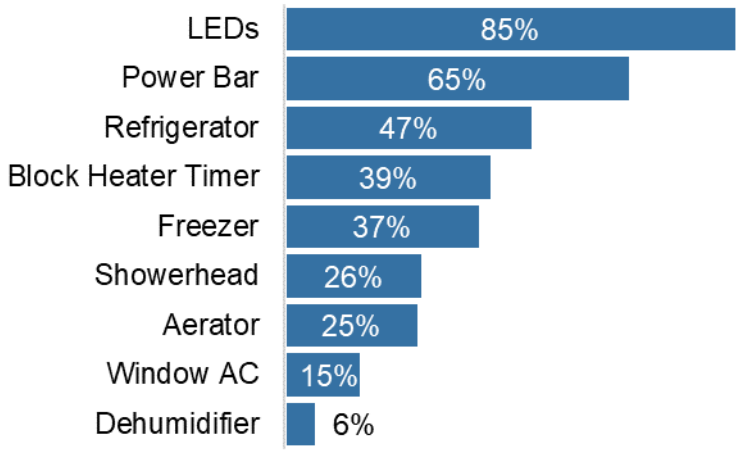
B.1.5 Miscellaneous Measures

The miscellaneous measure category only includes block heat timers. Like hot water measures, the NMR team verified savings for the miscellaneous measures by confirming the measure type and the quantity installed matched between the project files and the program tracking data. The RR (12%) for block heater timers is directly correlated with the ISR and HOU findings from the participant survey, which found that block heater timers were not used as frequently and for a shorter duration than assumed in the substantiation sheet value. There are no demand savings associated with block heat timers.

B.2 In-Service Rates

Figure 10 displays the energy-efficiency upgrades respondents confirmed receiving. Most respondents received LEDs (85%) and/or a power bar (65%). Almost one-half of respondents received a refrigerator (47%), and nearly two-fifths of respondents received a block heater timer (39%) and/or a freezer (37%).

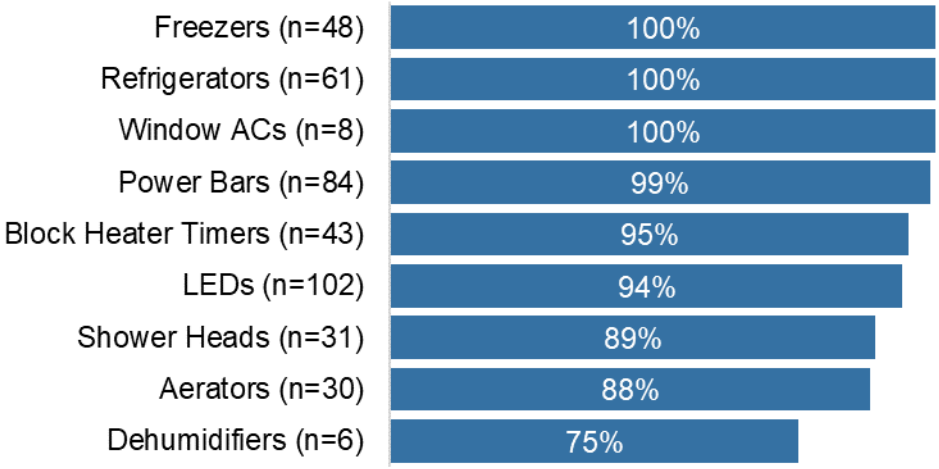
Figure 10: Energy-Efficiency Upgrades that Program Participants Received (n=131)



*Does not sum to 100% due to multiple response.

Figure 11 displays the ISRs for respondents' upgrades. All the freezers, refrigerators, and window ACs (100%) respondents received were still installed and functional at the time of the survey. Nearly all the power bars (99%), block heater timers (95%), and LEDs (94%) respondents received were still installed and functional. Only three upgrades had ISRs less than 90%: shower heads (89%), aerators (88%), and dehumidifiers (75%).

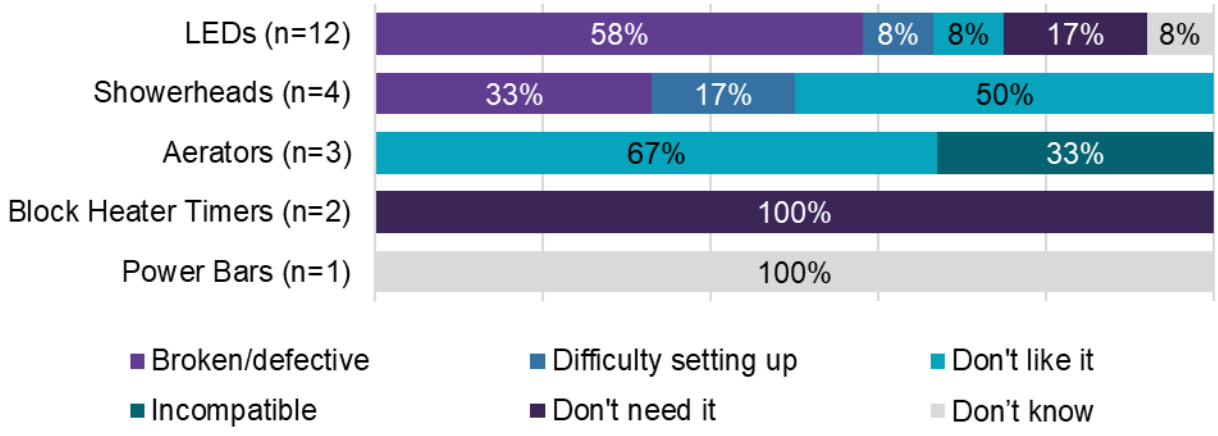
Figure 11: Energy-Efficiency Upgrade ISRs



*Does not sum to 100% due to multiple response.

Figure 12 displays the reasons respondents gave for uninstalling or removing upgrades. The most common reason for uninstalling LEDs (58%) was that they were broken or defective. The most common reason for uninstalling showerheads (50%) and aerators (67%) was simply not liking them. Both respondents who had uninstalled block heater timers said they did not need them.

Figure 12: Reasons Respondents Uninstalled or Removed Upgrades



*Does not sum to 100% due to rounding.

B.3 HOURS OF USE

The participant survey collected HOU information for several upgrades that homeowners received through the program. Figure 13 and Figure 14 display the average number of program-provided LEDs installed by room type and the average hours per day respondents used their LEDs. The highest number of LEDs installed occurred in bedrooms (average of 4.4 bulbs) and the highest hours of use per day occurred in kitchens (average of 10.0 hours).

Figure 13: Number of LEDs Installed by Room Type

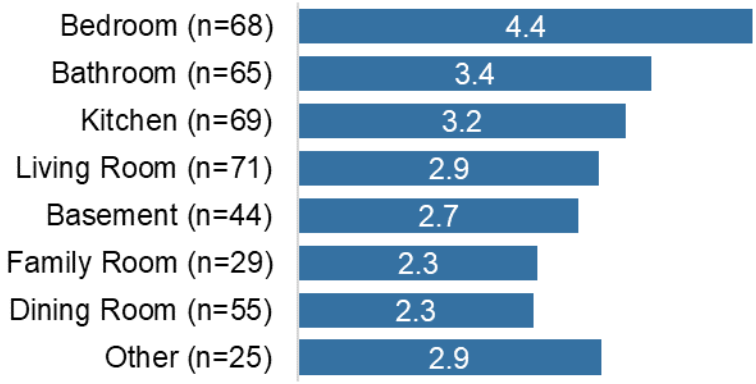
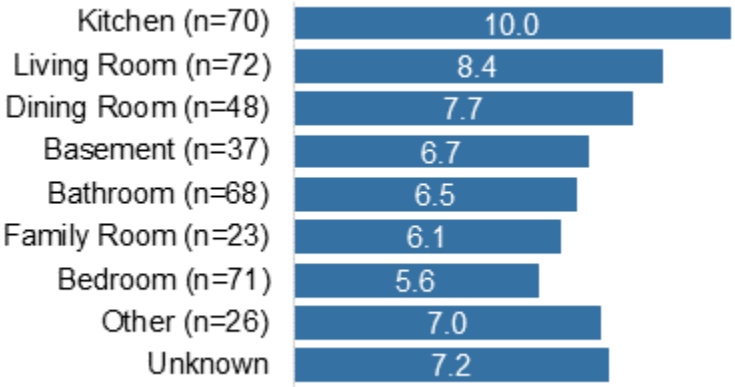


Figure 14: Hours per Day LEDs in Use by Room Type



On average, respondents took 13.5 showers per week. The average duration of each shower was 13.4 minutes. Figure 15 and Figure 16 display the distribution of shower frequency and duration among respondents.

Figure 15: Showers per Week (n=31)

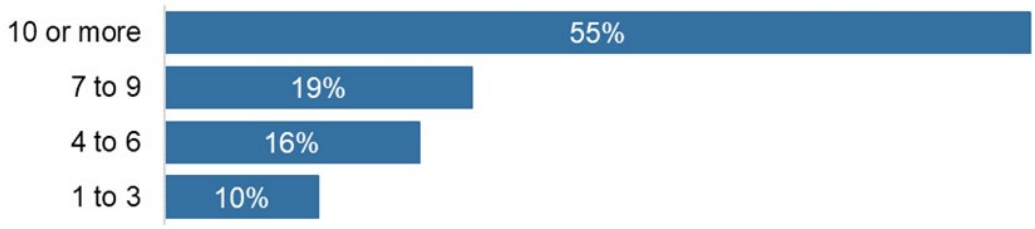
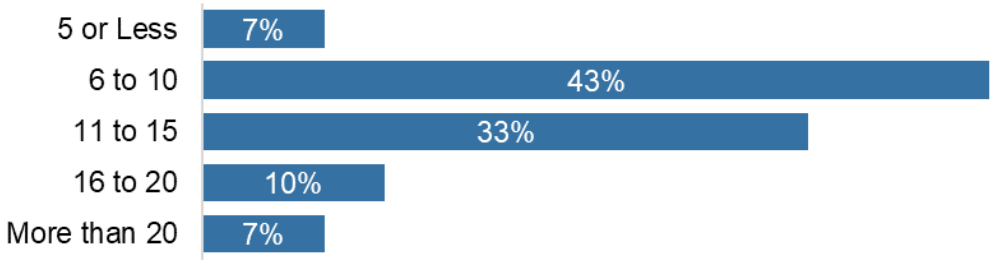


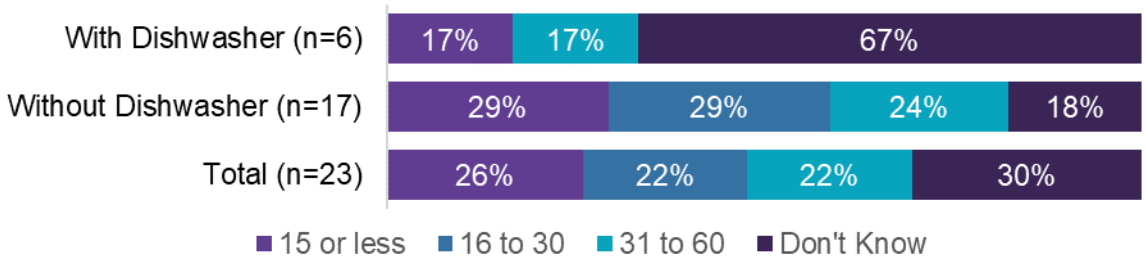
Figure 16: Minutes per Shower (n=30)*



*Excludes one outlier.

Figure 17 displays the minutes per day respondents with and without dishwashers used their kitchen aerators. Around one-fourth (26%) of respondents used their kitchen aerators for 15 minutes per day or less. On average, respondents used their aerators for 29.8 minutes per day.

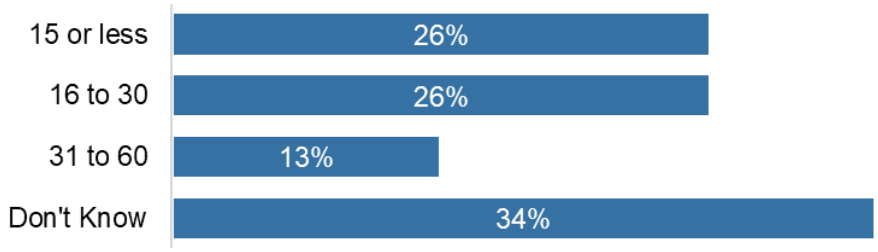
Figure 17: Minutes per Day Kitchen Aerator in Use*



*Does not sum to 100% due to rounding.

Figure 18 displays the minutes per day respondents used their bathroom aerators. Around one-fourth (26%) of respondents used their bathroom aerators for 15 minutes per day or less. On average, respondents used their aerators for 24.0 minutes per day.

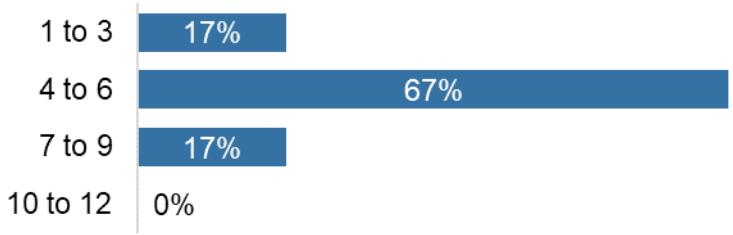
Figure 18: Minutes per Day Bathroom Aerator in Use (n=23)*



*Does not sum to 100% due to rounding.

On average, respondents used their dehumidifiers for 5.5 months of the year, 6.3 days per week, and 14.3 hours per day. Figure 19, Figure 20, and Figure 21 display the distribution of months per year, days per week, and hours per day respondents used their dehumidifiers.

Figure 19: Months per Year Dehumidifier in Use (n=6)*



*Does not sum to 100% due to rounding.

Figure 20: Days per Week Dehumidifier in Use (n=6)

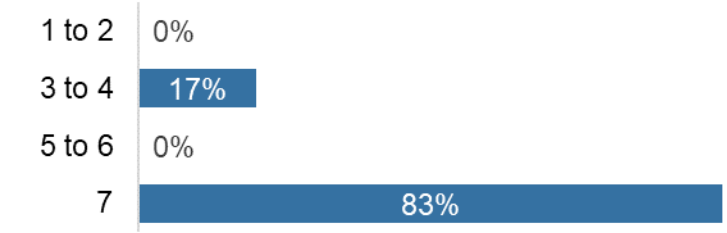
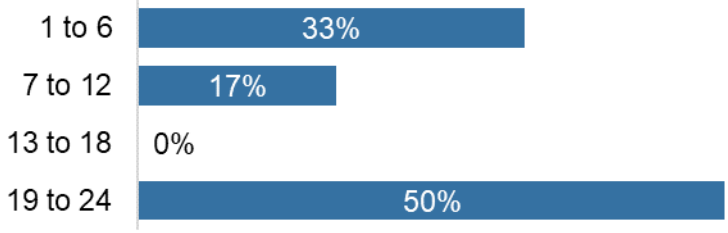


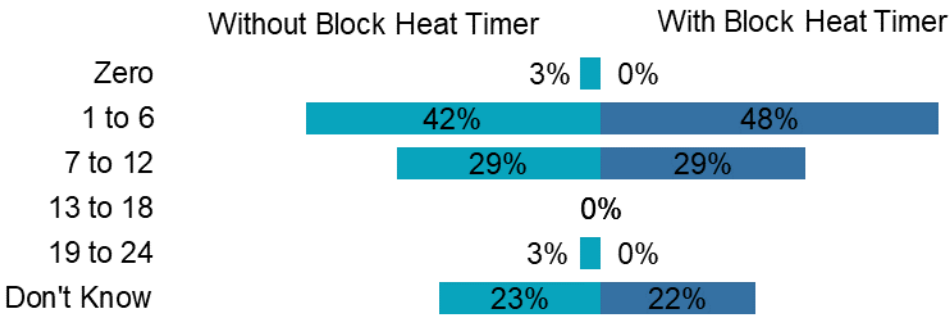
Figure 21: Hours per Day Dehumidifier in Use (n=6)



Before receiving the block heater timers provided by the program, respondents used their block heaters for seven hours per day on average. After installing the block heater timers, respondents used their block heaters for an average of six hours per day. Figure 22 displays the distribution of

hours per day that respondents used their block heaters before and after receiving the block heater timers.

Figure 22: Hours per Day Block Heater in Use (n=31)*



*Does not sum to 100% due to rounding.

Appendix C Additional Process Evaluation Results

This section provides additional Process evaluation results. Higher level results were provided in Section 5.

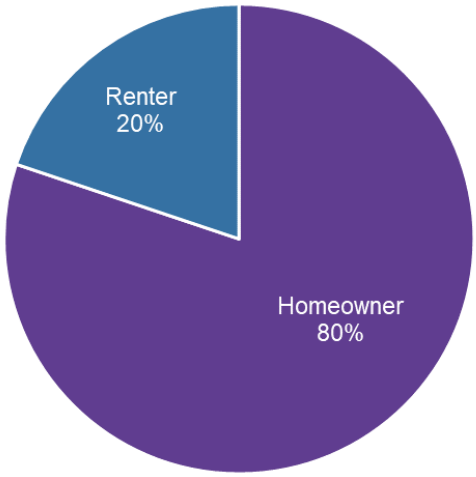
C.1 Additional Participant Results

This section provides additional detail regarding the process evaluation results collected as part of the auditor and contractor survey.

C.1.1 Participant Profile

As shown in Figure 23, most respondents (80%) are homeowners, while 20% are renters.

Figure 23: Relationship to Home (n=131)



Respondents' homes are predominantly primary residences (92%) that are occupied year-round (98%). Figure 24 and Figure 25 display characteristics of respondents' homes, including the type of dwelling and the year it was built. A majority (89%) of respondents' homes are single-family houses. More than five-sixths of respondents' homes (85%) were built after 1970. On average, respondents had 2.4 bedrooms and 1.5 bathrooms.

Figure 24: Type of Home (n=131)

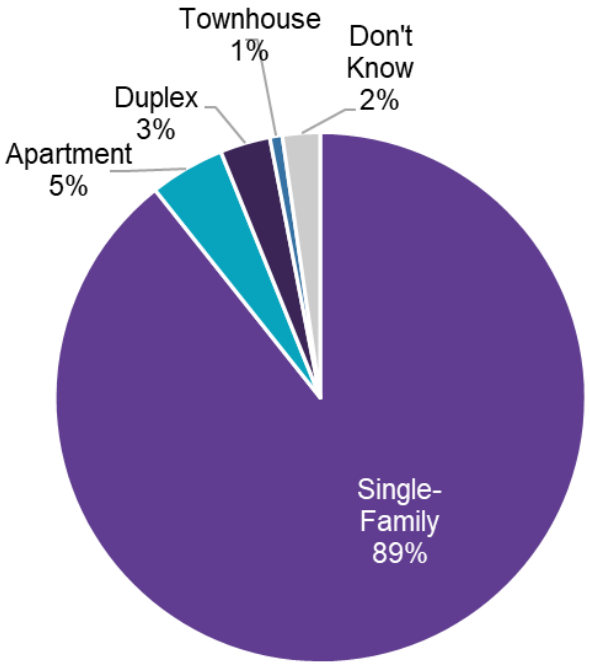


Figure 25: Year Home Built (n=131)

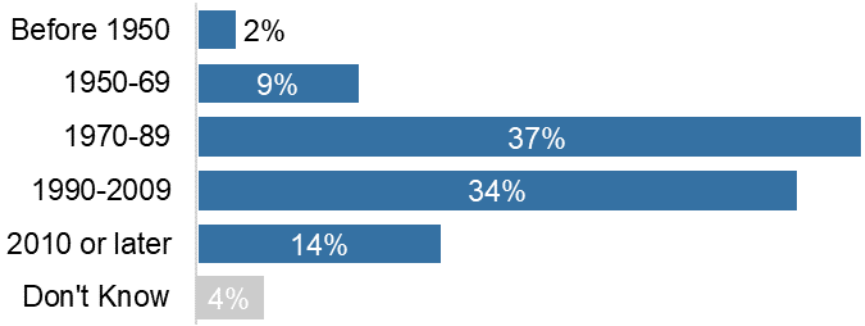


Figure 26 displays the number of occupants in the respondents' households. Over one-fourth (28%) of respondents live alone. The average household size was 2.1.

Figure 26: Number of Occupants (n=131)

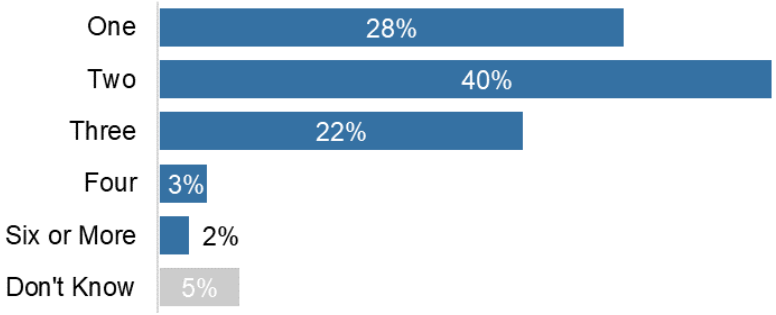
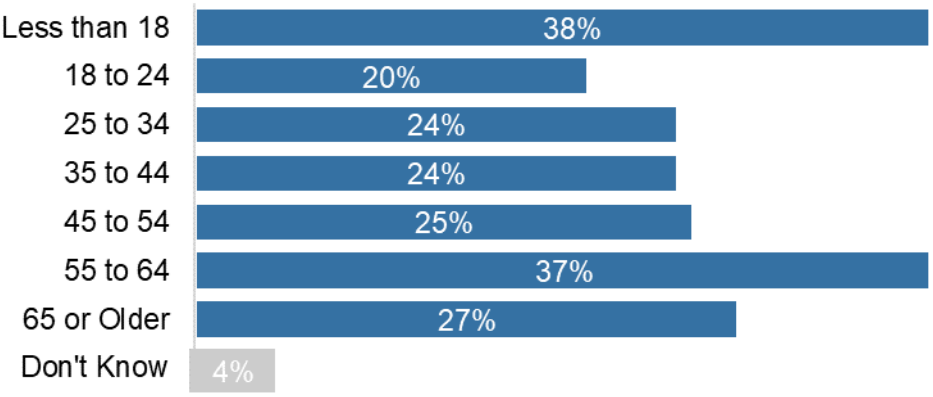


Figure 27 displays the percent of households with occupants of each age group. Children under the age of 18 reside in nearly two-fifths (38%) of households and seniors aged 65 or older reside in over one-fourth (27%) of households.

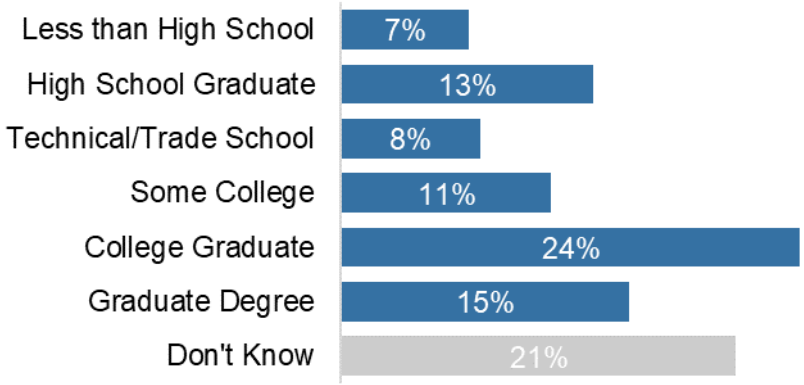
Figure 27: Households with Occupants of Each Age Group (n=131)*



*Does not sum to 100% due to multiple response.

Figure 28 displays respondents' highest education level. Nearly two-fifths (39%) of respondents have a college degree or higher.

Figure 28: Highest Education Level (n=131)

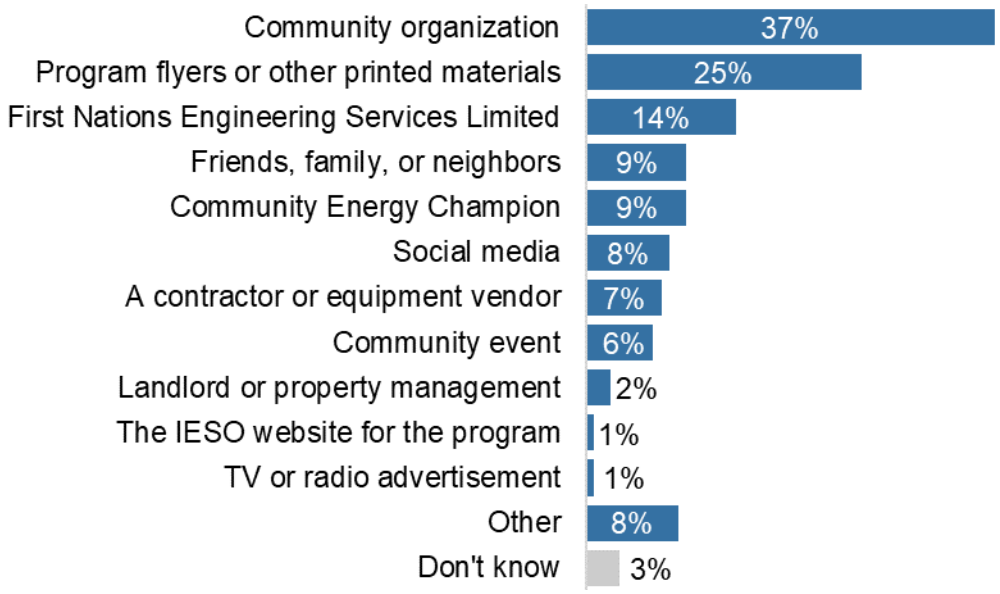


*Does not sum to 100% due to rounding.

C.1.2 Program Awareness and Motivation

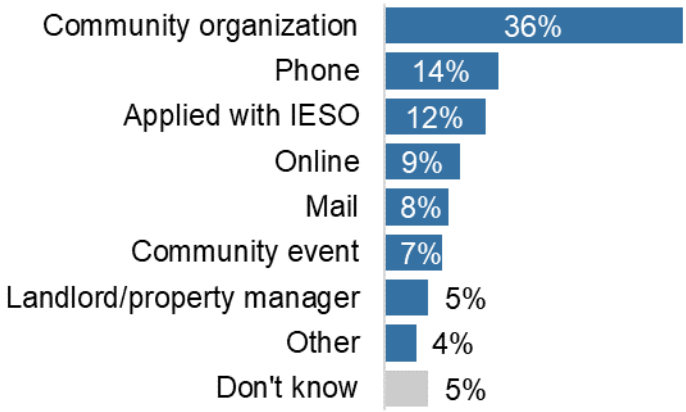
Figure 29 and Figure 30 show how respondents heard about and applied to the program. Section 5.3.2 includes more discussion around how participants heard about and applied to the program.

Figure 29: How Participants Heard about FNCP (n=131; Multiple Response)*



*Does not sum to 100% due to multiple response.

Figure 30: How Participants Applied for FNCP (n=131)

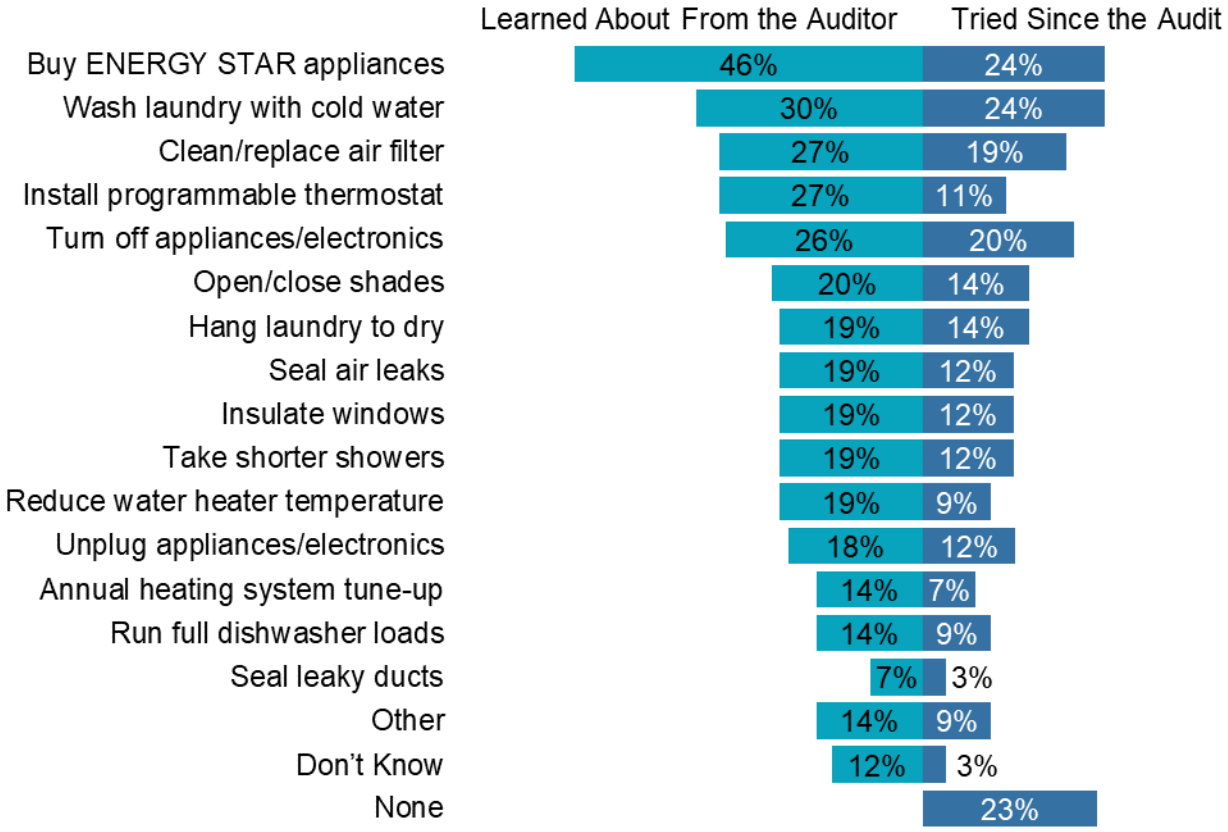


C.1.3 Program Education and Behavior Change

Figure 31 displays the additional energy-saving methods respondents said their auditor suggested as well as the methods participants reported trying after the auditor had suggested them. The most frequently suggested method was to purchase ENERGY STAR appliances.

Section 5.3.3 includes more discussion around the additional ways to save energy that were recommended and tried.

Figure 31: Additional Ways to Save Energy (n=74)*



*Does not sum to 100% due to multiple response.

Appendix D Additional Jobs Impact Results

This appendix presents additional results associated with the jobs impact analysis. Higher-level results were provided in Section 6.2. Input-Output models are informative for understanding the potential magnitudes and dynamics of economic shocks created by policies and programs. While useful, the StatCan IO Model is a simplified representation of the Canadian economy and thus has limitations. The model is based on the assumption of fixed technological coefficients. It does not take into account economies of scale, constraint capacities, technological change, externalities, or price changes. This makes analyses less accurate for long term and large impacts, where firms would adjust their production technology and the IO technological coefficients would become outdated. Assuming that firms adjust their production technology over time to become more efficient implies that the impact of a change in final demand will tend to be overestimated. For household consumption, the model is based on the assumptions of constant consumption behavior and fixed expenditure shares relative to incomes.

D.1 Input Values

The model was used to estimate the impacts of two economic shocks – one representing the demand for energy-efficient products and services from FNCP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 16 shows the input values for the demand shock representing the products and services related to FNCP. Each measure installed as part of FNCP was categorized according to the StatCan IO Supply and Use Product Classifications (SUPCs).

The first four rows of the table contain the categories corresponding to products, which were the measures installed in homes. The last two rows contain the services. Of the six product measures, Major appliances had the highest total cost ($621,000). Electric light bulbs and tubes was second highest at just over $128,000. Each measure's cost was divided into labor and non-labor. Electric light bulbs and tubes and Other miscellaneous manufactured products did not have any assumed labor costs for measure installation. Small electric appliances included thermostats, which had installation costs around 50% of the total. The installation cost for the Major appliances category was roughly 11%.

For the two service categories in Table 16, Office administrative services included general overhead and administrative services associated with program delivery, such as program management and staffing, call center operations, and IESO admin labor. The Other professional, scientific and technical services included the audits. The total demand shock represents the sum of the audit fees. The labor and non-labor amounts are not specified for these services, as the IO Model has assumptions incorporated for the relative proportions of each for these categories.

Table 16: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor ($ Thousands)	Total Demand Shock ($ Thousands)
Major appliances	551	70	621
Electric light bulbs and tubes	128	0	128
Small electric appliances	46	46	92
Other miscellaneous manufactured products	20	0	20
Other professional, scientific and technical services	-	-	211
Office administrative services	-	-	932
Total			**2,004**

Table 17 shows the calculations and input value for the household expenditure shock.[18] This shock represents the net additional amount that households would inject back into the economy through spending. The model does not distinguish between participants and non-participants in the residential sector, so the net amount of additional money households (as a whole) would have available is the difference between the bill savings (Net Present Value (NPV) = $985,000) and the portion of all energy-efficiency programs funded by the residential sector (35%, or $702,000). The difference is $283,000 and represents the additional money that households could either spend on goods and services or save, pay off debt, or otherwise not inject back into the economy. The surveys administered to participants as part of the FNCP process evaluation included several questions about what households would do with the money that they saved on their electricity bills. From the survey responses, we estimated that 47% of household bill savings would be spent. Thus, the household expenditure shock would be $132,000.

Table 17: Summary of Input Values for Household Expenditure Shock

Description	Demand Shock *($ Thousands)*
NPV of energy bill savings	985
Residential portion of program funding	(702)
Net bill savings to residential sector	**283**
Percent spent on consumption (vs. saved)	47%
Total Shock	**132**

D.2 Model Results

The StatCan IO Model generated results based on the input values detailed in Appendix D.1. Table 18 shows the results of the model run for the demand shock for products and services. This

[18] The model is actually run with a normalized value of $1 million in extra household expenditures and the job results can be scaled by the actual demand shock.

shock represented the majority of the job impacts. As the two right columns show, the model estimated that the demand shock will result in the creation of 12 total jobs (measured in person-years) in Canada, of which 11 will be in Ontario. Of the 12 jobs, 5 were direct, 4 were indirect, and 3 were induced. In terms of FTEs, the numbers are slightly less, with 8 FTEs created in Ontario and 9 in total across the country. Of these 9 FTEs, 4 were direct, 3 indirect, and 2 induced. As the table shows, the direct job impacts were realized exclusively in Ontario. As we move to indirect and induced jobs, impacts are dispersed outside of the province.

Table 18: Job Impacts from Demand Shock

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Direct	4	4	5	5
Indirect	3	3	3	4
Induced	2	2	2	3
Total	**8**	**9**	**11**	**12**

Table 19 shows the results of the model run for the household expenditure shock. This shock is actually run off a normalized $1 million bundle of extra household spending, which can then be scaled by the actual household expenditure shock. The extra household spending of $132,000 would yield 2 direct FTEs and 3 direct total jobs in Canada. Five of the six total jobs created in Canada were in Ontario.

Table 19: Job Impacts from Household Expenditure Shock

Job Impact Type	FTE *(in person-years)* Ontario	FTE *(in person-years)* Total	Total Jobs *(in person-years)* Ontario	Total Jobs *(in person-years)* Total
Direct	2	2	3	3
Indirect	1	1	1	1
Induced	1	1	1	1
Total	**4**	**4**	**5**	**6**

The other factors included in the research questions were the impact of program funding on the non-residential sector and the impact from reduced electricity consumption. Assuming that businesses absorb the increases in electricity costs to fund the program, there would be no impact on jobs. There would be an impact on direct GDP (value-added), equivalent to the profit loss resulting from the increase in electricity bills from program funding. The StatCan IO Model has production functions that cannot be adjusted, so electricity price changes would be modeled by making the assumption that surplus would be reduced by the extra amount spent on electricity.

The economic impact of the reduction of electricity production as a result of the increase in energy efficiency must be examined closely. Technically speaking, it can be estimated using StatCan

Input-Output multipliers[19] without running the model. The multiplier is 4.9[20] (per $ million) and the NPV of decreased electricity bills (retail) was $0.99 million. Thus, the model would predict that the reduction in electricity production would cause a job loss of 4.8 person-years over the course of 15 years (the longest EUL in the portfolio of FNCP measures). However, the IO model is linear, and not well suited to model small decreases in electricity production. Total electricity demand has been increasing over time and is projected to continue increasing.[21] FNCP first year energy savings represented less than 0.01% of total demand in 2021. This relatively small decrease in overall consumption may work to slow the rate of consumption growth over time but would likely not result in actual job losses in the utility industry or upstream suppliers. The linearity of the IO model means that it will provide estimates regardless of the size of the impact. Given the nature of electricity production, it is reasonable to conclude that the linear IO multiplier is not appropriate for estimating job impacts. This analysis assumes that job losses from decreased electricity production are negligible.

Table 20 shows the total estimated job impacts by type – combining Table 18 and Table 19. The majority (15 out of the 17 estimated total jobs) were in Ontario. All the direct and indirect jobs created were created in Ontario. A slightly smaller share of the induced jobs was in Ontario, with 3 out of 4 total jobs created within the province. The FTE estimates are slightly less, with a total of 12 FTEs (of all types) created in Ontario and 13 FTEs added throughout Canada. All direct FTEs were realized in Ontario, with this number representing 50% of the total FTEs added in Ontario and 46% of FTEs added in Canada.

Table 20: Total Job Impacts by Type

Job Impact Type	FTE *(in person-years)* - Ontario	FTE *(in person-years)* - Total	Total Jobs *(in person-years)* - Ontario	Total Jobs *(in person-years)* - Total	Total Jobs per $1M Investment *(in person-years)*
Direct	6	6	8	8	3.9
Indirect	3	4	5	5	2.6
Induced	2	3	3	4	2.2
Total	**12**	**13**	**15**	**17**	**8.7**

Calculating relative performance as a function of jobs created per $1M of program budget is helpful in comparing the FNCP program between years. This year, each $1M investment resulted in the creation of 8.7 jobs. Programs can increase in effectiveness—in terms of jobs created per $1M of budget—when the incentives catalyze spending by participants on EE measures. Given that the FNCP incentives cover 100% of measure costs, the relative proportion of participant spending is removed as a driver of variability, and as such the number of jobs per $1M investment is expected to remain relatively consistent from year to year.

[19] Table 36-10-0595-01. The relevant industry is Electric power generation, transmission and distribution [BS221100].
[20] Statistics Canada. Table 36-10-0595-01 Input-output multipliers, provincial and territorial, detail level
DOI: https://doi.org/10.25318/3610059501-eng
[21] Annual Planning Outlook – A view of Ontario's electricity system needs; 2021. IESO.

Table 21 shows the job impacts in more detail, with jobs added by type and by industry category. Industries are sorted from top to bottom by those with most impacts to least, with industries that showed no impacts not included in the table. The table shows that the industry with the largest impacts was Administrative and support, waste management and remediation services, which added 6 jobs across Canada and 6 jobs in Ontario. This category is large and non-specific, and reflects the need to hire individuals to fill a large range of roles based on program need (e.g. office administration, call center operations, program management, etc.). Retail trade added a total of 3 jobs, the second most of any industry- all of the realized jobs were created in Ontario.

Table 21: Total Job Impacts by Industry

Job Impact Type	**FTE** *(in person-years) -* ***Ontario***	**FTE** *(in person-years) -* ***Total***	**Total Jobs** *(in person-years -* **Ontario**	**Total Jobs** *(in person-years) -* **Total**
Administrative and support, waste management and remediation services	5	5	6	6
Retail trade	2	2	3	3
Accommodation and food services	1	1	1	1
Finance, insurance, real estate, rental and leasing and holding companies	1	1	1	1
Professional, scientific and technical services	1	1	1	1
Wholesale trade	1	1	1	1
Manufacturing	0	1	0	1
Other services (except public administration)	0	0	1	1
Transportation and warehousing	0	1	0	1
Total[1]	**12**	**13**	**15**	**17**

[1] Columns may not add to totals due to rounding. Real values are rounded to nearest whole number and the whole numbers do not sum exactly to the whole number total in every column.