Interim Framework Remote First Nations Energy Efficiency Pilot Program Evaluation Report

September 13, 2023

SUBMITTED TO:
Independent Electricity System Operator

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

NMR Group, Inc.

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Acknowledgements

The NMR team would like to thank the participants, auditors, and contractors that supported the NMR team's surveys. Their cooperation with the NMR team's efforts has produced high quality data that will serve Ontario conservation efforts for years to come.

The NMR team would also like to thank the IESO staff, the delivery vendor staff, and the Community Coordinator that the NMR team interviewed and/or received information from. Their insights have been invaluable to the NMR team's efforts to improve the Conservation Programs.

Finally, the NMR team would like to thank Alice Herrera and Arwa Sayyadi at the Independent Electricity System Operator (IESO) for their assistance in managing this evaluation effort. With their support and guidance, the NMR team was able to complete their activities as efficiently and successfully as possible.

Acronyms

Acronym	Definition
AC	Air Conditioner
CDM	Conservation and Demand Management
CE Tool	Cost-Effectiveness Tool
CF	Correction Factor
CI	Confidence Interval
DHW	Domestic Hot Water
EM&V	Evaluation Measurement and Verification
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
LED	Light-emitting Diode
MAL	Measures and Assumptions List
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTG	Net-to-Gross
PAC	Program Administrator Cost Test
PIA	Prescriptive Input Assumption
PY	Program Year
RR	Realization Rate
StatCan	Statistics Canada
SUPC	Supply and Use Product Classification
SUT	Supply and Use Table
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 Remote First Nation Energy Efficiency Pilot Program (RFNEEPP) for program years (PYs) 2020 – 2022 as part of the Interim Framework (IF).

Program Description

RFNEEPP was a centrally delivered pilot program providing eligible remote First Nation communities, including Kasabonika, North Caribou, Sachigo Lake, and Wunnumin, the opportunity to improve energy efficiency in both residential and non-residential buildings. RFNEEPP helped residents in eligible communities improve the energy efficiency of their homes and manage their energy use more effectively. Energy-efficiency upgrades, education and health and safety upgrades were delivered free of charge to residents. Basic eligible efficiency measures were determined through an in-home energy audit and directly installed by a community representative. The audit results recorded eligibility for extended and weatherization measures that could be installed as part of a second home visit.

Evaluation Objectives

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

- Conduct audits of completed projects to evaluate, measure and verify completion and operating parameters through desk reviews.
- Verify gross energy and demand savings with a 90% level of confidence at 10% precision for the program.
- On an as-needed basis, review the prescriptive input assumptions (PIAs), recommend any revisions (e.g., the addition or removal of measures, or updating assumptions), and revise/develop substantiation documents.
- On an as-needed basis, review 8760 load shapes used in the programs and determine if they are representative of the seasonal energy savings pattern (or resource curve).
- Perform a cost-effectiveness analysis; an avoided greenhouse gas (GHG) reduction estimate; a Non-Energy Benefits (NEBs) analysis; and a jobs impact analysis.
- Conduct a process evaluation by addressing research questions identified with IESO.
- Deliver annual reporting memos and templates along with a final report that meet the requirements and deadlines set by the IESO.
- Provide thoughtful recommendations on program improvements based on feedback obtained through the evaluation.

Summary of Results

The impact evaluation results for RFNEEPP are displayed in Table 1. These results cover the entire Interim Framework. The overall RR for IF RFNEEPP is 100% for energy savings and 60% for demand savings.

Table 1: RFNEEPP Interim Framework Results

Metric	Units	Evaluated
Participation	Projects	175
Participation	Homes	172
Reported Energy Savings	MWh	115
Reported Demand Savings	MW	0.013
Gross Energy RR		1.00
Gross Demand RR		0.60
Gross Verified Energy Savings	MWh	115
Gross Verified Demand Savings	MW	0.008
Net-to-Gross (NTG) Ratio	--	1.00
Net Verified Annual Energy Savings (First Year)	MWh	115
Net Verified Annual Demand Savings (First Year)	MW	0.008
Net Verified Persisting Energy Savings to PY2022	MWh	115
Net Verified Persisting Demand Savings to PY2022	MW	0.008
Program Administrator Cost (PAC) Test Ratio	--	0.03
Levelized Delivery Cost (Energy)	$/kWh	1.39
Levelized Delivery Cost (Demand)	$/kW	20,485

Key Findings and Recommendations

This section provides a subset of the most important evaluation key findings and recommendations. Section 7 presents all the key findings and recommendations.

Finding 1: Tracking of health and safety barriers in project files and tracking data was inconsistent and overly broad. Tracking data only flagged projects that received funding to address health, safety, and comfort – i.e., no record of specific health and safety concerns. Engineering desk reviews turned up projects with health and safety barriers (e.g., mold, exposed electrical wiring) without a corresponding line item in tracking data, and projects with a flag for health issues in tracking data but no corresponding record in project files. Tracking health and safety barriers is key to understanding the potential for increasing the uptake of high-savings measures like weatherization. Previous evaluations [1] have recommended an emphasis on weatherization upgrades due to high per-unit savings and co-benefits of increased occupant comfort.

[1] See Finding 1 in the 2021-2024 CDM Framework: PY2021 Energy Affordability Program Evaluation Report; see also Recommendation 2a in the Interim Framework: First Nations Conservation Program Evaluation Report.

- **Recommendation 1a.** Improve the quality and comprehensiveness of health, safety, and comfort data collected on-site and contained in the program tracking data. This could include adding required fields to program tracking data for any projects where auditors and contractors identify a health and safety barrier (e.g., what barrier(s) did they observe, what measures were they unable to install as a result).
- **Recommendation 1b.** Develop a participant journey map for homes with observed health and safety barriers. Equip auditors and contractors with the time and resources to provide guidance on how participants can remediate any observed health and safety barriers. This could include referrals to contractors that could conduct the necessary remediation and program incentives specifically tied to these steps. In addition, these journey maps can extend into follow-up plans for participants to receive certain energy-efficiency measures that weren't installed due to health and safety concerns, after remediation has occurred.

Finding 2: Auditors and contractors observed whether participants' homes contained heat recovery ventilation (HRV) but rarely recommended maintenance or upgrades. Auditors and contractors documented the presence of HRV systems in 40% of desk-reviewed projects (n=77). However, only slightly more than one-fourth (29%) of desk-reviewed projects had an operational HRV, and there was no documentation of why non-operational systems were not in use. Engineering desk reviews did not find any evidence that auditors and contractors consulted participants on the overlapping impacts of upgrading building insulation and ventilation systems[2]. Data on HRV were not passed through to the program tracking database.

- **Recommendation 2a.** In participant homes that receive air sealing, add specific incentives for HRV or energy recovery ventilator (ERV) installation and/or upgrade to promote deeper air sealing savings. Program support for HRV/ERV should include balancing, maintenance, and educational materials. While an HRV/ERV represents an additional electric load, the deeper savings from tightening the home, lowering the overall heating and/or cooling load of the home, and potential non-energy benefits in occupant comfort and indoor air quality may outweigh the increased electrical load from any added mechanical ventilation.
- **Recommendation 2b.** Create variables in program tracking data that document whether participant homes have an HRV/ERV, and whether it is operational. As part of recommending building envelope upgrades, require that auditors and contractors assess whether ventilation systems are appropriately sized following those upgrades, per industry best practice.

Finding 3: RFNEEPP program tracking data lists completed projects under multiple identifiers for the same home and contains inconsistent contact information for verifying unique participants. In addition, tracking data does not typically include key characteristics that are collected during audits such as building type or mechanical equipment for heating/cooling. Data quality issues such as multiple unique identifiers,

[2] ASHRAE Standard 62.1 and 62.2 dictate a certain level of ventilation needed per person in a given space for acceptable indoor air quality.

inconsistent contact information, and incomplete building/equipment characteristics can adversely affect program planning and evaluation. A single, unique identifier that traces all project work back to one home improves the timeliness of sample development and subsequent data requests to program vendors. Identifiers can also be generated for homes where project work was attempted but not completed, to facilitate follow-up visits and track incomplete audits. These unique identifiers are critical for impact evaluations that encompass multiple program years. Data capturing key building and/or equipment characteristics can be used to better estimate savings impacts, to identify additional energy saving opportunities at existing participant homes, and to provide insights into future program offerings. However, all RFNEEPP participant records were missing data on building type information and had no fields to record mechanical equipment details.

- **Recommendation 3a.** Work with program staff and program delivery vendors to consistently incorporate additional details into the tracking data (e.g., building type mechanical equipment for heating/cooling, heating fuel, efficiency, capacity, and HRV data (see ***Finding 2***)). This could include revising the IESO's Field Audit Support (Fast) Tool program or development of a new uniform electronic data collection form for auditors to upload these data directly into the tracking data.
- **Recommendation 3b.** Consolidate the multiple, overlapping sets of application identifiers currently used in tracking data such that each home has a unique identifier.
- **Recommendation 3c.** Quantify the number of attempted but incomplete RFNEEPP audits, in addition to tracking program participants. These data can help program staff and program delivery vendors determine where program participation has the greatest growth potential and more quickly identify where there are potential participation barriers.
- **Recommendation 3d.** Develop protocols to verify that Measure Lists the IESO provides to delivery agents split out reported savings for measures whose substantiation sheets have different reported savings depending on building type, heating and/or cooling systems, heating fuel, etc. IESO Measure Lists should also flag which demand factor is used to calculate savings. Ensure the MAL also documents these different reported savings.

Finding 4: Desk review results suggest that the average electric consumption of replaced refrigerators aligns more closely with the federal minimum consumption (UEC_{base}) than assumed existing equipment consumption (UEC_{exist}). IESO deemed UEC_{exist} values are reasonable compared with equivalent deemed values in the Illinois Technical Reference Manual (TRM) but overestimate actual existing refrigerator consumption as observed in PY2022 and PY2021 desk reviews.[3] No other TRMs in the cross-jurisdictional scan explicitly listed UEC_{exist}

[3] PY2022 includes EAP and RFNEEPP desk reviews, whereas PY2021 only includes EAP desk reviews. Desk reviews are not sufficient for recommending updates to UEC_{exist} because they do not reflect the energy consumption for refrigerators associated with the non-participant population. A representative baseline for appliance energy consumption requires a sample frame containing households with and without prior experience in energy-efficiency programs such as EAP.

values. No TRMs require blended savings based on existing equipment and federal minimum baselines, as is currently the case in IESO substantiation sheets. Instead, reviewed TRMs list separate savings assumptions depending on whether the refrigeration equipment has a time of sale or early replacement baseline.[4] Separate MAL entries for time of sale and early replacement scenarios would reflect the reality that the IESO is in some cases replacing refrigeration equipment past its effective useful life (EUL). As a result, separate MAL entries could improve the accuracy of claimed savings from refrigeration upgrades.

- **Recommendation 4a.** Create separate MAL entries for time of sale vs. early replacement refrigerators, as well as different refrigerator configurations (e.g. top-freezer, bottom-freezer, side-by-side). Alternatively, conduct an appliance baseline study to update the current assumption in substantiation sheets that the remaining useful life (RUL) of an early replacement refrigerator/freezer is one-third of its effective useful life.
- **Recommendation 4b.** Conduct an appliance baseline study to update unit energy consumption values in all appliance substantiation sheets.
- **Recommendation 4c.** Make delivery vendors aware of any future changes to appliance baseline assumptions. Verify that vendors are installing refrigeration equipment that consumes less energy than the assumed unit energy consumption of existing (UEC_{exist}) and minimally compliant (UEC_{base}) refrigerators / freezers.

Finding 5: The energy consumption thresholds for refrigerators and freezers listed in Audit & Retrofit Protocols do not align with the equipment age used to determine eligibility for replacement (i.e., manufactured in 2011 or earlier) as listed in auditors' data collection forms. A cross-jurisdictional scan of technical reference manuals (TRMs) determined that for refrigerators and chest freezers, the Audit & Retrofit protocol thresholds for energy consumption (925 & 615 kWh, respective) imply that only models older than 2001 would be eligible for replacement. However, data collection forms list 2012 as the threshold for auditors and contractors to use when determining eligibility.

- **Recommendation 5a.** Lower the audit protocol thresholds for refrigerators and chest freezers to the NY TRM LMI baseline consumption for a refrigerator manufactured in the latest year IESO has determined is still eligible for replacement (2011) per the data collection forms included in project files.
- **Recommendation 5b.** Specify separate minimum refrigerator and freezer consumption thresholds in Audit & Retrofit Protocols based on appliance configuration (e.g., upright vs. chest freezers).

[4] "Time of sale" refers to cases where the replaced equipment is past its effective useful life (EUL), so the baseline equipment meets the minimum regulatory requirements for energy consumption (UEC_{base}). "Early replacement" refers to cases where the existing equipment is not past its EUL. In these instances, the baseline equipment is the existing refrigerator for the assumed remaining useful life (UEC_{exist}), then the "time of sale" baseline (UEC_{base}) until the end of its effective useful life (EUL). Refer to entry 5.1.6 in the 2022 Illinois TRM for additional details. Some jurisdictions may adjust their baseline and/or EUL assumptions based on the region, income levels, etc. of the populations they serve.

Finding 6: Building trust, developing relationships, and directly engaging with the community is critical to the success of the program. Distrust of government agencies and outside organizations or individuals was a major barrier to program participation mentioned by both IESO and program delivery vendor staff. IESO staff stated that this distrust often stems from the many issues generated by historical colonialism. To help address this barrier, the program worked to build relationships with community leaders and enlist the support of local delivery staff (see ***Finding 14*** in Section 7 for more details on the program delivery model). One program contractor stated that building relationships was highly valuable and could positively impact customers' perceptions of the program and upgrades. The program delivery vendor reported the greatest determinant of whether the program would be successful in a community was having a local champion to work with community leaders and drive the program forward. The delivery vendor and IESO staff also stressed the importance of receiving buy-in from Chiefs and/or band councils to confirm the program's legitimacy and to build trust. Finally, IESO staff stressed the importance of providing continuous funding to First Nations programs, noting that it becomes difficult to build trust when the funding's timeline is uncertain.

- **Recommendation 6a.** Continue to hire local champions who are enthusiastic about the program's goals and continue to hire and train local auditors and contractors. Doing so will help to build local knowledge and provide a base from which to build trust.
- **Recommendation 6b.** Receive buy-in from Chiefs and/or band councils to confirm the program's legitimacy.
- **Recommendation 6c.** Consider a longer-term funding approach for First Nations programs to offer assurance that the program will be a continued presence in supporting remote First Nations communities.

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 evaluation results, findings, and recommendations for program years (PYs) 2020 – 2022 (PY2020, PY2021 and PY2022) for the Remote First Nation Energy Efficiency Pilot Program (RFNEEPP) as part of the Interim Framework (IF).

1.1 Program Description

RFNEEPP was a centrally delivered pilot program providing eligible remote First Nation communities the opportunity to improve energy efficiency in both residential and non-residential buildings. RFNEEPP helped residents in eligible communities improve the energy efficiency of their homes and manage their energy use more effectively. Energy-efficiency upgrades, education and health and safety upgrades were delivered free of charge to residents. Basic eligible efficiency measures were determined through an in-home energy audit and directly installed by a community representative. The audit results recorded eligibility for extended and weatherization measures that could be installed as part of a second home visit.

1.1.1 Delivery

Under the Interim Framework, RFNEEPP 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. These communities included Kasabonika, North Caribou, Sachigo Lake, and Wunnumin.

1.1.3 Measures

The measures offered by RFNEEPP included basic track measures, 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, clothing racks, hot water tank and pipe insulation, aerators, ENERGY STAR® light-emitting

(LEDs), and basic thermal envelope weather-stripping. Measures that conserved water usage and/or insulated storage tanks/pipes were only provided to customers with electric water heaters.

Extended measures were those that required additional follow-up actions and installations, such as confirmation of appliance delivery, and were not completed during the initial audit. Extended measures included refrigerator replacements and freezer replacements. Other possible extended measures could include window air conditioner replacements, dehumidifiers, bathroom fans/ducts, storm window kits, and outdoor wall mounted area LED fixtures.

The weatherization track offered building shell and/or weatherization improvements, limited to attic insulation and draftproofing. These did not result in any claimed savings because all participating homes used a wood stove as the primary heating system. Installation of these measures may also improve the health and safety of the home.

1.2 EVALUATION OBJECTIVES

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

- Conduct audits of completed projects to evaluate, measure and verify completion and operating parameters through desk reviews.
- Verify gross energy and demand savings with a 90% level of confidence at 10% precision for the program.
- On an as-needed basis, review the prescriptive input assumptions (PIAs), recommend any revisions (e.g., the addition or removal of measures, or updating assumptions), and revise/develop substantiation documents.
- On an as-needed basis, review 8760 load shapes used in the programs and determine if they are representative of the seasonal energy savings pattern (or resource curve).
- Perform a cost-effectiveness analysis; an avoided greenhouse gas (GHG) reduction estimate; a Non-Energy Benefits (NEBs) analysis; and a jobs impact analysis.
- Conduct a process evaluation by addressing research questions identified with the IESO.
- Deliver annual reporting memos and templates along with a final report that meet the requirements and deadlines set by the IESO.
- Provide thoughtful recommendations on program improvements based on feedback obtained through the evaluation.

Section 2 Methodology

This section provides 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 IF RFNEEPP impact evaluation, the NMR team performed the following activities:

- Review of program tracking data
- Analysis of in-service rates (ISRs) and hours of use (HOU) using participant survey data
- Engineering desk reviews
- Incorporated results from the PY2019 review of technical reference manuals (TRMs) from other jurisdictions[5]

These are standard practices for comparing evaluated savings with reported savings. IESO Evaluation Measurement and Verification (EM&V) staff agreed with the NMR team to use the entire RFNEEPP population, from both the Interim Framework and 2021 – 2024 Conservation and Demand Management (CDM) Framework, to determine the desk review sample. This was done because program design and delivery were the same between both frameworks. However, only the impact results from the IF Framework are presented in this report. A more detailed description of the impact evaluation methodology is 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 First Nation, 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 RFNEEPP, which signifies the amount of savings that persist to the end of the interim Framework.

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*[6] and using

[5] See "Secondary Data Review of TRMs" (Section 2.1.2) in the Methodology section of the PY2019 HAP Evaluation.
[6] *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

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.1.6.

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, Community Coordinators, Community Energy Champions, auditors, 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. Due to the limited number of participants and the fact that the program design models were the same, IESO EM&V staff and the NMR team agreed to use the entire RFNEEPP population of participants from both the Interim Framework and the CDM Framework to determine the process evaluation participant sample. Given the similarities in program design, process evaluation feedback from both frameworks are provided together within the same report.

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	Fielding Firm	Completed	Population	90% CI Error Margin
RFNEEPP IESO Staff and Delivery Vendor Staff	Phone IDIs	NMR Staff	2	2	0
RFNEEPP Community Coordinators and Community Energy Champions	Phone IDIs	NMR Staff	1	7	N/A*
RFNEEPP Auditors and Contractors	Web and Phone	Resource Innovations Survey Lab	3	8	N/A*
RFNEEPP Participants	Web and Phone	Resource Innovations Survey Lab	15**	166	N/A*

*Error margin not displayed if the respondent count is below 30 unless census is achieved.
**Please note that the 15 completed participant surveys is related to the number of valid participant process evaluation surveys responses. The number of valid participant ISR and HOU evaluation survey responses is 19. This

difference is due to four of the participants dropping out of the survey after completing the ISR and HOU survey questions and before completing the process evaluation survey questions.

2.4 JOBS IMPACT ANALYSIS METHODOLOGY

The NMR team quantified the number of full time equivalent (FTE) net job impacts as well as total net job impacts (both direct and indirect jobs) resulting from the investment and activities of each program. Primary and secondary data collection and Statistics Canada[7] (StatCan) Input-Output (IO) modeling were utilized to quantify net jobs 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 RFNEEPP 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 and their impacts can be measured variables economic output and employment. A detailed description of the job impact analysis methodology is provided in Appendix A.4.

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

Section 3 Impact Evaluation

This section provides 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 RFNEEPP 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 associated savings persist beyond 2022. This is a key metric to assess RFNEEPP performance compared to the savings targets established for the Interim Framework.

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

3.1.1 Program Level Savings

Table 3 presents reported, gross verified, and net first-year energy and demand savings for the entire Interim Framework RFNEEPP program population covering PY2020 to PY2022. The program gross verified RR is 100% for energy savings and 60% for demand savings. As described above, the NTG ratio is assumed to be 1.0 for the RFNEEPP. Measure level impacts for both energy and demand savings are detailed in Appendix B.

Evaluated IF RFNEEPP project homes were spread across four First Nations communities:

- Wunnumin (n=93)
- Kasabonika (n=36)
- Sachigo Lake (n=25), and
- North Caribou (n=21)

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

Metric	Units	PY2022
Reported Energy Savings	MWh	**115**
Reported Demand Savings	MW	**0.013**
Gross Energy RR	--	**1.00**
Gross Demand RR	--	**0.60**
Gross Verified Energy Savings	MWh	**115**
Gross Verified Demand Savings	MW	**0.008**
Net-to-Gross (NTG) Ratio	--	**1.00**
Net Verified Annual Energy Savings (First Year)	MWh	**115**
Net Verified Annual Demand Savings (First Year)	MW	**0.008**
Net Verified Persisting Energy Savings to PY2022	MWh	**115**
Net Verified Persisting Demand Savings toPY2022	MW	**0.008**

3.1.2 Gross Verified Energy Savings Key Results

RFNEEPP achieved a total of 115,043 MWh of net energy savings persisting until 2022 (Table 4). The overall RFNEEPP gross energy savings RR is 100%. Among specific end-uses, domestic hot water (DHW) measures had an RR of 87% and accounted for over one-third of gross verified energy savings (35%). Lighting measures achieved an RR of 79% and were responsible for 19% of the total program savings. Smart power bars had a high RR of 512% due to outdated reported savings values being applied. The miscellaneous category includes block heater timers and indoor drying racks or clotheslines. It had had the second highest energy RR (95%) and accounted for the second-most gross verified energy savings of any category (26%). Appliance measures achieved an energy RR of only 47% and accounted for a marginal portion of gross verified savings (3%). The low appliance RR stems from discrepancies between assumed energy consumption values in reported savings and the project-specific consumption determined during desk reviews, for both refrigerators and freezers.

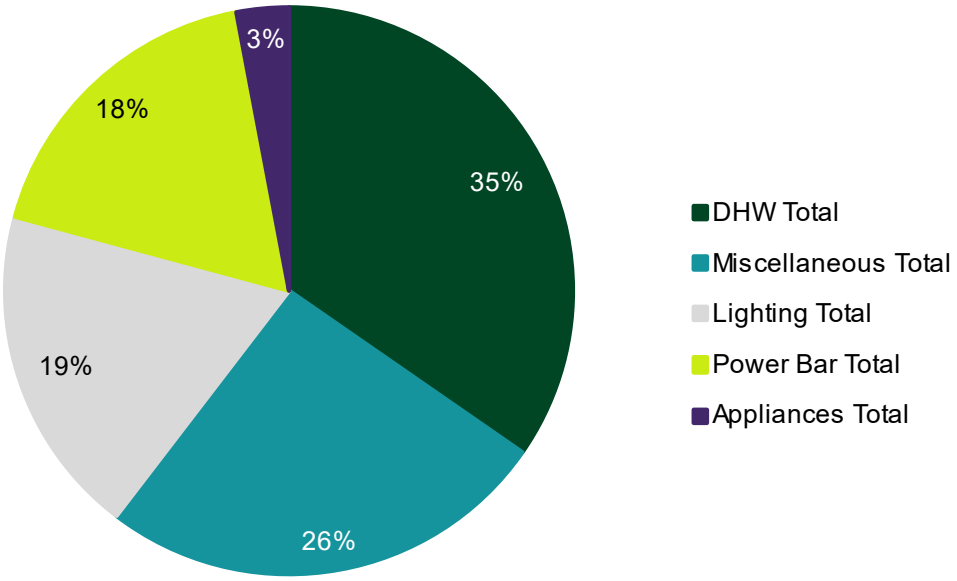
Table 4: Gross Verified Energy Savings Results by Measure Category (kWh)

Measure Category	Reported Savings – Energy - (kWh)	Verified Savings – Energy - (kWh)	RR – Energy	Drivers of RR
Domestic hot water (DHW) end-use total	45,885	40,077	87%	• PY2019 savings updates for showerheads, aerators, and pipe wrap • Low RR for pipe wrap due to reported savings from outdated MAL
Miscellaneous measures	31,115	29,585	95%	• Indoor drying rack or clothesline savings updates (PY2019) • Block heater timer ISRs of 89%

Measure Category	Reported Savings – Energy - (kWh)	Verified Savings – Energy - (kWh)	RR – Energy	Drivers of RR
Lighting end-use total	27,830	21,842	78%	• PY2019 savings updates which lowered baseline wattage and HOU values • Reported savings from outdated MAL used for some measures • ISR of 88%
Appliance end-use total	6,566	3,110	47%	• Significantly lower energy consumption of existing refrigerators than in default reported savings • Significantly higher conservation case freezer consumption than in default reported savings • Instances of project-specific existing freezer energy consumption lower than newly installed freezer
Smart power bar end-use	3,990	20,429	512%	• Reported savings from outdated MAL entry
Total	**115,386**	**115,043**	**100%**	

The gross verified energy savings for RFNEEPP were dominated by DHW and miscellaneous end-uses, which together covered over half (61%) of total program energy savings of 115 MWh. (Figure 1). Lighting and smart power bars were the next largest end-use categories for RFNEEPP. Appliances, comprised of refrigerators and freezers, accounted for 3% of gross verified demand savings for RFNEEPP.

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



3.1.3 Gross Verified Demand Savings Key Results

RNEEPP achieved a total of 0.008 MW of net demand savings persisting until 2022 (Table 5). The program achieved an overall demand RR of 60%. Among specific end-uses, DHW measures had the highest demand RR (95%) and accounted for the largest portion (54%) of total program demand savings. Lighting measures achieved an RR of 84% and were responsible for 19% of the total program demand savings. Only one measure in the miscellaneous category had non-zero demand savings, indoor drying racks or clotheslines. It had the lowest demand RR (19%) of any category and still accounted for less than one-fifth of gross verified demand savings (14%). Appliance measures achieved a demand RR of only 46% and accounted for a marginal portion of gross verified savings (5%). The low appliance RR stems from discrepancies between assumed energy consumption values in reported savings and the project-specific consumption determined during desk reviews, for both refrigerators and freezers.

Smart power bars did not include any demand savings in the tracking data. Therefore, a meaningful measure-level realization rate could not be calculated for them.[8]

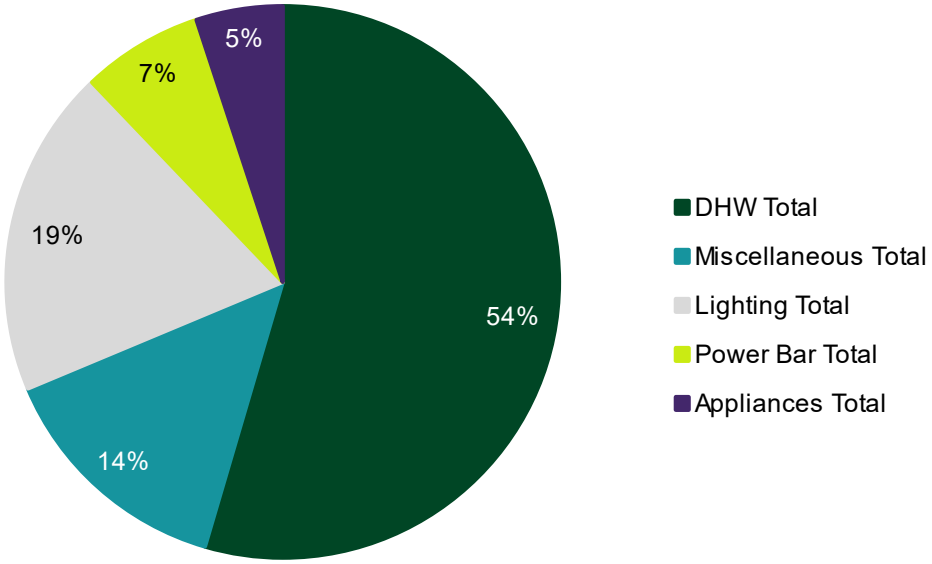
[8] While a measure-specific RR was not able to be calculated, the overall program realization rate considers the gross (reported) savings and the gross verified demand savings values.

Table 5: Gross Verified Demand Savings Results by Measure Category (kW)

Measure Category	Reported Savings – Demand (kW)	Verified Savings – Demand (kW)	RR – Demand	Drivers of RR
Miscellaneous measures	6.11	1.14	19%	• Reported savings from outdated MAL used for indoor drying racks or clotheslines
Domestic hot water (DHW) end-use total	4.53	4.32	95%	• PY2019 savings updates for showerheads, aerators, and pipe wrap • Low RR for pipe wrap due to reported savings from outdated MAL
Lighting end-use total	1.84	1.54	84%	• PY2019 savings updates which lowered baseline wattage and HOU values • Reported savings from outdated MAL used for some measures • ISR of 88%
Appliance end-use total	0.87	0.40	46%	• Significantly lower energy consumption of existing refrigerators than in default reported savings • Significantly higher conservation case freezer consumption than in default reported savings • Instances of project-specific existing freezer energy consumption lower than newly installed freezer
Smart power bar end-use	0	0.59	-	• Reported savings from outdated MAL entry
Total	**13.35**	**7.99**	**60%**	

The gross verified demand savings for RFNEEPP were dominated by DHW measures, which covered over half (54%) of total program demand savings of 0.008 MW. (Figure 2). Lighting (19%) and miscellaneous measures (14%) were the next-largest demand end-uses for RFNEEPP. Smart power bars and appliances each accounted for less than 10% of gross verified demand savings.

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



Section 4 Cost-Effectiveness Evaluation

This section provides the cost-effectiveness evaluation results. Details regarding the cost-effectiveness methodology can be found in Section 2.2 and Appendix A.1.6.

The IF RFNEEPP cost-effectiveness results are presented in Table 6. The program did not pass the Program Administrator Cost (PAC) test in any year as the program 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.[9]

Table 6: Program Level Cost-Effectiveness Key Metrics

Cost-Effectiveness Test	PY2020	PY2021	PY2022	Total
PAC				
PAC Costs ($)	$1,184,581	$72,201	$44,289	$1,301,071
PAC Benefits ($)	$14,762	$24,423	$3,533	$42,719
PAC Net Benefits ($)	-$1,169,818	-$47,778	-$40,756	-$1,258,352
PAC Net Benefit (Ratio)	0.01	0.34	0.08	0.03
Levelized Delivery Cost				
$/kWh	$3.43	$0.14	$0.65	$1.39
$/kW	$51,867	$2,030	$ 8,658	$20,485

The program's PAC, and levelized delivery cost (LC) metrics indicate that the program's cost effectiveness was at its lowest during PY2020, the program's first year with completed projects. This is mainly due to high admin and program startup costs in the first year of the program.

To understand why the ratios changed year to year, one can look at the corresponding costs and benefits that comprise these CE ratios. The PAC costs during the first program year of PY2020 were $1,184,581 and accounted for 91% of the total PY2020 through PY2022 PAC costs. As previously stated, most first-year program costs are attributed to IESO Admin costs and Vendor Admin costs. While PY2020 accounted for 91% of the total PAC costs, it only contributed 35% of the total PAC benefits at $14,762. This results in PY2020 having the lowest PAC ratio of the three years at 0.01. Admin costs decreased substantially from PY2020 to PY2021 and PY2022. This resulted in a 94% reduction in PAC program costs from PY2020 to PY2021, which had PAC costs of $72,201. PY2021 was also the highest total PAC benefits and PAC ratio of $24,423 and 0.34 respectively. PAC costs were substantially lower in PY2022 at $44,289, only 3% of the total PY2020 through PY2022 PAC costs. PY2022 also saw the lowest PAC benefits of the three years contributing 8% of the total PAC benefits at a PAC ratio of 0.08.

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

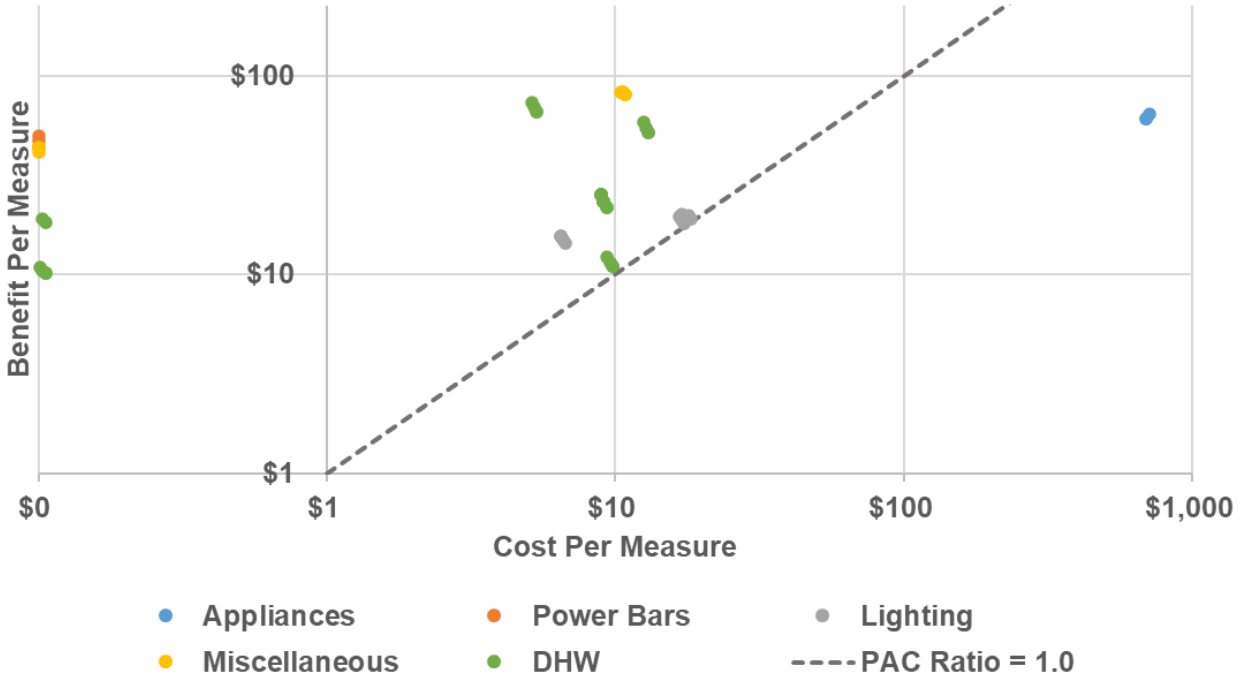
This observation is supported by the program's total verified net energy savings, which saw PY2021 contribute 56% of the total energy savings followed by PY2020 at 37% and PY2022 contributing only 7% of savings.

At the measure level, the measures with the highest PAC ratio (i.e., were the most cost effective) were lower cost and served lighting, hot water heating, and plug load end uses. These included 11W LED light bulbs, engine block heater timers, and all DHW measures. The pipe insulation measures had the highest PAC ratios of any measures ranging from 90 to 177.

The measures with the lowest PAC ratio (i.e., were the least cost-effective) were the appliances measures comprised of all sizes refrigerators and freezers. Correspondingly, these measures also make up the highest cost measures offered in the program.

Figure 3 below more generally presents the relative costs and benefits by end use. We observe that while household appliances (freezers and refrigerators) offer good benefits, their costs are by far the highest. Clustered around approximately $10 in cost each are some water heating measures, lighting measures, and miscellaneous (block heater timers and outdoor clotheslines) measures. While these are low-cost and generally have the best measure-level PAC ratios, they provide relatively smaller benefits per measure.

Figure 3: PAC Benefits vs. Costs by End Use



*Note: x and y axes use a logarithmic scale

Section 5 Process Evaluation

This section provides 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

This section provides the feedback received from the IESO and delivery vendor staff about the design and delivery of the program.

5.1.1 High-Level Results

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

- The original program delivery model, which called for technical team members to go into the communities and work side by side with local teams, was upended by the COVID-19 pandemic necessitating various adjustments.
- The budget for health and safety improvements enabled the delivery vendor to successfully deal with multiple health, safety, and structural issues, though not all issues could be addressed given budget constraints. Health and safety funding was most commonly used to address indoor air quality issues and to reduce fire risk.
- The RFNEEPP's strengths include the addition of energy-efficient freezers, which serve the needs of the targeted communities very well. The RFNEEPP also handled shipping issues well by trucking in program-incentivized equipment on shipping containers to local communities prior to the start of the program and using them as equipment storage and office space.
- The COVID-19 pandemic presented many challenges to the program in terms of engaging with community members and local support staff (e.g., Community Energy Champions and Community Coordinators).
- The delivery vendor noted that the biggest determinant of success was having a local champion within the community who was driving the program and working with community leaders. Doing so helped build trust and foster relationships across the community.
- IESO staff stressed that it is important to have continuous funding for First Nations programs since it is difficult to build trust and relationships where there is uncertainty about whether program funding will be available year to year.

5.1.2 Design and Delivery

IESO staff reported that the primary objectives of RFNEEPP were to enroll eligible communities, complete audits, and install program equipment for community members. RFNEEPP was offered to four communities where a new transmission line was to be built that would connect them to the Ontario grid; the aim was to have energy-efficiency equipment installed as these homes connected to the grid. However, due to the COVID-19 pandemic and challenges with community

engagement, only one community saw 100% participation in the program (see Section 5.1.5 for more discussion around barriers).

One program delivery vendor was responsible for all aspects of RFNEEPPs delivery. This program delivery vendor coordinated with a community outreach group, Nishnawbe-Aski Nation (NAN), that served as the face of the pilot to eligible communities. The program delivery vendor was responsible for purchasing eligible equipment and shipping it to community locations. They were also responsible for hiring, training, and overseeing the program auditors and contractors who performed the home energy audits and installed the equipment.

Additionally, Community Coordinators were employed by RFNEEPP to act as dedicated staff resources to support their communities in participating in the program and to help the program in securing contractors. Community Energy Champions, who were funded more broadly by the IESO (and not through RFNEEPP) acted as community-based resources in place to support energy initiatives within a participating First Nation community (e.g., proposing projects, working with the Community Coordinators on moving projects toward completion).

The program delivery vendor said that the program started off with a strong start, noting that they initially had good community partners with the Community Energy Champions and Coordinators. They also noted that the initial logistics were strong, that they had appropriate resources, and that there were strong partnerships related to shipping equipment into communities.

The original program design, which called for a technical team of experienced staff members to work with local teams to support them in completing audits and equipment installations, was upended by the COVID-19 pandemic. Different communities had different policies and restrictions, making it difficult to get traction around building a strong local network of auditors and contractors.

Other adjustments made to the program design and delivery as the pandemic progressed included adjusting targets and deciding to remove the commercial delivery stream to instead focus solely on delivery to residents. The program also added appliances to the measures offered to make the best use of the available budget.

5.1.3 Program Outreach

Due to the COVID-19 pandemic, in-person events and local door-to-door canvassing could not occur. These are important ways to disseminate program information and provide opportunities to engage with the community, build trust, and foster relationships. Delivery vendor staff noted it was very helpful to have the program endorsed by the Chiefs and band councils within communities. IESO staff and delivery vendor staff reported working to build program awareness and engagement in other ways, such as email outreach, phone calls, radio scripts, printed flyers, and social media. For example, IESO staff and the program delivery vendor reached out through posts on Facebook community groups and through Facebook Messenger to try to connect with communities and their members. Facebook posts often included information about participating in the program and success stories. Delivery vendor staff noted that virtual events or meetings were less successful, especially because internet access or internet speeds could be limited in the communities. IESO staff mentioned that it was important to be persistent when reaching out to communities. Both IESO and delivery vendor staff stressed that building relationships takes

time, especially in remote communities that were dealing with many challenges related to the pandemic, mental and physical health issues, and broader long-term issues related to historical colonialism.

5.1.4 Program Successes and Strengths

IESO staff indicated that one of the program's successes was that raised awareness among First Nations communities about energy efficiency and the related potential monetary savings from installing efficient equipment. IESO staff said that the program was successful in communities, such as Wunnumin, that had strong support from their band council and leadership. The program was less successful in communities if leadership was less involved or did not see the importance of the program. Additionally, the community of Wunnumin had a full time, dedicated Community Coordinator which likely also supported the community in reaching its higher levels of program participation.

RFNEEPP had a budget for health and safety upgrades that was utilized in all participating homes. Health and safety funding was most commonly used to address indoor air quality issues and to reduce fire risk (e.g., CO2 detectors, smoke detectors). The program delivery vendor noted addressing some mold and mildew damage as well, but that many participating homes had other health and safety or structural issues (e.g., floors, roofs) that the available budget was not able to cover.

The program also handled shipping issues well. Almost all program-incentivized equipment (the program delivery vendor estimated 95%) was sent to the communities via shipping containers on ice roads prior to program launch. This shipping method was approximately one-fourth of the cost of flying in materials according to the program delivery vendor. Only the bathroom fans and appliances were flown in, as they were added to the program at a later point. The delivery vendors noted that the shipping containers proved to be assets in other ways (e.g., equipment storage that allowed for easy access to equipment, office space for some Community Coordinators).

The delivery vendor also noted that the addition of appliances, such as freezers, served the needs of the targeted communities very well. Many customers use chest freezers to store provisions for the winter, so providing energy-efficient models generated a lot of positive feedback from the communities. Appliances were added to the list of RFNEEPP's offerings halfway through the program to help maximize the available budget. They noted that no other equipment types were dropped from the original scope.

5.1.5 Barriers and Opportunities

As noted in the previous sections, the COVID-19 pandemic posed major barriers to program delivery due to restricted access to the communities and competing priorities among community leaders and members. In addition to the pandemic, both the IESO staff and delivery vendor noted challenges in working with the Community Energy Champions and the Community Coordinators; in some communities, they effectively promoted the program and increased uptake, but in others they had conflicting priorities or were not as engaged. The delivery vendor reported that their staff often felt they were alone in trying to deliver the program in certain communities, often relying on one inaccessible local person to help them deliver the program.

Similarly, the delivery vendor noted that the biggest determinant of whether they would be successful in a community was having a local champion, not necessarily the Community Energy Champion, but one person within the community who was driving the program and working with community leaders. Without such support, community engagement was often lacking and presented major barriers to program uptake.

The program delivery vendor recommended that any delivery vendors serving future versions of the program offer in-person training sessions to bring technical teams and local program delivery staff together in small learning groups. The delivery vendor also recommended continuing to build relationships more generally with communities, with as much focus as possible on in-person engagement (e.g., First Nation symposiums, door-to-door canvassing, community events).

The program delivery vendor suggested heat recovery ventilation systems (HRVs) as a possible addition to the program as they would have a much-needed positive impact on air quality. However, the program delivery vendor also recognized that ongoing maintenance and education to prevent people from unplugging them would be needed to make them a realistic option.

IESO and delivery vendor staff stressed that it is critical to the success of programs such as these to provide continuous funding as it is difficult to build trust and relationships when there is uncertainty about whether funding will be available year to year.

5.2 Community Coordinator Perspectives

This section provides the feedback received from a Community Coordinator about the design and delivery of the program.

5.2.1 High-Level Results

High-level results from the Community Coordinator in-depth interview include the following:

- The Community Coordinator indicated that customers were attracted to the program offerings of free appliances and other upgrades.
- The most effective strategy for driving customer awareness was using a community member to reach out to their community directly through relevant community platforms (i.e., Facebook or radio) to circumvent language barriers.
- Program-provided cardboard baffles were a challenge to work with and it may be worthwhile to replace them with a more durable material in the future.
- The Community Coordinator recommended providing more information about potential program-related hydro bill savings opportunities to the Community Coordinators so that they could better educate potential participants.
- The Community Coordinator recommended increasing insulation contractor funding to ensure that they have adequate resources to complete the work.
- The Community Coordinator recommended expanding social media marketing strategies to increase community awareness of the program.

5.2.2 Background

The NMR team sought to complete IDIs with relevant Community Energy Champions and Community Coordinators from participating communities to understand their experiences with the program. “Community Coordinator” refers to the RFNEEPP-funded community-based resource(s) in place to support RFNEEPP within each Eligible Community. “Community Energy Champion” or “CEC” refers to the IESO-funded community-based resource in place to support energy initiatives within a participating First Nation community. This resource is not funded through RFNEEPP.

5.2.3 Customer Motivations

When asked why customers chose to participate, the respondent stated that customers were interested in the new, free appliances and other upgrades offered through the program, noting that customers liked the products provided overall.

5.2.4 Customer Awareness

When asked what strategies were most effective in driving customer awareness of the program, the respondent indicated that they found that it was most effective to have a community member reach out to the community about the program because of the language barrier. The respondent said that a Community Energy Champion from this particular community talked about the program over the radio and on the community’s Facebook page.

5.2.5 Equipment and Services

The respondent stated that it was hard to work with the cardboard baffles provided by the program and that contractors who helped with the program described a Styrofoam option that may be a better option for a future program to consider. The respondent also mentioned that he preferred the cool white color over the warm white option for the A-shaped bulbs, though he did not have feedback to share on what others may have preferred.

5.2.6 Barriers and Opportunities

The respondent stated that they would like to better understand potential savings that participants could expect to achieve on their hydro bills. They noted that it would have been helpful to provide potential participants with this information to give them an idea of what they would be saving by participating.

The respondent recommended that the delivery vendor provide training on simple calculations (e.g., to estimate energy savings, etc.)

The respondent said that the insulation contractors needed more funding to complete their work. More funding was provided, but respondent recommended starting with a higher funding level in any future versions of the program.

Finally, the respondent recommended social media as a good way to get the word out in the community about the availability of the program.

5.3 AUDITOR AND CONTRACTOR PERSPECTIVES

This section provides the feedback received from RFNEEPP auditor and contractor survey.

5.3.1 High-Level Results

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

- The respondents were highly satisfied with the program marketing and outreach and the interactions they had with the program delivery vendors.
- Auditors and contractors reported that they almost always informed customers about the program.
- An auditor perceived the greatest barriers to program participation to be customer beliefs that the upgrades are not worth the trouble of participating, a need for customers to prioritize more pressing equipment upgrade issues such as ventilation, and difficulty engaging with local support staff.
- Auditors and contractors recommended key ways to improve the program, such as ensuring that program delivery staff are well trained and informed about the program, building relationships with local communities, and providing more support for enabling measures such a repairs and moisture remediation.
- Respondent opinions about the impact of the COVID-19 pandemic varied, with one respondent stating that the associated lockdown had a large impact on operations, whereas the other two respondents reported minimal impact.

5.3.2 Auditor and Contractor Profile

Each of the interviewed auditors reported completing approximately 25 home energy audits in PY2022 though RFNEEPP. Of the three respondents who completed the survey, two performed in-home energy audits (i.e., auditors), and one installed program-eligible equipment (i.e., a contractor). One respondent also performed quality assurance work for the program. The companies represented among the respondents included ones focusing on program delivery, construction, and home inspection services.

5.3.3 Program Experience

The interviewed contractor performed an unspecified number of appliance installations and reported that 95% of the time it was necessary to fly in equipment and measures due to winter road conditions, and that this would typically cost approximately $200.

One respondent indicated that they received training on program offerings, program rules, installation procedures and practices, marketing and outreach techniques to better promote the program to customers, and application process training or support, whereas two respondents indicated that they did not receive any training from the program.

5.3.4 Program Awareness

Respondents indicated that they almost always inform customers who are not already RFNEEPP customers about the program. Using a scale from 1 to 5, where 1 meant “never” and 5 meant

"always," respondents indicated how often they inform customers about the program, with an average rating of 4.5 for the contractor and one auditor who responded that the question was applicable to them.

5.3.5 Program Barriers and Opportunities

Survey respondents were asked to share the barriers that they believe prevent some customers from participating in the program. The one respondent who shared a response to this question pointed to an array of barriers to RFNEEPP participation, including a belief that the upgrades are not worth the trouble of participating, a need to prioritize more pressing equipment upgrade issues such as ventilation, and difficulty engaging with local support staff such as Community Coordinators. The respondent suggested several ways in which the program could help to overcome these barriers, such as expanding program support for health and safety measures, ventilation, and either having program auditors or contractors train local support staff (Community Coordinators) or allowing the program to operate without Community Coordinators if no community members are available to serve as Community Coordinators on a continuous basis while the program is available.

5.3.6 Program Satisfaction

Responding auditors and contractors were asked to rate their satisfaction with the program. The aspects of the program that received the highest scores for satisfaction were the interactions they had with any of the program delivery vendors as well as program marketing and outreach. Aspects of the program such as the application process and forms, the program website, the available measures, and training received a score of 4 out of 5, where 1 means "not at all satisfied" and 5 means "completely satisfied." The satisfaction ratings for the program overall ranged widely, with a mean score of 3.3 out of 5. One respondent indicated that they were not satisfied with the program overall, stating that there is a "lack of knowledge of what needs to be done."

Two respondents provided feedback on what they thought worked well for RFNEEPP. One respondent said "First Nations participation in delivery was a great idea but much harder than it looks and likely needs adjustment to make it work better. I found [that] going into the communities an[d] building relationships with the community members was really valuable. When contractors etc. go into the community it can go either way. A long-term relationship building approach is good as they have had many projects come and go. Even if the projects aim to [do] some good, they are not necessarily perceived like that."

Another respondent said that the training provided to program delivery staff was "a valuable way to help build knowledge base and local capacity," and noted that all homes in the community now have working fans.

5.3.7 Virtual Audit

All respondents provided feedback that they were not involved with virtual audits. One respondent was not in favor of using virtual audits in the future, though they didn't elaborate on reasons why. In contrast, one respondent recommended that RFNEEPP or similar program(s) should continue to allow virtual audits while also building relationships with local support staff (e.g., Community Coordinators, etc.). One respondent identified benefits for virtual audits such as air fare savings,

while also cautioning that virtual audits do not allow for building relationships with the community: "The virtual audit is potentially another thing that [exacerbates] the problems associated with the disconnect between the structure of the program and what is actually happening in the communities. Virtual audits have potential [to help] but also have potential to make some of the existing problems with the program worse."

5.3.8 Community Coordinators

Surveyed auditors and contractors shared their experiences with the Community Coordinators who worked with RFNEEPP. Two of three respondents reported working with one or more Community Coordinators. One of these respondents stated that they worked closely with the Community Coordinators (e.g., doing audits and providing training), whereas the second respondent said that the Community Coordinators helped them navigate through the community but did not communicate very much. The remaining respondent, while they did not work with a Community Coordinator, did interact with the chief and community members and found that the interactions went well overall.

The respondents shared some challenges that they faced with Community Coordinators, such as some communication and cultural barriers, insufficient knowledge about the program, and unreliability. One respondent shared their perspective on what communities without a dedicated coordinator could do to achieve higher program participation. One suggestion was to train program representatives to focus on community engagement and relationship building in addition to auditing and installation services. A second recommendation was to provide a flexible path in which program auditors and contractors provide most of the support initially while local staff receive training and support on program delivery approaches, then increase the role of community members over time.

5.3.9 Recommendations for Program Improvement

All surveyed auditors and contractors shared their suggestions on how RFNEEPP could improve. The most common suggestion (two respondents) was to create standard operating procedures for the program, ensure program support staff such as the Community Coordinators are well trained and informed about all aspects of the program, and check in frequently with community support staff to answer questions and provide support. One respondent suggested that the program could build community members' interest in participating by focusing on their most urgent issues (e.g., ventilation and moisture) and building relationships and trust between program support staff and the community. In addition, gradually building the local First Nation staff's involvement and skills would help to ensure continuity and program achievement. Other recommendations included improving marketing and outreach and better promoting the website.

Two survey respondents provided feedback on additional energy-efficient equipment or services that they would like to see added to RFNEEPP. Both respondents recommended that the program provide more support for enabling measures such as repairs, mold and moisture remediation, and electrical line repair or upgrades. One respondent recommended providing heating systems such as heat pumps. Another respondent recommended providing for direct venting and upgrades to wood stoves, heat recovery ventilation maintenance or replacement, exterior upgrades to improve

thermal comfort, and working with band councils on an ongoing basis to track maintenance needs and provide education.

5.3.10 Health and Safety

Survey respondents rated the difficulty they experienced with installing the appropriate health and safety measures for RFNEEPP customers. While one respondent indicated that this question was not applicable to them, the other two respondents provided an average rating of 3.5 on a scale from 1 to 5, where 1 meant "extremely difficult" and 5 meant "not difficult at all." While the responding contractor stated that they never needed to complete repairs or health and safety upgrades for their projects, one auditor stated that they frequently needed to make such repairs.

When asked what percentage of homes or properties, if any, could not participate in RFNEEPP because health and safety issues were too extensive, two respondents said they did not know, and one declined to answer.

5.3.11 COVID-19 Pandemic Impacts

The respondents' companies experienced some impacts from the COVID-19 pandemic during 2021 and 2022, but two out of three respondents stated that the impact on their work with RFNEEPP was minimal. The third respondent said that they were not able to access communities during lockdowns and therefore there was a large impact on the program.

5.4 Participant Perspectives

This section provides the feedback received from the RFNEEPP participant survey. Results are presented as counts since the sample size is below 20. Additional results can be found in Appendix C.1.

5.4.1 High-Level Results

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

- Most participants heard about the program from a community resource (12 of 15 respondents) and applied to the program with an IESO representative at their home or property (7 out of 15 respondents).
- Participants' primary motivations for applying to the program were the ease of participation and increased safety and reliability (average rating of 4.2 and 4.0, respectively, 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 (8 of 15) of respondents said their energy auditor explained efficiency upgrades and nearly three-fourths (7 of 11) of respondents who received an in-home audit (as opposed to a virtual audit) said these auditors provided educational materials.
- Respondents were satisfied with the program overall (average rating of 4.1 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 performance of the upgrades (average rating of 4.3) and least satisfied with the professionalism of the post-audit contractor (average rating of 3.8).

- Two respondents suggested including exterior lighting, lighting controls, and ovens in the program.
- Other suggestions for improving the program included only performing in-home (not virtual) audits (one respondent) and more community education (one respondent).

5.4.2 Program Awareness and Motivation

Over three-fourths (12 of 15) of respondents heard about the program from a community resource, such as a Community Coordinator (three respondents), Community Energy Champion (three respondents), or from the Chief and/or Council (two respondents). Three of the respondents also mentioned an unspecified Save on Energy representative providing information about the program to them. The most common method for applying to the program was with a Save on Energy representative at the participant's home or property with nearly one-half (7 of 15) of respondents applying this way. Additional feedback on how participants heard about and applied to the program can be found in Figure 23 and Figure 24 in Appendix C.1.2.

Respondents rated the influence that various factors had on their decision to participate in the program 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 that it was easy to participate in the program with an average rating of 4.2 and increased safety and reliability with an average rating of 4.0. Additional feedback on factors influencing RFNEEPP participation can be found in Figure 25 in Appendix C.1.2.

5.4.3 Program Education and Behavioral Changes

Energy auditors provided various educational resources to participants at the time of the audit. Over one-half (8 out of 15) of respondents said the auditor explained the efficiency upgrades performed the day of the audit. Additionally, over three-fifths (7 out of the 11) respondents who had their audit performed at their home (rather than virtually) received educational materials, such as flyers and brochures, while the auditor was on-site. Of the 15 respondents who reported having either an at-home or virtual audit, only four said the auditor discussed additional ways to save energy in their home and five were offered guidance about additional upgrades for which they may have been eligible. Respondents found these resources (i.e., the educational materials and the discussion with the auditor about additional ways to save energy) useful: the average rating was 3.8 on a scale from 1 to 5, where 1 meant "not at all useful" and 5 meant "extremely useful". Additional feedback about the educational resources provided by the auditor to participants can be found in Figure 26 in Appendix C.1.3.

Four participants provided feedback about the additional energy-saving methods that their auditor suggested. The listed methods are having an annual heating system tune-up, hanging laundry to dry, unplugging appliances and electronics, and washing laundry with cold water. Of these four suggestions, hanging laundry to dry has been attempted since the audit. Respondents found these additional energy-saving methods somewhat useful: the average rating was 3.5 on a scale from 1 to 5, where 1 meant "not at all useful" and 5 meant "very useful." Additional feedback on other energy-saving methods suggested and tried can be found in Table 23 in Appendix C.1.3.

5.4.4 Program Satisfaction

Respondents rated their 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 4.1, suggesting most respondents were satisfied with the program. The program aspect that respondents were most satisfied with was the performance of the upgrades (average rating of 4.3). Respondents were least satisfied with the professionalism of the post-audit contractor (average rating of 3.8). Additional feedback on participant satisfaction can be found in Figure 27 in Appendix C.1.4.

When respondents were asked how likely they were to recommend the program and using a scale of 1 to 5, where 1 meant "not at all likely" and 5 meant "extremely likely," all 15 gave a rating of 3 or higher, with an average rating of 4.0.

When asked if the equipment and services provided through the program adequately met their needs, most (12 of 15) respondents said that they did. The remaining respondents stated that the equipment and services did not meet their needs (two respondents) or preferred not to answer (one respondent).

5.4.5 Recommendations for Program Improvement

Two respondents recommended additional energy-efficiency equipment or services for inclusion in the program. These respondents suggested including exterior lighting, lighting controls, and ovens in the program. When asked what, if any, other suggestions they had to improve the program, one respondent stated that the audits should be done on-site only (rather than virtual) and another respondent recommended more community education. As noted in Section 5.4.2, respondents relied heavily on the community to support their participation in the program.

Section 6 Other Energy-Efficiency Benefits

This section provides 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 7 presents the results of these calculations for each program year and the total for the framework.

Table 7: Avoided GHG Emissions by Program Year and Total Framework

Avoided (Tons CO_2 equivalent)	PY2020	PY2021	PY 2022	Total
First Year	4.75	7.81	1.06	13.63
Lifetime	70.69	112.36	15.24	198.29

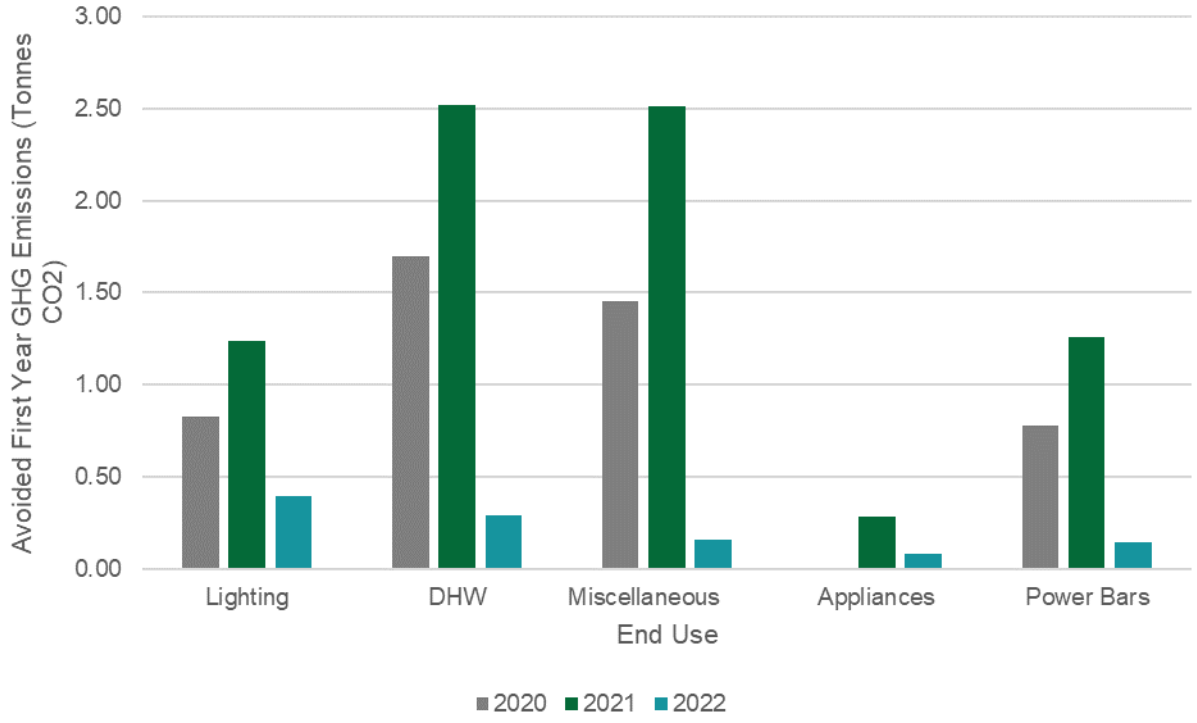
Figure 4 compares avoided cost emissions by end use and program year. Corresponding to energy and demand savings performance, each end use produced the highest GHG emissions reductions in PY2021.

In PY2020 the DHW end-use, which is comprised of bathroom aerators, kitchen aerators, shower aerators, water heater tank insulation and pipe insulation was the largest contributor to avoided first year GHG emissions, contributing 1.69 tonnes CO2e, 36% of the yearly total. The miscellaneous end-use was the second largest contributor to avoided first year GHG emissions, contributing 1.45 tonnes CO2e, 31% of the yearly total. The miscellaneous end-use is comprised of outdoor clotheslines and drying racks, and block heater times. The appliance end-use, which is freezers and refrigerators, did not contribute to avoided GHG emissions in PY2020. Overall, PY2022 contributed 35% of the total PY2020 through PY2022 avoided first year GHG emissions.

In PY2021 the DHW and Miscellaneous end-uses were once again the two largest contributors to avoided first year GHG emissions, contributing 2.52 and 2.51 tonnes CO2e respectively. This amounted to 32% of the yearly total for both end-uses. The appliance end-use was the lowest contributor to avoided first year GHG emissions in PY2021 contributing 0.28 tonnes CO2e, which was only 4% of the yearly total. Overall, PY2021 produced the highest GHG emission reductions accounting for 57% of the total PY2020 through PY2022 avoided first year GHG emissions.

In PY2022 the lighting end-use was the largest contributor to avoided first year GHG emissions, contributing 0.39 tonnes CO2e, 37% of the yearly total. The second largest end-use was DHW which accounted for 0.29 tonnes CO2e, 27% of the yearly total. Similar to PY2020 and PY2021, the appliance end-use was the lowest contributor accounting for only 8% of the total avoided first year GHG emissions in PY2022 at 0.08 tonnes CO2e. Overall, PY2022 produced the lowest GHG emission reductions accounting for only 8% of the total PY2020 through PY2022 avoided first year GHG emissions.

Figure 4: Comparison of Avoided GHG Emissions by End Use and Program Year



6.2 JOBS IMPACT ANALYSIS

This section provides 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 RFNEEPP will create 14 total jobs in Canada, of which 13 will be in Ontario.
- All of the jobs created stem from the demand created for energy-efficient products and services related to program delivery.
- The RFNEEPP program is estimated to create approximately 11 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 RFNEEPP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 8 shows the input values for the demand shock representing the products and services related to

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

Table 8: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor ($ Thousands)	Total Demand Shock ($ Thousands)
Other miscellaneous manufactured products	30	0	30
Major appliances	24	3	27
Electric light bulbs and tubes	6	0	6
Small electric appliances	1	2	3
Other professional, scientific and technical services	-	-	472
Office administrative services	-	-	763
Total			**1,301**

Table 9 shows the calculations and input value for the household expenditure shock.[10] 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 A.4.

Table 9: Summary of Input Values for Household Expenditure Shock

Description	Demand Shock *($ Thousands)*
Net Present Value (NPV) of energy bill savings	175
Residential portion of program funding	(455)
Net bill savings to residential sector	**(281)**
Percent spent on consumption (vs. saved)	54%
Total Shock	**(153)**

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 RFNEEPP, this means that two different sets of job impacts are combined into the overall jobs impacts. Table 10 shows the total estimated job impacts by type – combining the impacts from the demand and household expenditure shocks.

[10] 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.

The majority (13 out of the 14 estimated total jobs) were in Ontario. All the direct jobs created were created in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 3 out of 4 indirect and 3 out of 4 induced total jobs within the province. The full time equivalent (FTE) job estimates are slightly less, with a total of 10 FTEs (of all types) created in Ontario and 11 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. RFNEEPP was estimated to create 10.7 total jobs per $1M of investment in 2022.

Table 10: 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	7	7	5.1
Indirect	2	3	3	4	2.8
Induced	2	3	3	4	2.8
Total	**10**	**11**	**13**	**14**	**10.7**

A more detailed write up of the model impacts, including a breakout of impacts by industry, can be found in Appendix D.

Section 7 Key Findings and Recommendations

This section provides all the key findings and recommendations for the evaluation.

Finding 1: Tracking of health and safety barriers in project files and tracking data was inconsistent and overly broad. Tracking data only flagged projects that received funding to address health, safety, and comfort – i.e., no record of specific health and safety concerns. Engineering desk reviews turned up projects with health and safety barriers (e.g., mold, exposed electrical wiring) without a corresponding line item in tracking data, and projects with a flag for health issues in tracking data but no corresponding record in project files. Tracking health and safety barriers is key to understanding the potential for increasing the uptake of high-savings measures like weatherization. Previous evaluations[11] have recommended an emphasis on weatherization upgrades due to high per-unit savings and co-benefits of increased occupant comfort.

- **Recommendation 1a.** Improve the quality and comprehensiveness of health, safety, and comfort data collected on-site and contained in the program tracking data. This could include adding required fields to program tracking data for any projects where auditors and contractors identify a health and safety barrier (e.g., what barrier(s) did they observe, what measures were they unable to install as a result).
- **Recommendation 1b.** Develop a participant journey map for homes with observed health and safety barriers. Equip auditors and contractors with the time and resources to provide guidance on how participants can remediate any observed health and safety barriers. This could include referrals to contractors that could conduct the necessary remediation and program incentives specifically tied to these steps. In addition, these journey maps can extend into follow-up plans for participants to receive certain energy-efficiency measures that weren't installed due to health and safety concerns, after remediation has occurred.

Finding 2: Auditors and contractors observed whether participants' homes contained heat recovery ventilation (HRV) but rarely recommended maintenance or upgrades. Auditors and contractors documented the presence of HRV systems in 40% of desk-reviewed projects (n=77). However, only slightly more than one-fourth (29%) of desk-reviewed projects had an operational HRV, and there was no documentation of why non-operational systems were not in use. Engineering desk reviews did not find any evidence that auditors and contractors consulted participants on the overlapping impacts of upgrading building insulation and ventilation systems[12]. Data on HRV were not passed through to the program tracking database.

- **Recommendation 2a.** In participant homes that receive air sealing, add specific incentives for HRV or energy recovery ventilator (ERV) installation and/or upgrade to promote deeper air sealing savings. Program support for HRV/ERV should include

[11] See Finding 1 in the 2021-2024 CDM Framework: PY2021 Energy Affordability Program Evaluation Report; see also Recommendation 2a in the Interim Framework: First Nations Conservation Program Evaluation Report.
[12] ASHRAE Standard 62.1 and 62.2 dictate a certain level of ventilation needed per person in a given space for acceptable indoor air quality.

balancing, maintenance, and educational materials. While an HRV/ERV represents an additional electric load, the deeper savings from tightening the home, lowering the overall heating and/or cooling load of the home, and potential non-energy benefits in occupant comfort and indoor air quality may outweigh the increased electrical load from any added mechanical ventilation.

- **Recommendation 2b.** Create variables in program tracking data that document whether participant homes have an HRV/ERV, and whether it is operational. As part of recommending building envelope upgrades, require that auditors and contractors assess whether ventilation systems are appropriately sized following those upgrades, per industry best practice.

Finding 3: RFNEEPP program tracking data lists completed projects under multiple identifiers for the same home and contains inconsistent contact information for verifying unique participants. In addition, tracking data does not typically include key characteristics that are collected during audits such as building type or mechanical equipment for heating/cooling. Data quality issues such as multiple unique identifiers, inconsistent contact information, and incomplete building/equipment characteristics can adversely affect program planning and evaluation. A single, unique identifier that traces all project work back to one home improves the timeliness of sample development and subsequent data requests to program vendors. Identifiers can also be generated for homes where project work was attempted but not completed, to facilitate follow-up visits and track incomplete audits. These unique identifiers are critical for impact evaluations that encompass multiple program years. Data capturing key building and/or equipment characteristics can be used to better estimate savings impacts, to identify additional energy saving opportunities at existing participant homes, and to provide insights into future program offerings. However, all RFNEEPP participant records were missing data on building type information and had no fields to record mechanical equipment details.

- **Recommendation 3a.** Work with program staff and program delivery vendors to consistently incorporate details collected on-site into the tracking data (e.g., building type, mechanical equipment for heating/cooling, heating fuel, efficiency, capacity, and HRV data (see ***Finding 2***)). This could include revising the IESO's Field Audit Support (Fast) Tool program or development of a new uniform electronic data collection form for auditors to upload these data directly into the tracking data.
- **Recommendation 3b.** Consolidate the multiple, overlapping sets of application identifiers currently used in tracking data such that each home has a unique identifier.
- **Recommendation 3c.** Quantify the number of attempted but incomplete RFNEEPP audits, in addition to tracking program participants. These data can help program staff and program delivery vendors determine where program participation has the greatest growth potential and more quickly identify where there are potential participation barriers.
- **Recommendation 3d.** Develop protocols to verify that Measure Lists the IESO provides to delivery agents split out reported savings for measures whose substantiation sheets have different reported savings depending on building type, heating and/or cooling

systems, heating fuel, etc. IESO Measure Lists should also flag which demand factor is used to calculate savings. Ensure the MAL also documents these different reported savings.

Finding 4: Desk review results suggest that the average consumption of replaced refrigerators aligns more closely with the federal minimum consumption (UEC_{base}) than assumed existing equipment consumption (UEC_{exist}). IESO deemed UEC_{exist} values are reasonable compared with equivalent deemed values in the Illinois Technical Reference Manual (TRM) but overestimate actual existing refrigerator consumption as observed in PY2022 and PY2021 desk reviews.[13] No other TRMs in the cross-jurisdictional scan explicitly listed UEC_{exist} values. No TRMs require blended savings based on existing equipment and federal minimum baselines, as is currently the case in IESO substantiation sheets. Instead, reviewed TRMs list separate savings assumptions depending on whether the refrigeration equipment has a time of sale or early replacement baseline.[14] Separate MAL entries for time of sale and early replacement scenarios would reflect the reality that the IESO is in some cases replacing refrigeration equipment past its effective useful life (EUL). As a result, separate MAL entries could improve the accuracy of claimed savings from refrigeration upgrades.

- **Recommendation 4a.** Create separate MAL entries for time of sale vs. early replacement refrigerators, as well as different refrigerator configurations (e.g. top-freezer, bottom-freezer, side-by-side). Alternatively, conduct an appliance baseline study to update the current assumption in substantiation sheets that the remaining useful life (RUL) of an early replacement refrigerator/freezer is one-third of its effective useful life.
- **Recommendation 4b.** Conduct an appliance baseline study to update unit energy consumption values in all appliance substantiation sheets.
- **Recommendation 4c**. Make delivery vendors aware of any future changes to appliance baseline assumptions. Verify that vendors are installing refrigeration equipment that consumes less energy than the assumed unit energy consumption of existing (UEC_{exist}) and minimally compliant (UEC_{base}) refrigerators / freezers.

Finding 5: The energy consumption thresholds for refrigerators and freezers listed in Audit & Retrofit Protocols do not align with the equipment age used to determine eligibility for replacement (i.e., manufactured in 2011 or earlier) as listed in auditors' data collection forms. A cross-jurisdictional scan of technical reference manuals (TRMs) determined that for refrigerators and chest freezers, the Audit & Retrofit protocol thresholds for energy consumption

[13] PY2022 includes EAP and RFNEEPP desk reviews, whereas PY2021 only includes EAP desk reviews. Desk reviews are not sufficient for recommending updates to UEC_{exist} because they do not reflect the energy consumption for refrigerators associated with the non-participant population. A representative baseline for appliance energy consumption requires a sample frame containing households with and without prior experience in energy-efficiency programs such as EAP.

[14] "Time of sale" refers to cases where the replaced equipment is past its effective useful life (EUL), so the baseline equipment meets the minimum regulatory requirements for energy consumption (UEC_{base}). "Early replacement" refers to cases where the existing equipment is not past its EUL. In these instances, the baseline equipment is the existing refrigerator for the assumed remaining useful life (UEC_{exist}), then the "time of sale" baseline (UEC_{base}) until the end of its effective useful life (EUL). Refer to entry 5.1.6 in the 2022 Illinois TRM for additional details. Some jurisdictions may adjust their baseline and/or EUL assumptions based on the region, income levels, etc. of the populations they serve.

(925 & 615 kWh, respective) imply that only models older than 2001 would be eligible for replacement. However, data collection forms list 2012 as the threshold for auditors and contractors to use when determining eligibility.

- **Recommendation 5a.** Lower the audit protocol thresholds for refrigerators and chest freezers to the NY TRM LMI baseline consumption for a refrigerator manufactured in the latest year IESO has determined is still eligible for replacement (2011) per the data collection forms included in project files.
- **Recommendation 5b.** Specify separate minimum refrigerator and freezer consumption thresholds in Audit & Retrofit Protocols based on appliance configuration (e.g., upright vs. chest freezers).

Finding 6: Building trust, developing relationships, and directly engaging with the community is critical to the success of the program. Distrust of government agencies and outside organizations or individuals was a major barrier to program participation mentioned by both IESO and program delivery vendor staff. IESO staff stated that this distrust often stems from the many issues generated by historical colonialism. To help address this barrier, the program worked to build relationships with community leaders and enlist the support of local delivery staff (see ***Finding 14*** for more details on the program delivery model). One program contractor stated that building relationships was highly valuable and could positively impact customers' perceptions of the program and upgrades. The program delivery vendor reported the greatest determinant of whether the program would be successful in a community was having a local champion to work with community leaders and drive the program forward. The delivery vendor and IESO staff also stressed the importance of receiving buy-in from Chiefs and/or band councils to confirm the program's legitimacy and to build trust. Finally, IESO staff stressed the importance of providing continuous funding to First Nations programs, noting that it becomes difficult to build trust when the funding's timeline is uncertain.

- **Recommendation 6a.** Continue to hire local champions who are enthusiastic about the program's goals and continue to hire and train local auditors and contractors. Doing so will help to build local knowledge and provide a base from which to build trust.
- **Recommendation 6b.** Receive buy-in from Chiefs and/or band councils to confirm the program's legitimacy.
- **Recommendation 6c.** Consider a longer-term funding approach for First Nations programs to offer assurance that the program will be a continued presence in supporting remote First Nations communities.

Finding 7: Additional opportunities exist to support program outreach and marketing. In contrast to other Save on Energy programs, most RFNEEPP participants (12 of 15) heard about the program directly from someone in their community. One contractor thought that communication could be improved and encouraged the program to find ways to boost visibility. The interviewed Community Coordinator stressed that one of the most effective strategies for driving community awareness was through trusted community members who directly contacted their community through popular local pathways (e.g., community Facebook groups, radio, community events). The interviewed Community Coordinator also indicated that they found it most

effective to have a community member reach out about the program, especially to avoid language barriers. Program delivery vendors said that while most in-person events and door-to-door canvassing were cancelled due to the pandemic, they are recommended as important ways to build relationships and to better understand the unique needs of each community.

- **Recommendation 7a.** Continue to reach out to communities through existing and popular communication pathways to share information about the program (e.g., social media, such as through community Facebook pages, or local radio).
- **Recommendation 7b.** Provide communities with an array of customizable marketing materials to meet a community's needs, such as outreach scripts for social media and radio, or video or audio clips with testimonials from community members who have participated.
- **Recommendation 7c.** Consider offering social media training sessions to Community Coordinators and/or Community Energy Champions to help them maximize the program's social media presence.
- **Recommendation 7d.** Consider employing local staff (e.g., Community Coordinators, Community Energy Champions, or others as needed) to translate marketing materials into the communities' preferred languages.
- **Recommendation 7e.** Future versions of the program are encouraged to increase the program's presence in group settings, such as lunch and learns, door-to-door canvassing, First Nations symposiums, and other local community events. Doing so will help to build relationships while informing communities members about the program and its benefits.

Finding 8: Expanding the scope of equipment offerings was a common improvement suggestion. While most participants (12 of 15) indicated that the equipment and services provided through the program adequately met their needs, two recommended the program consider adding exterior lighting and ovens. The interviewed delivery vendor staff and auditors and contractors expressed a desire for additional ventilation equipment. The Community Coordinator recommended providing A-shape bulbs with cool white coloring, Styrofoam baffles (instead of carboard), and adequate funding for insulation updates. Two auditors suggested including additional equipment in the program, including heating equipment (such as heat pumps), upgrades to woodstoves, exterior lighting, and lighting controls. Both the program delivery vendor and the Community Coordinator reported participants were often very interested to learn that the program offered appliances. The program delivery vendor noted that the addition of freezers was welcomed by many community members who often store provisions for the winter.

- **Recommendation 8a.** Consider the feasibility of offering additional ventilation improvement support (see **Recommendation 2a**).
- **Recommendation 8b.** Continue to explore the possibility of offering additional types and varieties of equipment. Examples provided by respondents included heating equipment (including cold climate heat pumps following grid connection), lighting in a variety of light color choices, Styrofoam baffles, ovens/stoves, exterior lighting, and lighting controls.
- **Recommendation 8c.** Ensure that adequate funding is provided to insulation contractors for insulation upgrades.

- **Recommendation 8c.** Continue to offer freezers in any future versions of the program, as they help remote community members store provisions.

Finding 9: Additional budget for health, safety, and other improvements is recommended. Participants indicated that one of the most influential factors in their decision to participate in the program was to increase safety and reliability (average rating of 4.2 on a scale from 1 to 5 where 1 is "not at all influential" and 5 is "extremely influential"). The program delivery vendor reported that the budget for health and safety improvements enabled them to address some structural issues related to mold and mildew damage, to improve indoor air quality, and to reduce fire risk. However, the program delivery vendor and two auditors recommended that the program provide additional funding for health and safety upgrades because the existing funding was often not able to address all issues. They also recommended addressing other upgrades not currently covered by the health and safety budget, such as broken windows and repairs to roofs and floors, with one auditor stressing that it is important to treat the home as a system to ensure it is as safe and efficient as possible.

- **Recommendation 9a.** Consider increasing the budget for the health and safety upgrades in First Nations communities where housing stock may need more extensive health and safety upgrades.
- **Recommendation 9b.** Consider expanding the range of improvements that can be made under the health and safety budget, to include structural upgrades (e.g., broken windows, or roof and floor damage).

Finding 10: Opportunities exist to improve the training and support provided to auditors and contractors. To improve RFNEEPP, auditors and contractors most commonly (2 respondents) suggested creating standard operating procedures for the program, ensuring auditors and contractors are well trained and informed about all aspects of the program, and that program delivery vendor staff frequently check in to answer questions and provide support. Of the 15 participants who had either an at-home or virtual audit, only four said the auditor discussed additional ways to save energy in their home and five were offered guidance about additional upgrades for which they may be eligible. In addition, respondents were least satisfied with the professionalism of the post-audit contractor (average rating of 3.8). One program auditor stressed the importance of building local capacity through continuing to hire and train local auditors and contractors, recommending that new staff shadow experienced staff while they grow their knowledge base.

- **Recommendation 10a.** Ensure the program delivery vendor is offering training and education with regularity to ensure new auditors and contractors are well-informed about all aspects of the program and to provide refreshers to others.
- **Recommendation 10b.** Ensure auditors are helping participants identify additional ways to save energy during the initial site visit.
- **Recommendation 10c.** To improve the professionalism of auditors and contractors, consider offering training on customer service and relationship building tactics. Additionally, stress the importance of being responsive to any questions/concerns raised by participants during the visits.

- **Recommendation 10d.** Ensure that new locally hired auditors and contractors are given the opportunity to shadow more experienced staff to help them quickly get up to speed.

Finding 11: Opportunities exist to improve the training and support provided to Community Energy Champions and Community Coordinators. Participants frequently learned about the program from a Community Energy Champion (three respondents) or Community Coordinator (two respondents), indicating that these staff serve important roles in informing communities about the program. The delivery vendor, auditors, and contractors reported several challenges when working with Community Coordinators including unreliable communication, language barriers, and insufficient knowledge about the program. Some of these challenges were likely greatly exacerbated by the impacts that the pandemic had on local communities and their members. One surveyed auditor said that better training for Community Coordinators could help the program overcome barriers to participation. The program delivery vendor reported that in communities where local support staff such as Community Coordinators were more engaged, there was typically higher program uptake. The interviewed Community Coordinator recommended that the program delivery vendor provide all Community Coordinators with more information to help them better explain energy savings associated with program upgrades.

- **Recommendation 11a.** To ensure that Community Coordinators and Community Energy Champions are best able serve remote First Nation communities in the future, provide them with in-person training and education early and often. If language barriers exist, enlist local community members to serve as translation support.
- **Recommendation 11b.** Ensure there is frequent coordination between Community Energy Champions, Community Coordinators, auditors, contractors, and program delivery vendors. To help facilitate communications, set up frequent check-in meetings with key staff to reiterate messaging and check in about any challenges.
- **Recommendation 11c.** To help Community Energy Champions and Community Coordinators better explain program savings opportunities to community members, provide them with pamphlets that explain energy savings estimates for program-eligible equipment and/or share methods for calculating customers' potential monetary savings after participation.

Finding 12: Using shipping containers to send equipment to communities was a more cost-effective delivery approach than sending equipment via air. The program delivery vendor explained that the program handled shipping issues well by sending shipping containers to remote communities in advance of the start of the program, while the ice roads were still operational. Doing so involved advance planning given that ice roads to ship the equipment on are available for a limited time during the year. They also reported that it was a more cost-effective approach than sending equipment by air.

- **Recommendation 12.** Future versions of the program should continue to consider preparing and trucking in shipping containers with program equipment while the ice roads are still operational.

Finding 13: Virtual audits can collect the same information as in-person audits and can be more cost-effective, but they are much less effective at building relationships and keeping

community members engaged with the program. Auditors and contractors indicated that virtual audits, introduced to the program in some communities during the COVID-19 pandemic, are a viable option, but that whenever possible, in-person audits should be performed to help build relationships with the local communities. One participant who provided feedback about the audits suggested that audits only be done in-person.

- **Recommendation 13.** Perform audits in person as often as possible, only offering virtual audits when in-person interactions are not feasible or when customers request them.

Finding 14: The COVID-19 pandemic heavily impacted many of the program's planned activities and its overall reach. The program delivery vendor reported that RFNEEPP had been off to a strong start before it was upended by the COVID-19 pandemic. They explained that they had a good delivery model in place based on building relationships through in-person interactions and close coordination with local communities. The program delivery vendor reported having hired a strong technical team to work with local staff to perform audits and installations. Additionally, the program delivery vendor had initiated local partnerships in participating communities (e.g., through hiring Community Coordinators and enlisting the support of Community Energy Champions). However, once the pandemic took hold, different communities implemented varying COVID-related policies and restrictions, and priorities shifted to ensure lockdowns were observed. Once restrictions were lifted, some work was able to resume, but many communities had been severely impacted and were not able to participate to the same degree that was initially planned.

Appendix A Detailed Methodology

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

A.1 IMPACT METHODOLOGY

This appendix provides additional details about the impact evaluation methodology. A summary of the methodology was provided in Section 2. As noted there, IESO Evaluation Measurement and Verification (EM&V) staff agreed with the NMR team to use the entire RFNEEPP population, from both the Interim Framework and 2021 – 2024 Conservation and Demand Management (CDM) Framework, to determine the desk review sample. This was done because program design and delivery were the same between both frameworks. However, only the impact results from the Interim Framework are presented in this report.

A.1.1 Impact Sampling

The NMR team sampled RFNEEPP participants at the project level for desk reviews (Table 11). 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 the 33rd and 80th percentile of savings) and low-savers (projects whose summed measure savings were in the lowest 33% of savings).

The NMR team used the projects in the top 20% of savings as the sample frame for desk reviews. Initial allocations yielded a sample size that met the desired confidence levels for all measures of interest except refrigerators and freezers. Given this deficiency and the low incidence of these measures in the program population, the NMR team modified the allocation to include a census review of projects with either a refrigerator or freezer. These steps resulted in a final sample size of 77 projects. This approach balanced competing needs: the desk review sample included the most program savings possible while covering as many low-incidence measures as possible.

Table 11: Desk Review Sample Summary

n	77
Avg. # of Measures per Project	8.9
Avg. kWh Deemed Savings per Project	1,387

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 RFNEEPP tracking database to identify key measures, savings discrepancies, and other issues that impact the accuracy of reported savings. The review checked for consistency between measure-level reported savings and the Measures and Assumptions List (MAL) values. In addition, the NMR team 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

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

As part of the program tracking database review, the NMR team also reviewed the appliance energy consumption thresholds used in substantiation sheet algorithms and the IESO Audit and Retrofit Protocols to determine measure eligibility and calculate program savings for refrigerators and freezers. This review consisted of three tasks:

- A jurisdictional scan to compare baseline energy consumption data, using updated versions of the TRMs that informed PY2019 substantiation sheet savings updates
- Analysis of on-site metering of refrigeration energy consumption by RFNEEPP auditors and contractors
- A review of the split between existing appliance consumption and federal minimum energy consumption in substantiation sheet algorithms

The results of the appliance energy consumption threshold review are discussed in Appendix B.5.

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

The NMR team surveyed RFNEEPP participants to verify the number of measures installed and in use on their premises. No measures achieved the desired sampling error (10%) at a 90% confidence level based on the PY2022 participant survey alone, so the NMR team incorporated the PY2021 FNCP participant survey ISR results.[15]

[15] Aerators, showerheads, indoor drying racks or clotheslines, and tank/pipe insulation did not have an ISR due to low sample sizes.

The NMR team also surveyed participants to determine HOU for measures more directly impacted by occupant usage. However, no measures achieved the desired sampling error (10%) at a 90% confidence level to justify an adjustment, even when incorporating PY2021 FNCP participant survey HOU results.

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 the 77 sampled projects that the NMR team selected as part of the program tracking database review and sampling 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 confirmations, energy models, photos, and auditor data collection forms.

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. 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, excluding net-to-gross adjustments, are conducted.
- **Reported unit savings:** The savings associated with installing one unit of a particular measure (e.g., one light bulb or 3' of pipe insulation) according to the IESO's substantiation sheets and MAL.
- **Desk review RR:** This is the ratio of reported to verified savings for a particular measure based on review of project files. For example, some measures have discrepancies in quantity or type between data sources or may exist in program tracking data but not in project file documentation.

- **Adjusted TRM CF:** A factor applied to ensure that reported savings align with deemed savings values defined in substantiation sheets (see Equation 1).
- **ISR:** For each measure, the percentage of units distributed to participants that are still in use. This factor accounts for measures distributed to participants that are not used. For example, gross verified savings for freezers include a factor of 98% because one participant reported that the freezer they received was no longer in use.
- **HOU adjustment:** For each measure where hours of use appear in its substantiation sheet algorithm, this factor represents the ratio of self-reported HOU (via the participant survey) to deemed hours of use (as defined in substantiation sheets).
- **Measure quantity:** The number of measures that a participant received. For example, a participant who received 20 lightbulbs would have the per-unit savings value multiplied by 20.

Equation 2: Gross Verified Savings – Prescriptive Measures

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

A.1.6 Weatherization Measures

The NMR team verified weatherization measures were installed through a review of Hot2000 energy model files, photo verification, and audit documentation. However, there were no reported savings for any installed weatherization measures because all homes were wood-heated rather than electrically heated homes. The NMR team did not conduct a comprehensive engineering analysis of these measures, nor determine a RR, because there were no savings.

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.*[16] The tool was populated with the following key information from the evaluation:

- First year energy and summer peak demand savings
- EUL
- End use load profile
- Incremental equipment and installation cost

[16] *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

- Net to gross ratios for energy savings and demand savings

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:

- 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 2.3.

A.3.1 Research Question Development

Table 12 provides a list of the key research questions and the data sources used to investigate each. The team developed these research questions at the beginning of the PY2022 evaluation period in January and February 2022. They were written in consultation with the IESO program and the IESO EM&V staff. Before finalizing the research questions, the NMR team reviewed the timing of the related survey instruments to ensure that the number of research questions addressed within them did not result in a survey that would be too time consuming for respondents to complete. . After the research questions were finalized, they were adapted for inclusion in the interview guides and survey instruments, which were, in turn, reviewed and approved by the IESO EM&V and program staff (see Appendix A.3.2 for more information on the interview and survey methodology).

Table 12: Process Evaluation Research Questions and Data Sources

Research Questions	Document & Records Review	IESO & Delivery Vendor Interviews	Participant Survey	Auditor & Contractor Survey	Energy Champion & Community Coordinator Interviews
Is sufficient data being captured to effectively verify program processes and savings?	✓	✓			
What are the goals and objectives of the program, and how well is the program doing in terms of meeting them?		✓			
What strategies were effective in terms of driving participation and increasing program awareness?		✓		✓	✓

Research Questions	Document & Records Review	IESO & Delivery Vendor Interviews	Participant Survey	Auditor & Contractor Survey	Energy Champion & Community Coordinator Interviews
What strategies were not as effective? Were the strategies implemented as planned?		✓		✓	✓
What are the programs strengths, barriers, and areas of improvement (e.g., in terms of program design, delivery)?		✓	✓	✓	✓
What were the experiences of participants and auditors/contractors in participating in the program? How satisfied were they with the various program elements and with the program overall?			✓	✓	
What were the experiences of each of Community Coordinator and the Community Energy Champions? Where there any challenges coordinating between them or with the delivery vendor?		✓			✓
The IESO expects that the Community Coordinator will be able to use their network to help secure certified contractors if needed. Have there been any challenges faced by the Community Coordinators in finding/ securing certified contractors for the measures that require this?		✓			✓
There was high uptake by communities with a dedicated on-the-ground Community Coordinator. Wunnumin's success is in large part due to having a full-time dedicated resource, who was also engaged with the community full-time. For the communities without a dedicated coordinator, how might the process be improved?		✓		✓	✓
One pilot learning was that a directive from the Chief and Council to participate in the project would increase registration rates from the beginning of the Program. In cases where these directives		✓			✓

Research Questions	Document & Records Review	IESO & Delivery Vendor Interviews	Participant Survey	Auditor & Contractor Survey	Energy Champion & Community Coordinator Interviews
were not obtained, what were the main barriers?					
Do the current range of program equipment/services meet customer needs? What suggestions exist for additional equipment/services?		✓	✓	✓	✓
For what proportion of project was it necessary to fly measures in to avoid the winter road season? If it was necessary to fly measures in, what was the cost impact (i.e., transportation cost per measure, if available)? What is cost difference between shipping when roads are accessible versus storing and shipping when the roads open?		✓		✓	
According to the Program Requirements, a Service Provider may make repairs to the Eligible Residence where such repairs would permit additional Eligible Measures to be installed and may install Health and Safety Upgrades to the Eligible Residence where such upgrades promote electricity conservation and are reasonably required to mitigate an immediate health and safety concern in the residence. What was the impact of health and safety measures undertaken? Are any changes needed?		✓		✓	
Baseline energy consumptions for freezers and refrigerator replacements are defined in the Audit & Retrofit Protocols. Are these thresholds reasonable?	✓				
In response to the COVID-19 pandemic, an update to the pilot was implemented in late spring of 2020 to allow for virtual audits. How well did this work? Are there benefits to continuing with this approach going forward (e.g., cost savings or ease of scheduling)?		✓	✓	✓	

Research Questions	Document & Records Review	IESO & Delivery Vendor Interviews	Participant Survey	Auditor & Contractor Survey	Energy Champion & Community Coordinator Interviews
What impact has the COVID-19 pandemic had on delivery vendors, participants, on auditors/contractors, on Community Coordinators and Energy Champions, on measure availability and costs, and the program overall?		✓	✓	✓	✓

A.3.2 In-Depth Interview and Survey Methodology

During the process evaluation, the NMR team collected primary data from key program actors, including the IESO staff, the delivery vendor staff, Community Coordinators, Community Energy Champions, participants, and auditors and contractors. (Table 13). 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. Given the similarities in program design, process evaluation feedback from both frameworks is provided together within the same report.

The NMR team conducted 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 both the RFNEEPP participant survey and the RFNEEP auditor and contractor survey as both web and phone-based surveys. 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 13: Process Evaluation Primary Data Sources

Respondent Type	Methodology	Fielding Firm	Completed	Population	90% CI Error Margin
RFNEEPP IESO Staff and Delivery Vendor Staff	Phone IDIs	NMR Staff	2	2	0
RFNEEPP Community Coordinators and Community Energy Champions	Phone IDIs	NMR Staff	1	7	N/A*
RFNEEPP Auditors and Contractors	Web and Phone	Resource Innovations Survey Lab	3	8	N/A*
RFNEEPP Participants	Web and Phone	Resource Innovations Survey Lab	15**	166	N/A*

*Error margin not displayed if the respondent count is below 30 unless census is achieved.
**Please note that the 15 completed participant surveys are related to the number of valid participant process evaluation surveys responses. The number of valid participant ISR and HOU evaluation survey responses is 19. This difference is due to four of the participants dropping out of the survey after completing the ISR and HOU survey questions and before completing the process evaluation survey questions.

A.3.3 IESO Staff and Delivery Vendor 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 RFNEEPP (Table 14). 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, COVID-19 pandemic impacts, program measurement and tracking, market actor engagement, customer participation, Community Coordinator and Community Energy Champion 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 60 minutes to complete. The NMR team conducted IDIs via phone with the IESO staff and the delivery vendor staff on April 18 and April 21, 2023, respectively.

Table 14: RFNEEPP 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.3.4 Community Coordinator and Community Energy Champion

The NMR team completed one partial interview with one Community Coordinator to gain a detailed understanding of RFNEEPP (Table 15). 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; COVID-19 pandemic impacts; market actor engagement; customer participation; Community Coordinator and Community Energy Champion activities; program strengths and weaknesses; and suggestions for improvement.

The NMR team identified the appropriate Community Coordinators and Community Energy Champions to interview in consultation with the IESO EM&V staff. Survey outreach was conducted between April 13 and May 17, 2023. Given the low response rate, the NMR team enlisted the help of relevant IESO staff and delivery vendor staff to encourage participation from the Community Coordinators and Community Energy Champions in the interviews. The NMR team received a partial response from one Community Coordinator by email.

Table 15: RFNEEPP Community Coordinator and Community Energy Champion Interview Disposition

Disposition Report	Count
Completes	-
Emails Bounced	-
Bad Contact Info (No Replacement Found)	-
Unsubscribed	-
Partial Complete	1
Refused	1
No Response	5
Total Invited to Participate	7

A.3.5 Auditor and Contractor Survey

The NMR team surveyed one RFNEEPP contractor from a sample of two and contractors (Table 16). The purpose of the survey was to better understand RFNEEPP auditor and contractor perspectives related to program delivery.

The interview topics included role in the program; firmographics; training and education received; outreach and marketing to customers; program satisfaction; program strengths; cost impacts of flying in equipment; virtual audits; Community Coordinator engagement; health and safety; COVID-19 pandemic impacts; 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. 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 and web in partnership with the Resource Innovations survey lab using Qualtrics survey software. Survey implementation was conducted between April 3 and May 8, 2023. The survey was designed to allow the respondent to come back to the survey later to complete it if they preferred. Given that all respondents chose to complete the survey in this way, the average time to complete the survey cannot be determined.

Table 16: RFNEEPP Auditor and Contractor Survey Disposition

Disposition Report	Web	Phone
Completes	1	2
Emails Bounced	1	-
Partial Complete	2	-
Screened Out	1	-
Non-working #	-	2
Voicemail	-	2
Agreed to Complete Online	-	1
No Response	3	-
Total Invited to Participate	8	7

A.3.6 Participant Survey

The NMR team surveyed 15 RFNEEPP participants from a sample of 166 unique contacts (Table 17). The purpose of the survey was to better understand RFNEEPP 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; in-home and virtual audits; education and materials provided by the energy auditor; suggested energy-saving methods that participants implemented; satisfaction with various aspects of the program process as well as with program equipment and services; suggestions for program improvement, including additional equipment or services to consider; COVID-19 pandemic impacts; and demographics.

The NMR team developed the sample from program records provided by the IESO EM&V staff. Due to the limited number of participants and the fact that the program design models were the same, IESO EM&V staff and the NMR team agreed to use the entire RFNEEPP population of participants from both the Interim Framework and the CDM Framework to determine the process evaluation participant 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 22 and May 1, 2023. The survey took an average of 24 minutes to complete after removing outliers.[17] The NMR team sent weekly email reminders to non-responsive contacts over the course of web survey fielding.

Table 17: RFNEEPP Participant Survey Disposition

Disposition Report	Web	Phone
Completes	8	7
Emails Bounced	3	-
Bad Contact Info (No Replacement Found)	-	3
Unsubscribed	-	
Partial Complete	1	1
Screened Out	10	
Busy	-	11
Callback	-	5
Soft Refusal	-	3
Hard Refusal	-	1
Picked up but no response	-	9
Emailed new contact	-	-
No Eligible Respondent	-	5
Non-working #	-	39
Left message with operator	-	1
Call did not connect	-	3
Bad Signal	-	1
Voicemail	-	30
Agreed to Complete Online	-	1
Wrong Number	-	8
Language Barriers	-	4
No longer with company	-	--
Out of business	-	-
No Response	84	28
Total Invited to Participate	106	160

[17] Note that the survey was designed to allow the respondent to come back to the survey later 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.

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 RFNEEPP 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[18]. The models are classical Leontief-type open-IO models[19], 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 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 2019. The model has been used to model employment impacts from a wide range of economic shocks, including structural changes to the Canadian economy[20], the bovine spongiform encephalitis (BSE) crisis in the early-mid 2000s[21], and the construction of hydropower projects[22].

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

[18] Statistics Canada - Industry Accounts Division System of National Accounts; (2009). User's Guide to the Canadian Input-Output Model. Statistics Canada. Ret
[19] Ghanem, Ziad; (2010). The Canadian and Inter-Provincial Input-Output Models: The Mathematical Framework. Statistics Canada – Industry Accounts Division.
[20] Gera, S & Masse, P; (1996). Employment Performance in the Knowledge-Based Economy, Gouvernement du Canada - Industrial Organization 14, Gouvernement du Canada - Industry Canada.
[21] 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.
[22] Desrochers, R. et al.; (2011). Job Creation and Economic Development Opportunities in the Canadian Hydropower Market. Canadian Hydropower Association.

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 CAD dollars) to simulate the effects of RFNEEPP
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 RFNEEPP was to determine which specific research questions (RQs) the model would answer. In a scenario without the existence of RFNEEPP, customers receive electricity from IESO and pay for it via the monthly billing process. Delivering RFNEEPP 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 RFNEEPP 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 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 3).

   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[23] (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:

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

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

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

3. **RFNEEPP funding.** IESO energy-efficiency programs are funded by a volumetric charge on electricity bills and, volumetrically, residential customers accounted for 35% of consumption and non-residential customers accounted for 65% in 2021[24]. 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 Interpreted Results

Determining the total job impacts from RFNEEPP 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:

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

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

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.

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 Result

Table 18 presents the detailed measure-level results of the RFNEEPP impact evaluation. The savings values in the table represent the measure-level savings for the entire population. The proportion of total program savings is also included to show the representative impact of each measure's energy and demand RRs.

Table 18: Total Gross Verified Savings by Measure Type

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									
7W - 11W LED A Shape	385	18,365	1.16	76%	83%	13,905	0.96	12%	12%
17W - 23W LED A Shape	42	2,413	0.17	82%	89%	1,987	0.15	2%	2%
8W - 12W LED PAR 30	67	3,779	0.27	86%	79%	3,254	0.21	3%	3%
14W - 18W LED PAR 38	62	3,274	0.25	82%	89%	2,696	0.22	2%	3%
Lighting Total	**556**	**27,830**	**1.84**	**79%**	**84%**	**21,842**	**1.54**	**19%**	**19%**
Appliances									
Freezer Replacement	12	1,236	0.17	-34%	-34%	-415	-0.06	0%	-1%
Refrigerator Replacement	26	5,330	0.70	66%	65%	3,525	0.45	3%	6%
Appliances Total	**38**	**6,566**	**0.87**	**47%**	**46%**	**3,110**	**0.4**	**3%**	**5%**
Domestic Hot Water (DHW)									
Bathroom Aerator	89	4,379	0.45	68%	60%	2,966	0.27	3%	3%
Kitchen Aerator	93	11,672	1.12	108%	161%	12,637	1.80	11%	23%
Shower Aerator	79	18,462	1.82	86%	79%	15,823	1.43	14%	18%
Water heating - Hot Water Tank Insulation	72	7,142	0.72	94%	90%	6,684	0.65	6%	8%
Water heating - Per 3' Pipe Wrap (1/2" Pipe)	70	3,367	0.35	45%	39%	1,499	0.14	1%	2%
Water heating - Per 3' Pipe Wrap (3/4" Pipe)	12	863	0.08	54%	50%	467	0.04	0%	1%
DHW Total	**415**	**45,885**	**4.53**	**87%**	**95%**	**40,077**	**4.32**	**35%**	**54%**
Miscellaneous									
Outdoor clotheslines or umbrella stand or indoor drying rack	94	9,118	6.11	92%	19%	8,404	1.14	7%	14%
Block Heater Timer	92	21,997	-	96%	-	21,181	-	18%	0%

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)
Miscellaneous Total	**186**	**31,115**	**6.11**	**95%**	**19%**	**29,658**	**1.14**	**26%**	**14%**
Smart Power Bar									
Smart Power Bar	86	3,990	-	512%	-	20,429	0.59	18%	7%
Smart Power Bar Total	**86**	**3,990**	**-**	**512%**	**-**	**20,429**	**0.59**	**18%**	**7%**
Program Total	**1,281**	**115,386**	**13.35**	**100%**	**60%**	**115,043**	**7.99**	**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 RFNEEPP 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 79%. In addition, the NMR team applied the ISR results from the participant survey (88%) to the gross verified savings. The impact of adjustments to lighting measures represents a significant driver to the program's overall RR as lighting measures account for roughly one-fifth (19%) of total verified savings for the program. The lighting end-use category is dominated by 7 to11-watt A-line bulbs, which represents 12% of the program savings, compared to 2 to 3% for every other type of bulb. 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 RFNEEPP 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 RFNEEPP auditors. The NMR team conducted model number lookups to incorporate appliance-specific values into the desk reviewed savings calculations for the installed equipment and, where possible, the existing equipment – instead of default reported savings input assumptions. 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 no instances where the appliances replaced were not the same size as their replacement. Energy savings RRs were generally low among appliances (47%), particularly with freezers (-34%). Appliances accounted for only 3% of total program gross verified energy savings. The RR for appliance demand savings was also low at 46%, and they accounted for 5% of the program gross verified demand savings.

Refrigerators. The NMR team calculated verified savings based on appliance-specific annual energy consumption derived from model number lookups for the installed and existing refrigerators, while the reported savings applied 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 3,525 kWh in energy savings (66% RR) and 0.45 kW in demand savings (65% RR). Where available, project-specific energy consumption values for existing refrigerators were often dramatically lower than the existing refrigerator consumption otherwise assumed in IESO substantiation sheets.

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 -415 kWh in energy savings (-34% RR) and -0.06 kW in demand savings (-33%). The negative savings for freezers had two drivers:

- **High conservation case energy consumption.** Participants' newly installed freezers' energy consumption resulted in a 28% RR compared to default reported savings assumptions.
- **Low project-specific energy consumption.** In all but one case, project-specific energy consumption for existing freezers was lower than that of the newly installed freezers, resulting in negative savings.

B.1.3 Smart Power Bars

The incredibly high RR (512%) for the smart power bars is due to outdated reported savings values being used for smart power bars. The smart power bar measure accounted for the largest proportion of savings of any individual measure in the RFNEEP program (18%, tied with block heater timers). However, there were no reported demand savings for power bars (86 units) in the tracking data. Due to this issue with reported demand savings in the tracking data, the NMR team could not calculate an RR for demand. The NMR team corrected demand savings for power bars in the verification process and they accounted for 7% of the program's gross verified demand 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-foot increments. This resulted in an overestimation of reported savings by a multiple of three.

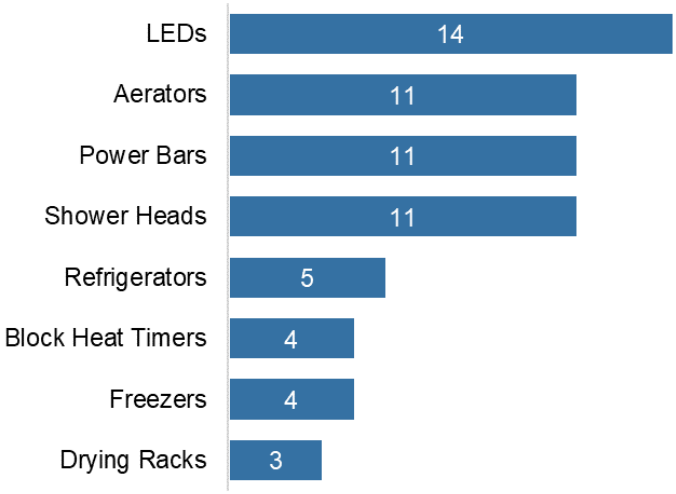
B.1.5 Miscellaneous Measures

The miscellaneous measure category includes block heat timers and indoor drying racks or clotheslines. 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 block heaters had an RR of 96% and contributed 18% of RFNEEP's verified savings. The indoor drying rack or clothesline also had a high RR (92%) and was responsible for 7% of total verified energy savings, while also resulting in 1.14 kW in demand savings, which was 14% of the total verified demand savings. There are no demand savings associated with block heat timers.

B.2 In-Service Rates

Figure 5 displays the energy-efficiency upgrades respondents confirmed receiving. Most respondents received LEDs (14 out of 19 respondents). More than one-half of respondents received an aerator, power bar, and/or shower head (11 out of 19 respondents), and over one-fourth of respondents received a refrigerator (5 out of 19 respondents) and/or a block heat timer (4 out of 19 respondents, or 21%).

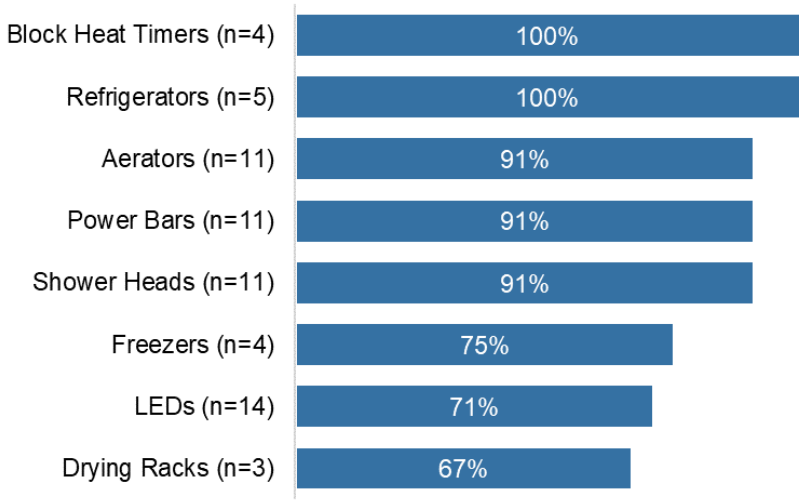
Figure 5: Energy-Efficiency Upgrades that Program Participants Received (n=19)*



*Does not sum to 19 due to multiple response. Counts displayed rather than percentage due to small n.

Figure 6 displays the ISRs for the respondents' upgrades. All the block heat timers, and refrigerators (100%) respondents received were still installed and functional at the time of the survey. Nearly all the aerators, power bars, and shower heads (91%), respondents received were still installed and functional. Only three upgrades had ISRs less than 90%: freezers (75%), LEDs (71%), and indoor drying racks or clotheslines (67%).

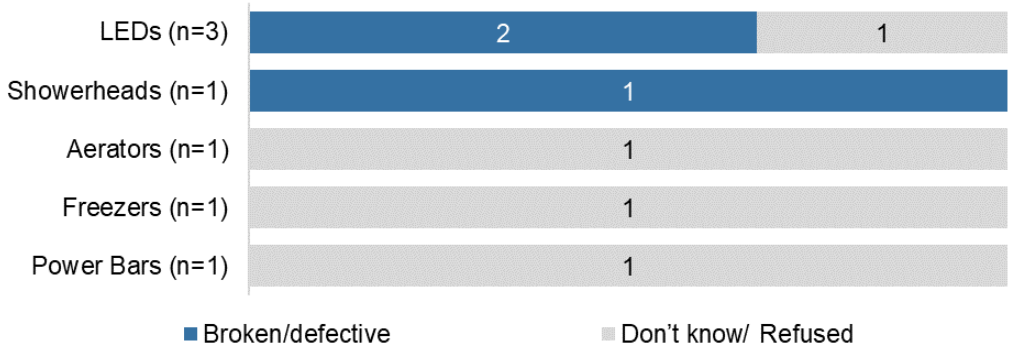
Figure 6: Energy-Efficiency Upgrade ISRs



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

Figure 7 displays the reasons respondents gave for uninstalling or removing upgrades. The most common reason for uninstalling shower heads (one respondent), and LEDs (two respondents) was that they were broken or defective.

Figure 7: Reasons Respondents Uninstalled or Removed Upgrades*



*Counts displayed rather than percentage due to small n.

B.3 HOURS OF USE

The participant survey collected HOU information for several upgrades that homeowners received through the program. Figure 8 and Figure 9 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 4.3 bulbs) and the highest hours of use per day occurred in other rooms such as outdoors (average of 9.0 hours).

Figure 8: Average Number of LEDs Installed by Room Type

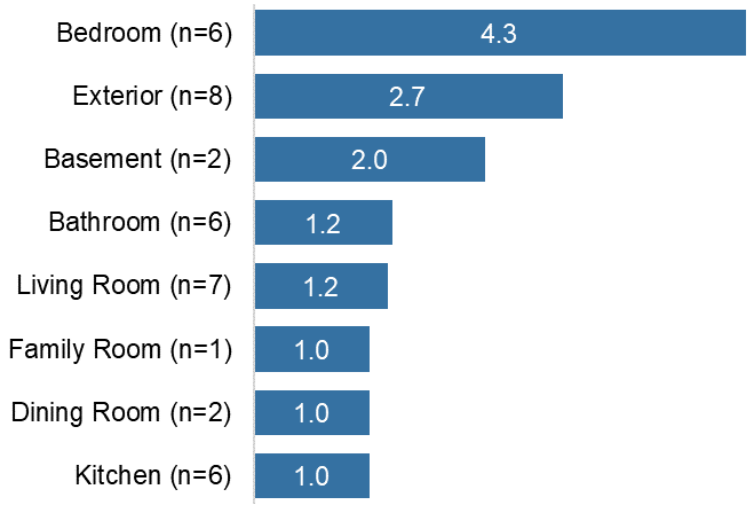
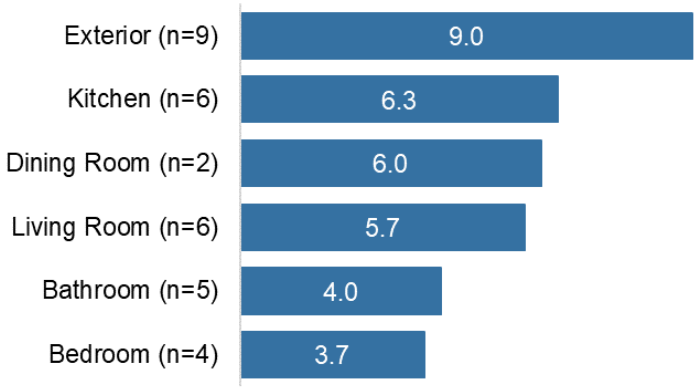
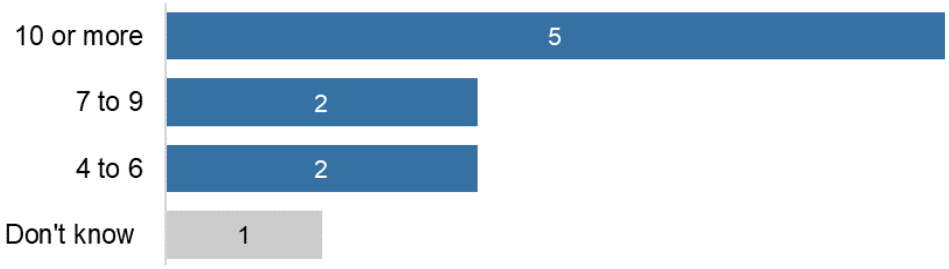


Figure 9: Average Hours per Day LEDs in Use by Room Type



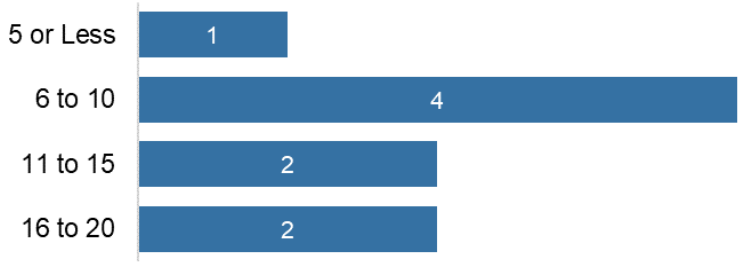
To gain an understanding of the frequency with which showerheads are used, the survey asked respondents to estimate the average number of showers taken in the participating household per week as well as the average duration per shower. On average, respondents took 16 showers per week per household. The average duration of each shower was 14 minutes. Figure 10 and Figure 11 display the distribution of shower frequency and duration among respondents.

Figure 10: Showers per Week (n=10)*



*Counts displayed rather than percentage due to small n.

Figure 11: Minutes per Shower (n=9)*

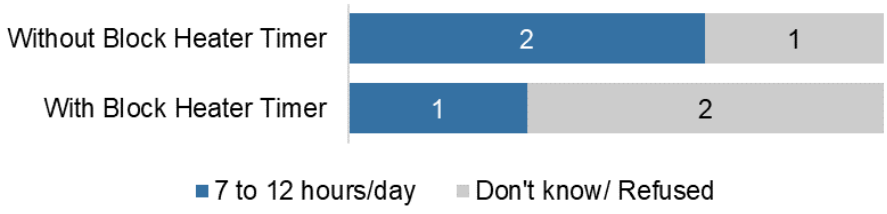


*Counts displayed rather than percentage due to small n.

Three respondents used their kitchen aerators for 31 to 60 minutes per day. Two respondents used their bathroom aerators for 31 to 60 minutes per day.

Before receiving the block heater timers provided by the program, the three respondents used their block heaters for eight hours per day on average. After installing the block heater timers, respondents used their block heaters for an average of eight hours per day affirming no change. Figure 12 displays the distribution of hours per day that respondents used their block heaters before and after receiving the block heater timers. Prior to receiving and using the block heat timer, two respondents used engine block heaters for 7 to 12 hours per day and one respondent did not know how many hours they used their block heater. After receiving the block heater timer through the program, one respondent used the block heater for the same amount of time, 7 to 12 hours per day and two said they did not know much they used it.

Figure 12: Hours per Day Block Heater in Use (n=3)*



*Counts displayed rather than percentage due to small n.

B.4 Refrigeration Baseline Energy Consumption

This appendix provides the results of evaluating the appliance energy consumption values used in substantiation sheet algorithms and the IESO Audit and Retrofit Protocols to determine program eligibility and calculate program savings.[25]

B.4.1 IESO Assumptions

Table 19 documents the minimum energy consumption for existing refrigerators and freezers to qualify for replacement during an audit. The minimum consumption thresholds do not account for the different appliance sizes and classes documented in the IESO substantiation sheets (Table 20 and Table 21).

Table 19: Refrigeration Energy Consumption Thresholds for Replacement
(Source: Audit and Retrofit Protocols, Energy Affordability Program, v1.0)

Appliance	Replacement threshold, kWh/year
Refrigerator	925
Freezer	615

Substantiation sheets document the assumed unit energy consumption (UEC) values for existing and baseline (i.e., minimally code-compliant) refrigeration equipment when calculating program savings. Equation 3 shows the algorithm used to calculate unit refrigerator and freezer savings in program tracking data, where UEC values appear.

Equation 3: IESO Energy Savings Algorithm, Refrigeration

$$\Delta \boldsymbol{kWh} = \boldsymbol{kWh_b} - \boldsymbol{kWh_{ee}}$$

$$kWh_b = UEC_{exist} * \%EREP + UEC_{base} * \%REMAIN$$

$$kWh_{ee} = UEC_{ee}$$

UEC_{exist} refers to the annual energy consumption of the removed appliance, while UEC_{base} refers to the federal minimum annual energy consumption. UEC_{ee} refers to the estimated annual consumption of the conservation measure, whether refrigerator or freezer. %EREP refers to the percentage of the equipment's effective useful life (EUL) during which savings are calculated using the existing equipment's energy consumption as the baseline, assumed to be 33%. %REMAIN refers to the remaining percentage of the EUL, assumed to be 67%, during which savings are calculated using the federal minimum energy consumption as the baseline. Table 20 shows assumed UECs for refrigerators in the IESO substantiation sheets, and Table 21 shows them for chest and upright freezers.

[25] Independent Electricity System Operator, "Audit & Retrofit Protocols, Energy Affordability Program," version 1.0, July 6, 2021.

Table 20: Existing and Baseline Refrigeration Unit Energy Consumption (UEC)

Product Class	UEC_{exist} (kWh/yr)	UEC_{base} (kWh/yr)
Refrigerator-freezers - automatic defrost with top-mounted freezer without an automatic ice maker (10.0 - 12.5 cu ft)	790.81	338.72
Refrigerator-freezers - automatic defrost with top-mounted freezer without an automatic ice maker (15.5 - 16.9 cu ft)	925.20	386.22
Refrigerator-freezers - automatic defrost with top-mounted freezer without an automatic ice maker (17.0 - 18.4 cu ft)	965.93	404.19
Refrigerator-freezers - automatic defrost with bottom-mounted freezer without an automatic ice maker (10.0 - 12.5 cu ft)	790.81	436.77
Refrigerator-freezers - automatic defrost with bottom-mounted freezer without an automatic ice maker (15.5 - 16.9 cu ft)	925.20	494.00
Refrigerator-freezers - automatic defrost with bottom-mounted freezer without an automatic ice maker (17.0 - 18.4 cu ft)	965.93	502.75
Refrigerator-freezers - automatic defrost with bottom-mounted freezer with through-the-door ice service (17.0 - 18.4 cu ft)	965.93	672.00

Table 21: Existing and Baseline Freezer Unit Energy Consumption (UEC)

Product Class	Measure Name	UEC_{exist} (kWh/yr)	UEC_{base} (kWh/yr)
Upright Freezers with automatic defrost	Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	623.03	434.21
Upright Freezers with automatic defrost	Freezer Replacement (ENERGY STAR Qualified 12-14.4 cu ft)	596.33	415.70
Upright Freezers with automatic defrost	Freezer Replacement (ENERGY STAR Qualified 14.5 - 16.0 cu ft)	658.34	458.70
Upright Freezers with automatic defrost	Freezer Replacement (ENERGY STAR Qualified 14.5 - 16.0 cu ft)	663.35	462.18
Chest Freezers	Freezer Replacement (ENERGY STAR Qualified 14.5 - 16.0 cu ft)	411.20	305.17
Chest Freezers	Freezer Replacement (ENERGY STAR Qualified 7.75≤ and <12.0cu ft)	562.64	395.51
Compact Chest Freezer	Freezer Replacement (ENERGY STAR Qualified <7.5 cu ft)	262.45	262.45

B.4.2 Desk Reviewed Appliances

Table 22 compiles the counts, ages, baseline and new energy consumption values, and verified energy savings associated with refrigeration measures sampled for desk review. It compares these values from the RFNEEPP desk reviews with the equivalent values from PY2022 and PY2021 Energy Affordability Program (EAP) impact evaluations. The table excludes cases where

there was insufficient information to look up project-specific baseline and/or conservation case consumption values.

Table 22: Average Desk Review Refrigeration Consumption and Savings

Program	Measure	Projects Sampled	Age	Baseline kWh	Conservation Case kWh
RFNEEPP	Refrigerator	47	2007	509	363
RFNEEPP	Freezer	21	2005	339	461
EAP (PY2022)	Refrigerator	73	2003	510	348
EAP (PY2022)	Freezer	24	2001	383	261
EAP (PY2021)	Refrigerator	88	1999	667	355
EAP (PY2021)	Freezer	86	1997	513	264

B.4.3 Cross-Jurisdictional Scan

Updated versions of the technical reference manuals (TRMs) that informed the PY2019 substantiation sheet review also contain deemed values for appliance energy consumption:[26]

- Illinois Technical Reference Manual, version 10, effective 2022[27] (IL TRM)
- Massachusetts Technical Reference Manual, 2022 Plan-Year Report, effective 2022[28] (MA TRM)
- New York Technical Resource Manual, version 9, effective 2022[29] (NY TRM)
- Pennsylvania Technical Reference Manual, effective 2021[30] (PA TRM)

The IL TRM explicitly tabulates UEC_{exist} values for refrigerators, but not freezers. The NY TRM is the only one to explicitly tabulate appliance energy consumption using a low- and moderate-income (LMI) baseline, for both refrigerators and freezers. They also provide separate deemed consumption values for different appliance ages and sizes. While these values are not equivalent to UEC_{exist} values, they serve as useful points of comparison for the RFNEEPP program population.

[26] See "Secondary Data Review of TRMs" (Section 2.1.2) in the Methodology section of the PY2019 HAP Evaluation.
[27] Illinois Commerce Commission, "2022 Statewide Technical Reference Manual for Energy Efficiency: Version 10, Volume 3: Residential Measures", accessed June 2023, https://icc.illinois.gov/downloads/public/2022%20IL-TRM%20Version%2010.0%20Volume%203%20Residential%20Measures%20(Final).pdf.
[28] Massachusetts Department of Public Utilities, "2022 Plan-Year Report Technical Reference Manual", accessed June 2023, https://etrm.anbetrack.com/#/workarea/home?token=6d6c45766e692f527044.
[29] New York Department of Public Service, "New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs: Version 9", accessed June 2023, https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/72c23decff52920a85257f1100671bdd/$FILE/NYS%20TRM%20V9.pdf.
[30] Pennsylvania Public Utilities Commission, "2021 Technical Reference Manual, Volume 2, Residential Measures", accessed June 2023, https://www.puc.pa.gov/pcdocs/1692531.docx.

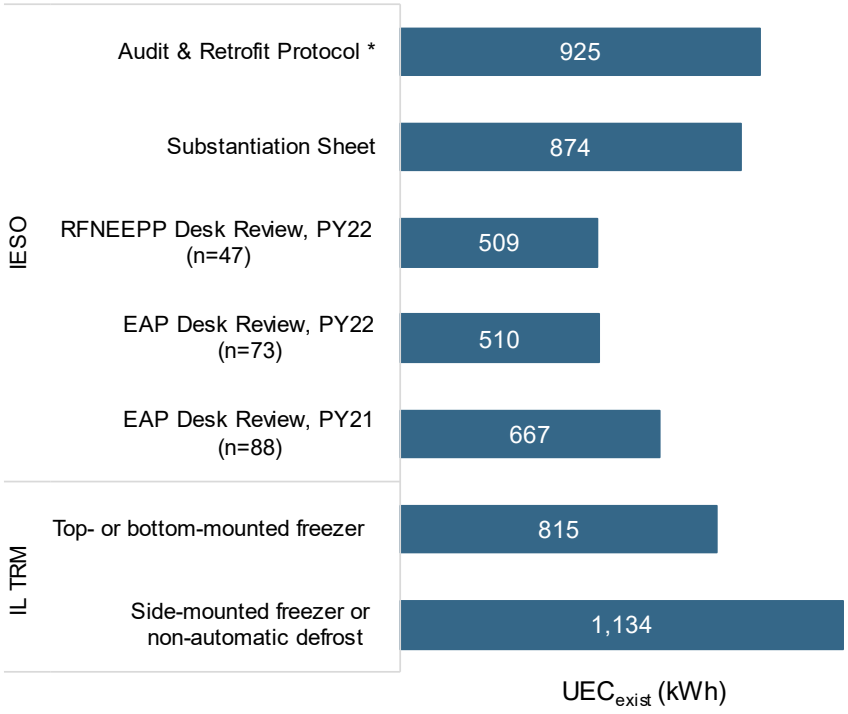
B.4.4 Existing Refrigerator Unit Energy Consumption

Figure 13 compares the IESO Audit & Retrofit Protocol consumption threshold for refrigerators with the average refrigerator UEC_{exist} value derived from IESO substantiation sheets, multiple Illinois TRM UEC_{exist} values, as well as average desk review results from recent IESO impact evaluations.

Using the IL TRM as a reference, the Audit & Retrofit protocol threshold for refrigerator energy consumption implies that the only models eligible for replacement would be those with side-mounted freezers or lacking automatic defrost. Typical top- or bottom-mounted freezer models would not be eligible. Using the average of all substantiation sheet UEC_{exist} values instead of the protocol threshold yields the same result, though the sheets specify different UEC_{exist} for different refrigerator sizes.

The average consumption results from the three desk review efforts are well below the more-conservative estimates outlined in the IESO substantiation sheets and the Illinois TRM. Both PY2022 and PY2021 desk reviews yielded existing refrigerator consumption values more aligned with deemed baseline unit energy consumption (UEC_{base}) values in the IESO substantiation sheets (Figure 13), suggesting that deemed UEC_{exist} values overestimate the actual consumption of refrigerators replaced through RFNEEPP.

Figure 13: Comparison of Existing Refrigerator Unit Energy Consumption Values



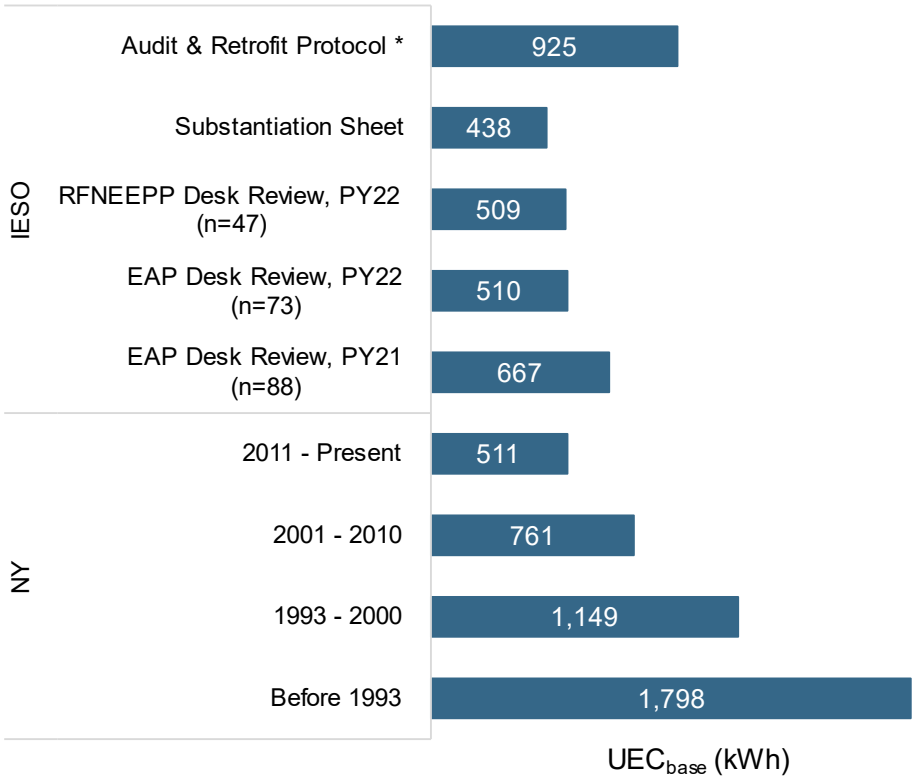
*Indicates the minimum energy consumption for an existing refrigerator to qualify for replacement during an audit

B.4.5 Low- and Moderate-Income Appliance Energy Consumption

Figure 14 compares the IESO Audit & Retrofit Protocol consumption threshold for refrigerators with the average refrigerator UEC_{base} value derived from IESO substantiation sheets, multiple NY TRM LMI baseline (UEC_{base}) values, as well as average desk review results from recent IESO impact evaluations.

Using the NY TRM LMI baseline as a reference, the Audit & Retrofit protocol threshold for refrigerator energy consumption implies that only models older than 2001 would be eligible for replacement. This conflicts with the stated eligibility threshold of 2011 or earlier in IESO data collection forms reviewed during desk review.

Figure 14: Comparison of Baseline Refrigerator Unit Energy Consumption Values



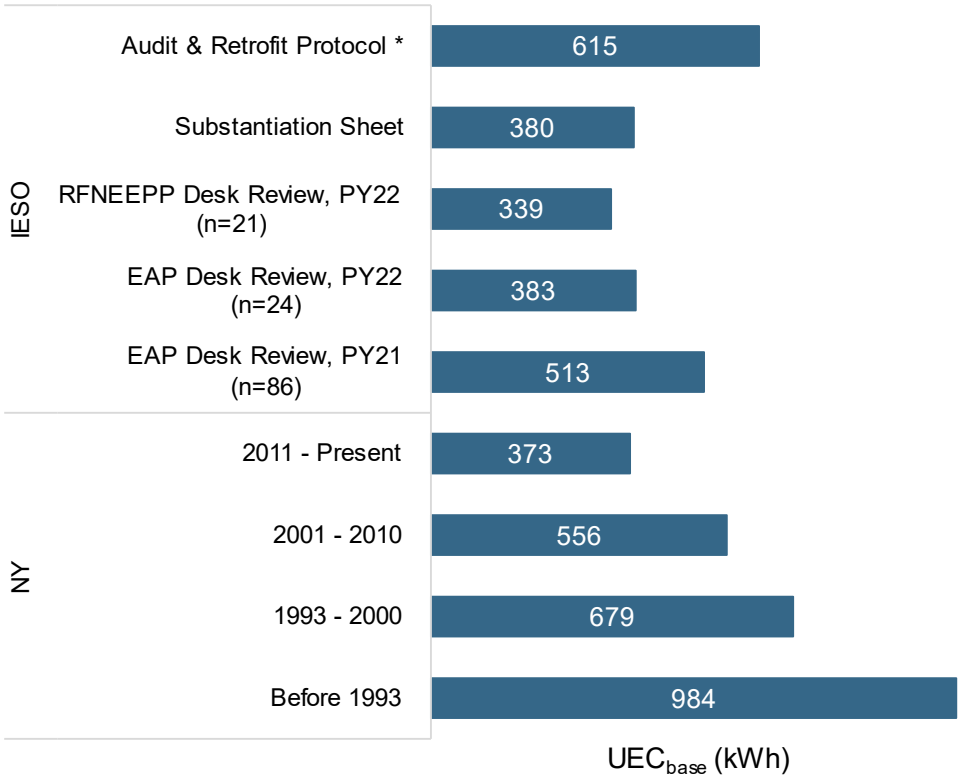
*Indicates the minimum energy consumption for an existing refrigerator to qualify for replacement during an audit.

Figure 15 and Figure 16 compare the IESO Audit & Retrofit Protocol consumption thresholds for chest and upright freezers, respectively, with the average freezer UEC_{base} value derived from IESO substantiation sheets, multiple NY TRM LMI baseline (UEC_{base}) values, as well as average desk review results from recent IESO impact evaluations.

Using the NY TRM LMI baseline as a reference, the Audit & Retrofit protocol threshold for freezer energy consumption implies that only chest freezer models older than 2001 would be eligible for

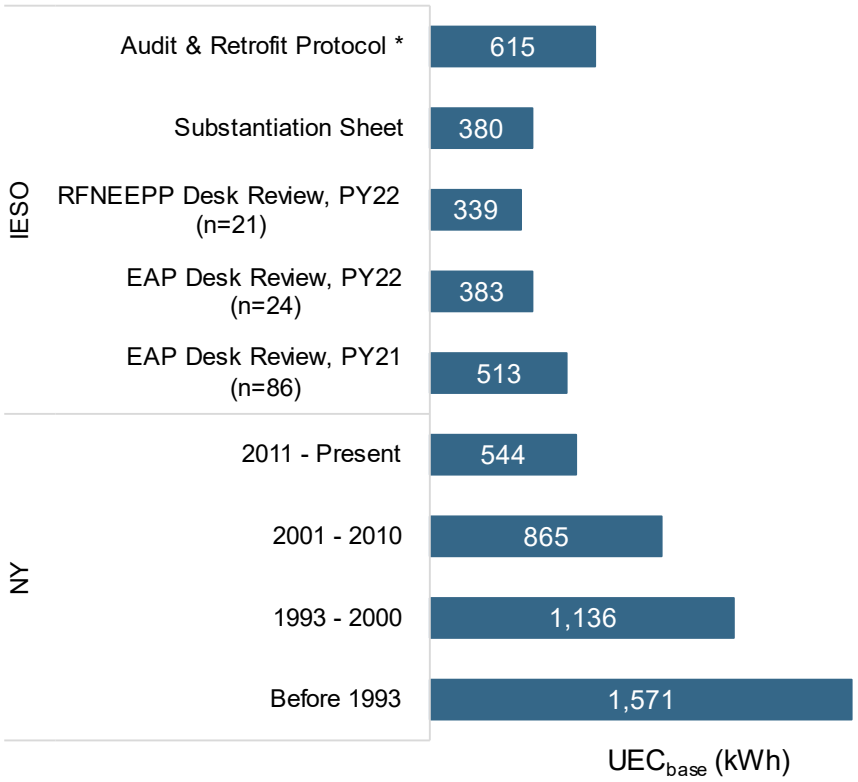
replacement, compared to upright models older than 2011 (which aligns with the age threshold program auditors and contractors use).

Figure 15: Comparison of Baseline Chest Freezer Unit Energy Consumption Values



*Indicates the minimum energy consumption for an existing freezer to qualify for replacement during an audit

Figure 16: Comparison of Baseline Upright Freezer Unit Energy Consumption Values



*Indicates the minimum energy consumption for an existing freezer to qualify for replacement during an audit

Appendix C Additional Process Evaluation Results

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

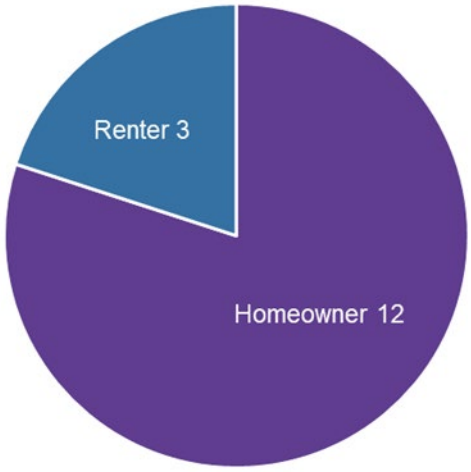
C.1 Additional Participant Results

This appendix provides additional detail regarding the process evaluation results collected as part of the participant survey.

C.1.1 Participant Profile

As shown in Figure 17, most respondents (12 out of 15) were homeowners, while three were renters.

Figure 17: Relationship to Home (n=15)*

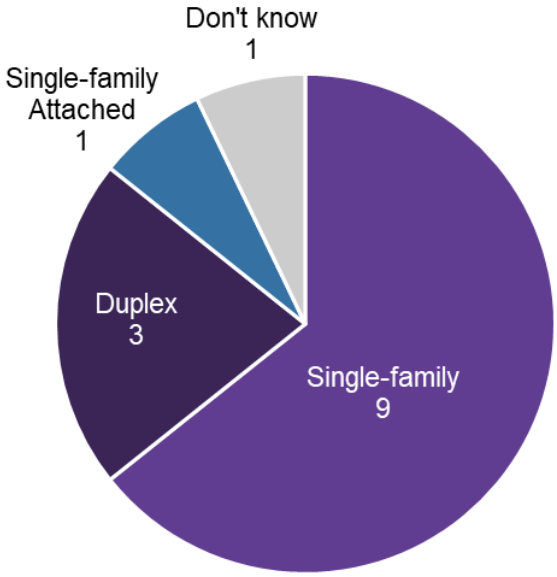


*Counts displayed rather than percentage due to small n.

Respondents' homes are predominantly primary residences (13 out of 14) that are occupied year-round (13 out of 14). Figure 18 and Figure 19 display characteristics of respondents' homes, including the type of dwelling and the year it was built. A majority (9 out of 14) of respondents' homes are single-family houses. More then one-half (9 out for 14) of respondents' homes were built after 1990.

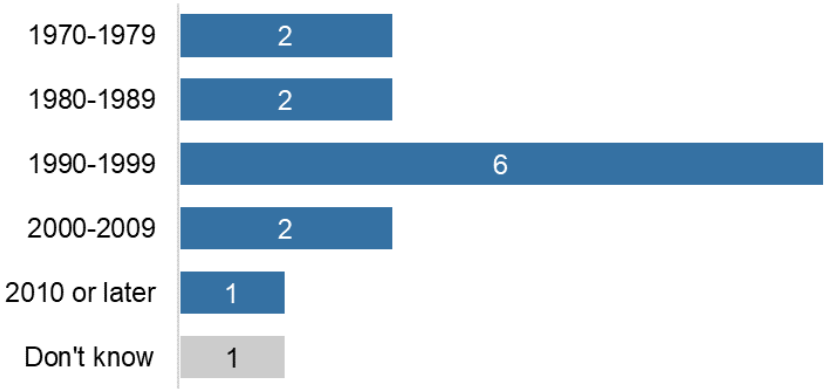
When asked about the number of bedrooms in the home, one respondent reported having two bedrooms, two reported having more than four bedrooms, and the remaining respondents declined to answer. On average, there was one bathroom.

Figure 18: Type of Home (n=14)*



*Counts displayed rather than percentage due to small n.

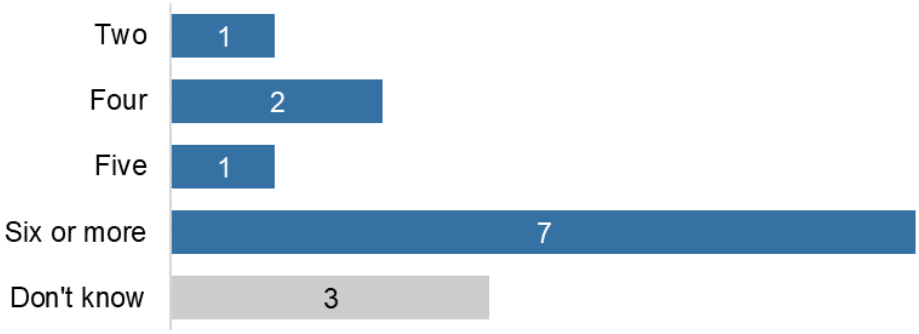
Figure 19: Year Home Built (n=14)*



*Counts displayed rather than percentage due to small n.

Figure 20 displays the number of occupants in the respondents' households. Almost all (10 out of 14) of respondents live in a household with four or more people. The average household size was 5.6.

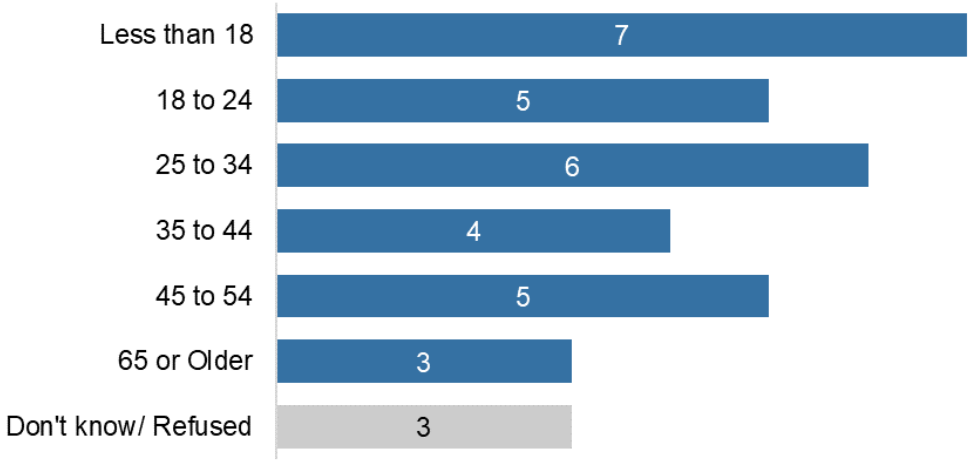
Figure 20: Number of Occupants (n=14)*



*Counts displayed rather than percentage due to small n.

Figure 21 displays the percentage of households with occupants of each age group. Children under the age of 18 reside in one-half (7 out of 14) of households and seniors aged 65 or older reside in only three of the households.

Figure 21: Households with Occupants of Each Age Group (n=14)*

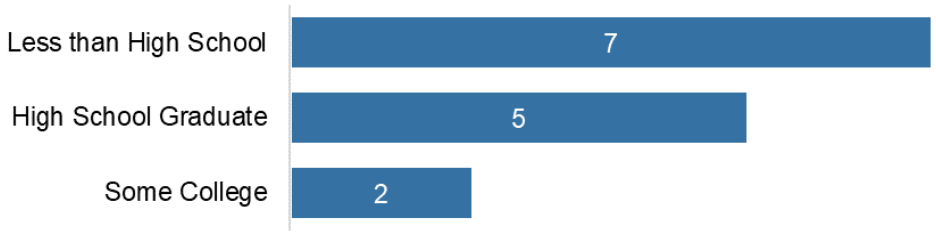


*Does not sum to 100% due to multiple response. Counts displayed rather than percentage due to small n.

Respondents reported heating their homes most frequently with wood (12 out of 15 respondents), followed by electricity (2 out of 15 respondents). Most (11 out of 15) respondents said they are directly responsible for paying their electricity bills for their households. Respondents who were directly responsible for paying their electricity bills said their electricity bills covered energy used by appliances and lighting (7out of 15 respondents), water heating (4 out of 15 respondents), and space heating (2 out of 15 respondents).

Figure 22 displays respondents' highest education level. One-half (7 of 14) of respondents have received less than high school.

Figure 22: Highest Education Level (n=14)*

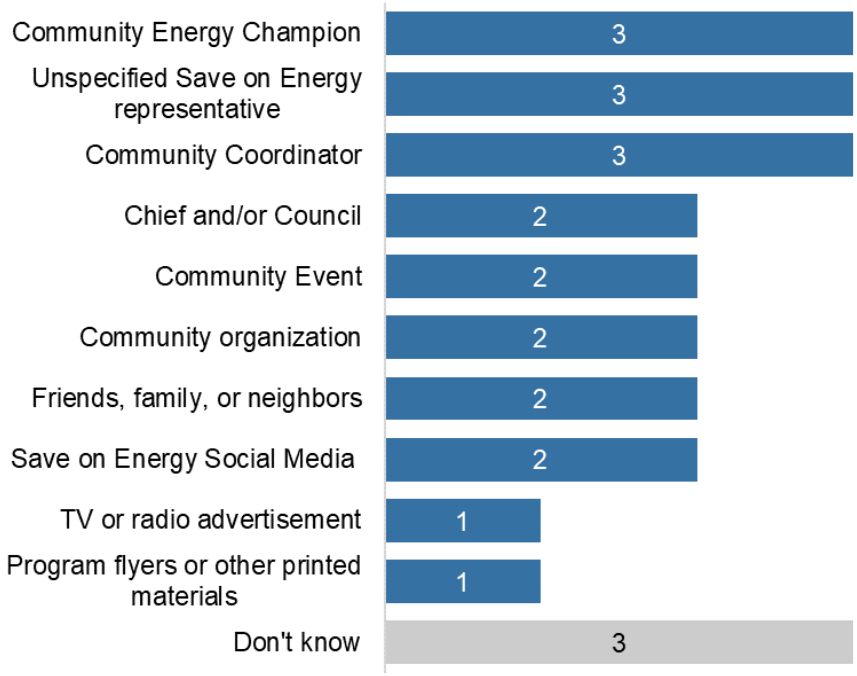


*Counts displayed rather than percentage due to small n.

C.1.2 Program Awareness and Motivation

Figure 23 and Figure 24 show how respondents heard about and applied to the program. Section 5.4.2 includes more discussion around how participants heard about and applied to the program.

Figure 23: How Participants Heard about RFNEEPP (n=15; Multiple Response)*



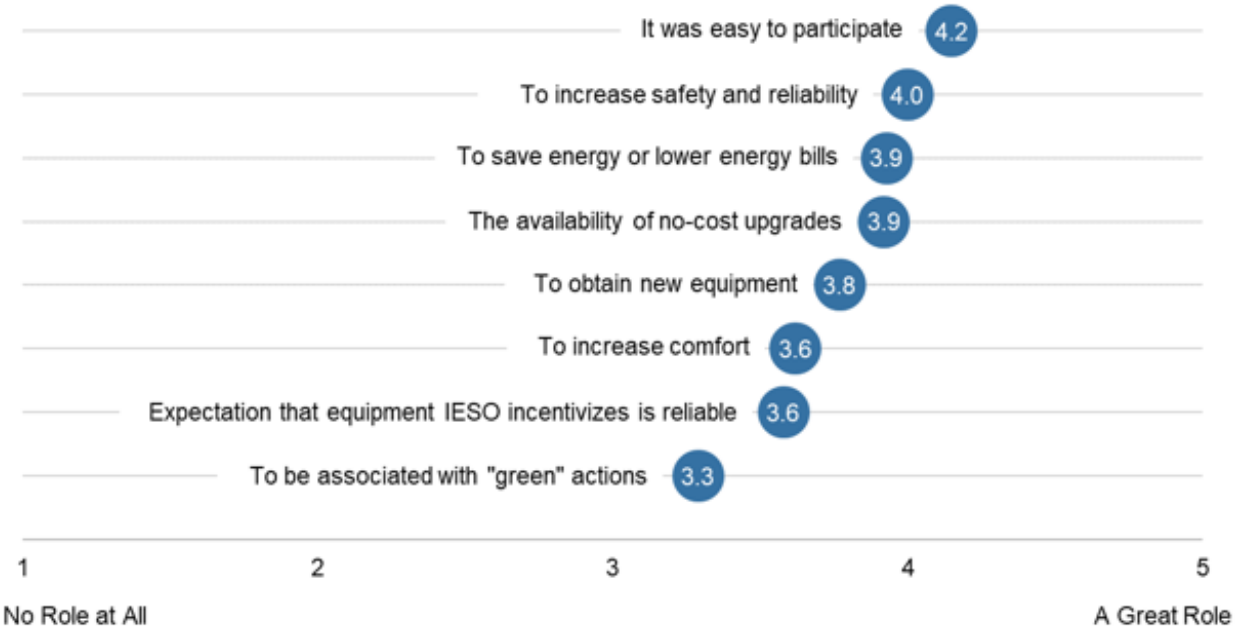
*Does not sum to 100% due to multiple response. Counts displayed rather than percentage due to small n.

Figure 24: How Participants Applied for RFNEEPP (n=15)*

*Counts displayed rather than percentage due to small n.

Figure 25 shows the influence that various factors had on respondent decisions to participate in the program. Section 5.4.2 includes more discussion around these factors.

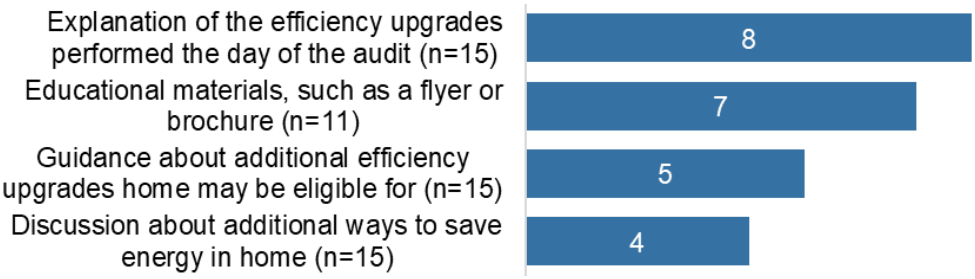
Figure 25: Factors Influencing RFNEEEPP Participation (n=15)



C.1.3 Program Education and Behavior Change

Figure 26 displays the educational resources that respondents reported being provided by the energy auditor during the site visit. Section 5.4.3 includes more discussion around these educational resources.

Figure 26: Resources Provided by Energy Auditor (Multiple Response)*



*Does not add to 15 due to multiple response. Counts displayed rather than percentage due to small n. Additionally, only 11 respondents were asked whether they received educations materials because only these respondents had an in-home audit performed (rather than a virtual audit) where they could have received these materials.

Table 23 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. Section 5.4.3 includes more discussion around the additional ways to save energy that were recommended and tried.

Table 23: Additional Ways to Save Energy (n=4)*

Additional ways to save energy	Learned From Auditor (n=4)	Tried Since Audit (n=2)
Annual heating system tune-up	1	-
Hang laundry to dry	1	1
Unplug appliances/electronics	1	-
Wash laundry with cold water	1	-
Energy efficient lighting	1	1
Don't know	2	-

*Does not sum to four due to multiple response. Counts displayed rather than percentage due to small n.

C.1.4 Program Satisfaction

Figure 27 displays participation satisfaction with various aspects of the program. Section 5.3.6 includes more discussion around participant satisfaction.

Figure 27: Satisfaction with Program Aspects (n=15)

C.1.5 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 (8 out of 14) respondents 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 24). The average rating was 4.3.

Table 24: Adherence to Health and Safety Standards Associated with Covid-19 Pandemic (n=14)*

Adherence to Health and Safety Standards	Number of Respondents
5- Adhered completely	4
4	4
3	1
2	0
1- Did not adhere at all	0
Don't know/ Refused	5
Average Rating	**4.33**

*Counts displayed rather than percentage due to small n. Number of respondents equal to 14 rather than 15 because one respondent dropped out of the survey before answering this question.

When asked to indicate the ways in which participation in the program may have been impacted by the COVID-19 pandemic, one-half (7 out of 14) of the respondents said there was no impact. Some barriers that the respondents experienced that impacted their participation were delays in completing the initial energy audit (three respondents) and delays in the delivery of energy-efficient equipment or services (two respondents) (Table 25).

Table 25: COVID-19 Impacts on RFNEEPP Participation (n=14)*

COVID-19 impacts	Number of Respondents
No impact	7
Initial energy audit was delayed	3
Delivery of energy-efficient equipment or services was delayed	2
Don't know	3

*Counts displayed rather than percentage due to small n. Number of respondents equal to 14 rather than 15 because one respondent dropped out of the survey before answering this question.

Appendix D Additional Jobs Impact Results

This appendix provides 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 RFNEEPP and the other from the increased household expenditures due to bill savings (and net of program funding). Table 26 shows the input values for the demand shock representing the products and services related to RFNEEPP. Each measure installed as part of RFNEEPP 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, *Other miscellaneous manufactured products* had the highest total cost ($30,000). *Major appliances* was second highest at just over $27,000. 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 26, *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 26: Summary of Input Values for Demand Shock

Category Description	Non-Labor ($ Thousands)	Labor ($ Thousands)	Total Demand Shock ($ Thousands)
Other miscellaneous manufactured products	30	0	30
Major appliances	24	3	27
Electric light bulbs and tubes	6	0	6
Small electric appliances	1	2	3
Other professional, scientific and technical services	-	-	472
Office administrative services	-	-	763
Total			**1,301**

Table 27 shows the calculations and input value for the household expenditure shock.[31] 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) = $170,000) and the portion of the energy-efficiency program funded by the residential sector (35% of the $1.3M required to fund the IF RFNEEPP program in PY2022, or $455,000). The difference is $-285,000 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[32]. The surveys administered to participants as part of the RFNEEPP 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 54% of household bill savings would be spent. Thus, the household expenditure shock would be $-153,000.

[31] 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.
[32] Note: Under normal program activities, enough measures are installed that the NPV of installed measures outweighs the residential portion of costs associated with running the program. This was not the case for RFNEEPP, and as a result the residential shock this year is negative. While in real world applications this may not be the case, for the purposes of the model a negative shock will result in jobs being removed from the overall total.

Table 27: Summary of Input Values for Household Expenditure Shock

Description	Demand Shock *($ Thousands)*
NPV of energy bill savings	170
Residential portion of program funding	(455)
Net bill savings to residential sector	**(285)**
Percent spent on consumption (vs. saved)	54%
Total Shock	**(153)**

D.2 Model Results

The StatCan IO Model generated results based on the input values detailed in Appendix D.1. Table 28 shows the results of the model run for the demand shock for products and services. This 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 16 total jobs (measured in person-years) in Canada, of which 14 will be in Ontario. Of the 16 jobs, 7 were direct, 4 were indirect, and 4 were induced. In terms of FTEs, the numbers are slightly less, with 11 FTEs created in Ontario and 12 in total across the country. Of these 12 FTEs, 6 were direct, 3 indirect, and 3 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 28: 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	6	6	7	7
Indirect	3	3	3	4
Induced	2	3	3	4
Total	**11**	**12**	**14**	**16**

Table 29 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. Negative household expenditure shocks thus result in negative job impacts. The extra household spending of $-153,000 would result in a decrease of 1 direct FTE and 1 direct total job in Canada. The single direct job was the only job lost as a result of household expenditures in both Ontario and across Canada. It should be noted that under normal model conditions, negative job impacts are not usually observed. For the purposes of the evaluation, a negative job impact results in a loss of jobs from the total jobs created.

Table 29: 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	0	0	-1	-1
Indirect	0	0	0	0
Induced	0	0	0	0
Total	**-1**	**-1**	**-1**	**-1**

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[33] without running the model. The multiplier is 5.0[34] (per $ million) and the NPV of decreased electricity bills (retail) was $0.2 million. Thus, the model would predict that the reduction in electricity production would cause a job loss of 1 person-year over the course of 20 years (the longest EUL in the portfolio of RFNEEPP 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.[35] RFNEEPP first year energy savings represented less than 0.01% of total demand in 2022. 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 30 shows the total estimated job impacts by type – combining Table 28 and Table 29. The majority (13 out of the 14 estimated total jobs) were in Ontario. All the direct jobs created were created in Ontario. A slightly smaller share of the indirect and induced jobs was in Ontario, with 3 out of 4 indirect and 3 out of 4 induced total jobs within the province. The FTE estimates are slightly less, with a total of 10 FTEs (of all types) created in Ontario and 11 FTEs added throughout

[33] Table 36-10-0595-01. The relevant industry is Electric power generation, transmission and distribution [BS221100].
[34] Statistics Canada. Table 36-10-0595-01 Input-output multipliers, provincial and territorial, detail level
DOI: https://doi.org/10.25318/3610059501-eng
[35] Annual Planning Outlook – A view of Ontario's electricity system needs; 2022. IESO.

Canada. All direct FTEs were realized in Ontario, with this number representing 60% of the total FTEs added in Ontario and 55% of FTEs added in Canada.

Table 30: 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	7	7	5.1
Indirect	2	3	3	4	2.8
Induced	2	3	3	4	2.8
Total	**10**	**11**	**13**	**14**	**10.7**

Calculating relative performance as a function of jobs created per $1M of program budget is helpful in comparing RFNEEPP between years. This year, each $1M investment resulted in the creation of 10.7 jobs. Programs can increase in effectiveness—in terms of jobs created per $1M of budget—when the incentives catalyze spending by participants on energy-efficient measures. Given that RFNEEPP 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. Program activities were significantly lower than anticipated for the RFNEEPP program in PY2022. This caused a negative household reinvestment shock and resulted in lower than expected jobs created per $1M of program spend. Should the amount of measures installed increase in future years, then the household reinvestment shock might be positive and thus add more jobs to the total, which could serve to increase the number of jobs created per $1M of investment.

Table 31 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 8 jobs across Canada and 8 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.). *Professional, scientific and technical services* added a total of 1 job, the second most of any industry- all of the realized jobs were created in Ontario.

Table 31: 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	6.6	6.6	8	8.1
Professional, scientific and technical services	0.6	0.7	0.9	1
Retail trade	0.6	0.7	0.8	0.9
Accommodation and food services	0.4	0.5	0.6	0.7
Finance, insurance, real estate, rental and leasing and holding companies	0.5	0.5	0.5	0.6
Transportation and warehousing	0.3	0.3	0.4	0.5
Other services (except public administration)	0.2	0.3	0.3	0.4
Manufacturing	0.2	0.3	0.2	0.3
Wholesale trade	0.2	0.3	0.2	0.3
Information and cultural industries	0.1	0.2	0.2	0.2
Health care and social assistance	0.1	0.1	0.2	0.2
Arts, entertainment and recreation	0.1	0.1	0.1	0.2
Repair construction	0.1	0.1	0.1	0.2
Educational services	0	0	0.1	0.1
Non-profit institutions serving households	0	0.1	0.1	0.1
Other municipal government services	0.1	0.1	0.1	0.1
Crop and animal production	0	0	0	0.1
Total[1]	**10**	**11**	**13**	**14**

[1] Columns may not add to totals due to rounding. Total values are rounded to nearest whole number and the per-industry impacts do not sum exactly to the whole number total in every column. Values presented in this table are rounded to the nearest 0.1 to better show the distribution of small jobs impacts.